

Technical Catalogue Relays PNOZ
Version 2016-09

PILZ
THE SPIRIT OF SAFETY

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



Introduction

Relays for functional safety

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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.




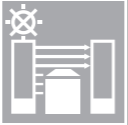

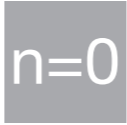




This catalogue contains a selection guide as well as a description of the individual products in the product ranges PNOZ X and PNOZsigma. Each unit is described in a detailed data sheet, helping you to select the units and also enabling configuration.

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



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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	
														
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

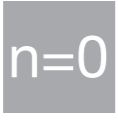






Type	Application						Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Output contacts				Housing width in mm
									Safety-related		Not safety-related		
PZE X5P	Contact expansion						e	3	5	-	-	2	45.0
PZE 9P	Contact expansion						e	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	-	1	1	◆	22.5
PNOZ s6.1				◆		EN 574, Type IIIA	c	1	-	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

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Safety relays PNOZ X PNOZ X1P



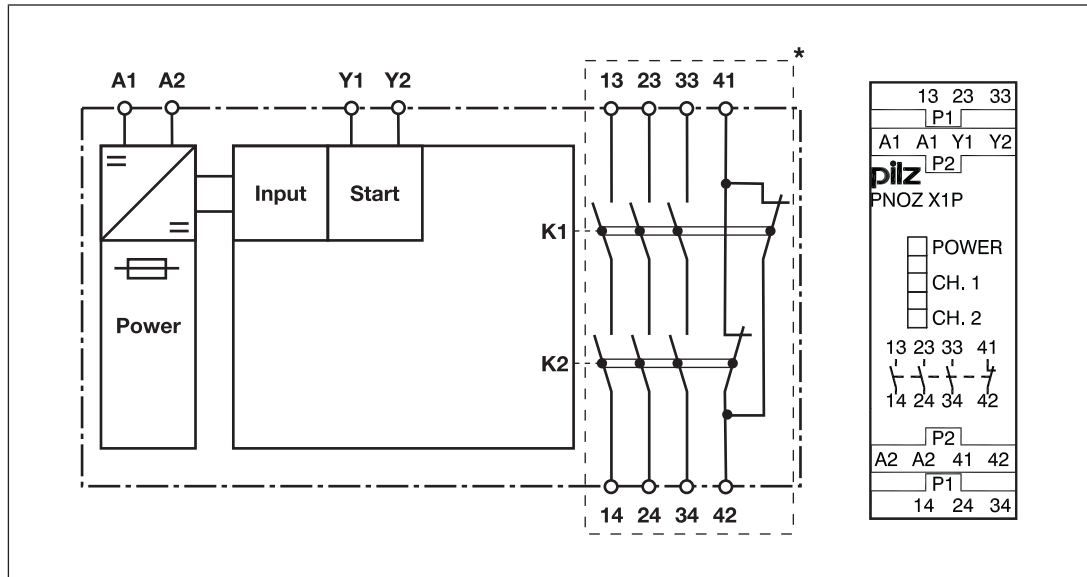
Unit features

- ▶ 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 (over-voltage 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.

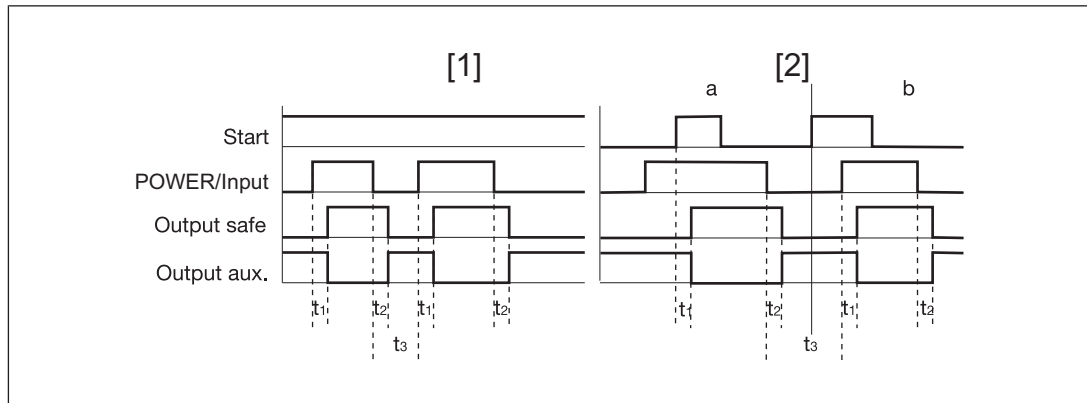
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - LEDs "CH1" and "CH2" will light.
 - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- ▶ Input circuit is opened (e.g. E-STOP pushbutton operated):
 - The LEDs "POWER", "CH1" and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

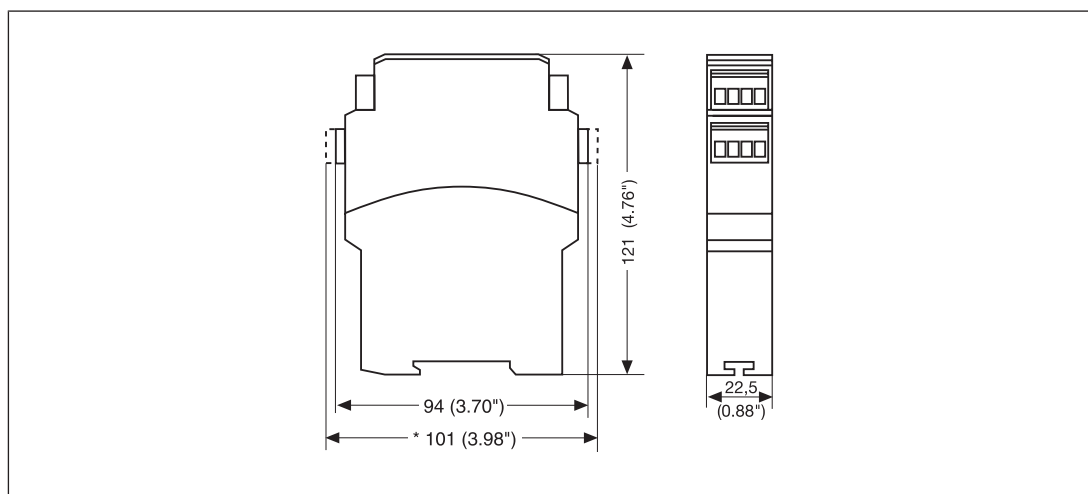
Start circuit	Automatic start	Manual start
E-STOP/safety gate		
Feedback loop	Automatic start	Manual start
Contacts from external contactors		

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 RI-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Relay outputs	777100	787100
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 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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	EN 62061 SIL CL	EN 62061 PFH _D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015
	PL	Category					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.

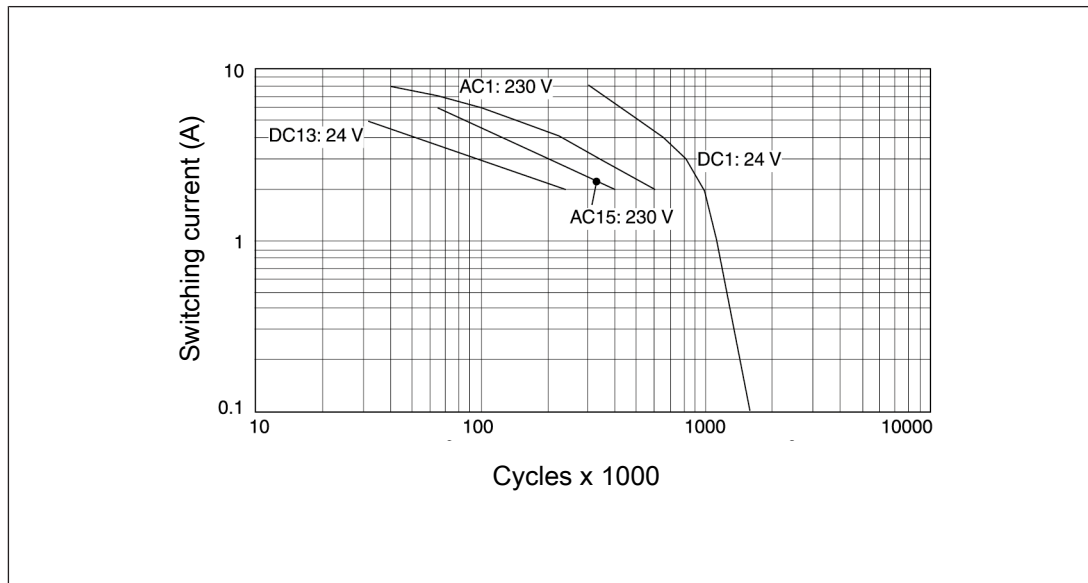
Supplementary data

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

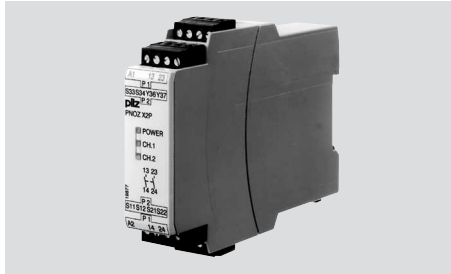
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 contacts, 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

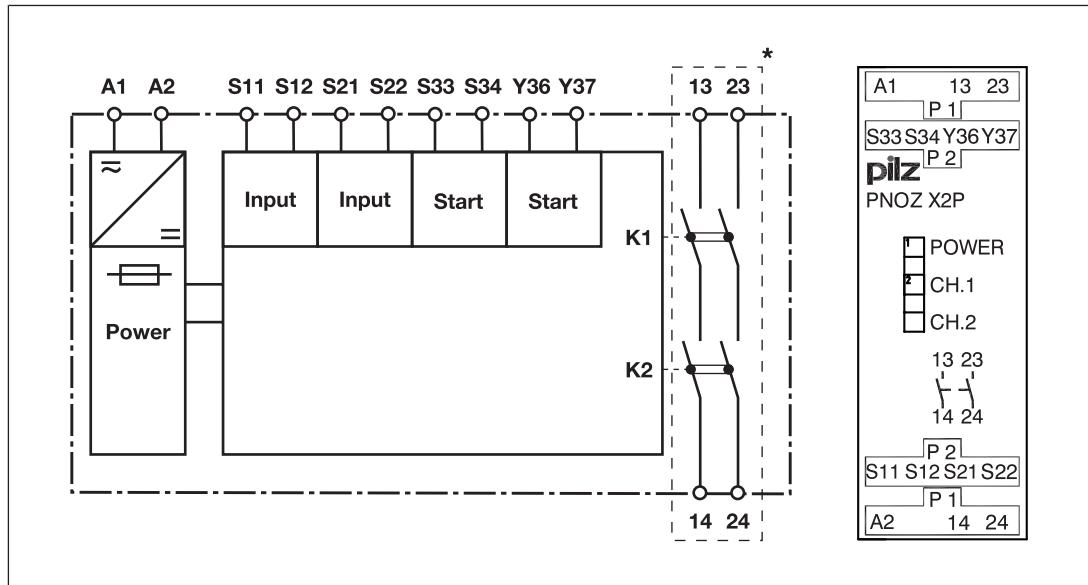
- ▶ Positive-guided relay outputs:
 - 2 safety contacts (N/O), instantaneous
- ▶ Connection options for:
 - E-STOP pushbutton
 - Safety gate limit switch
 - Start button
- ▶ LED display for:
 - Supply voltage
 - Switch status of the safety contacts
- ▶ Plug-in connection terminals (either spring-loaded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

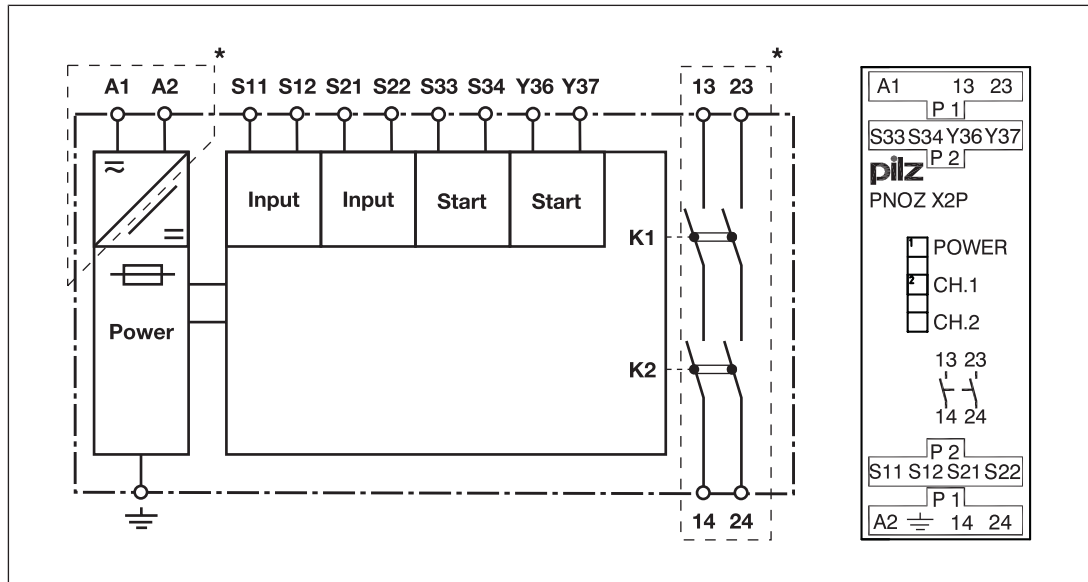


*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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 (over-voltage 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.

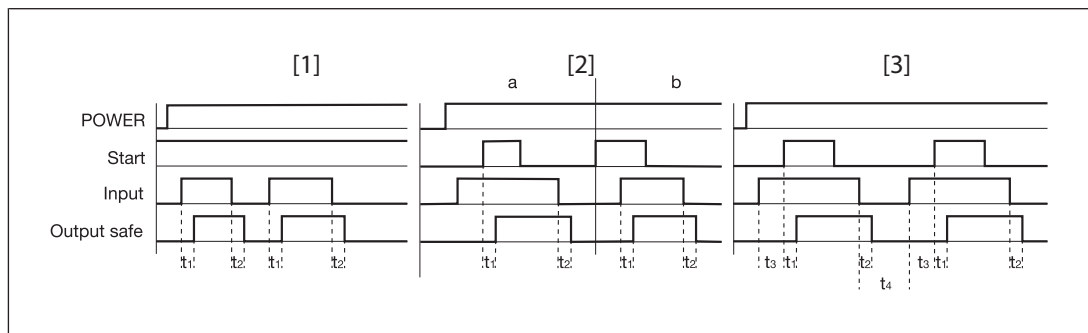
Operating modes

- ▶ 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 \[!\[\]\(2c0783baf87a2728b2fe49eb1c34c456_img.jpg\) 30\]](#)).
- ▶ Calculation of the max. cable length l_{\max} in the input circuit:

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

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[!\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\) 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
$U_B = 24 \text{ VAC/DC}$		
$U_B = 48-240 \text{ VAC/DC}$		
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		

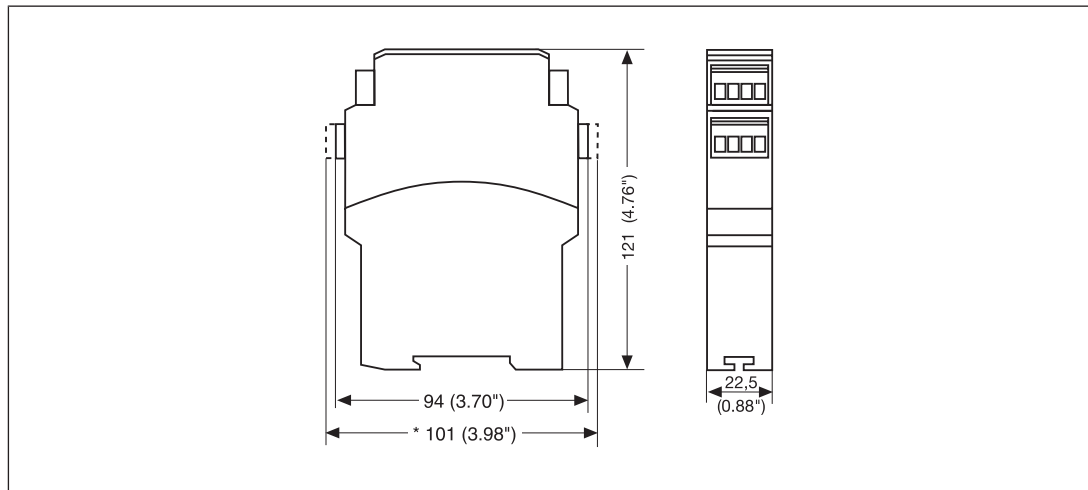
Legend

- ▶ 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 RI-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 A ² s	100 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI-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 A ² s	100 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
–	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.

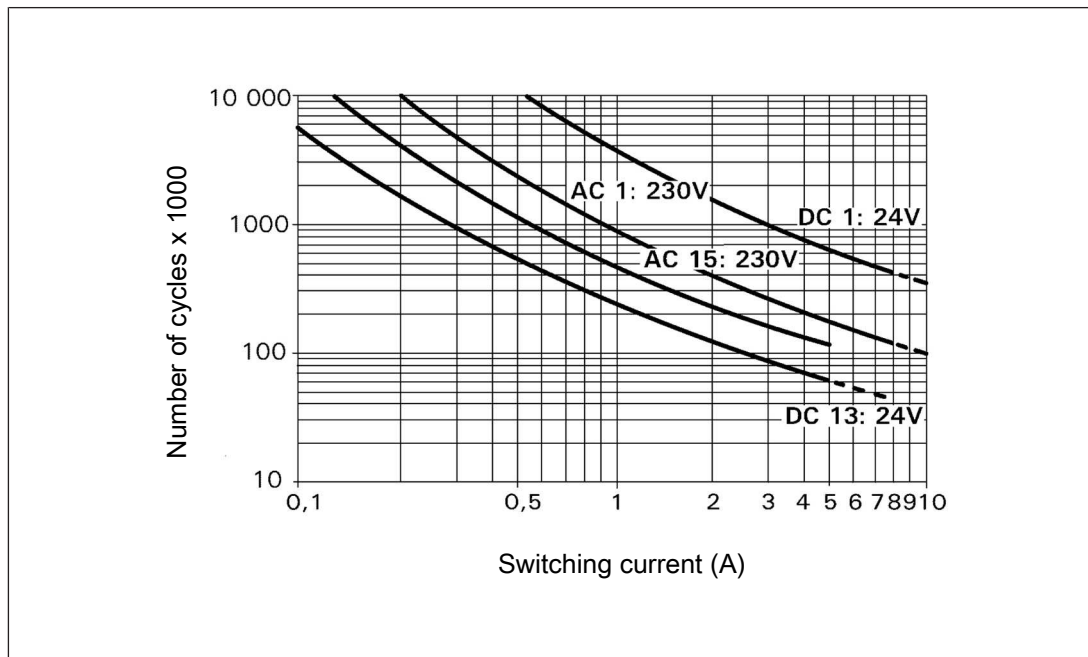
Safety relays PNOZ X PNOZ X2P

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

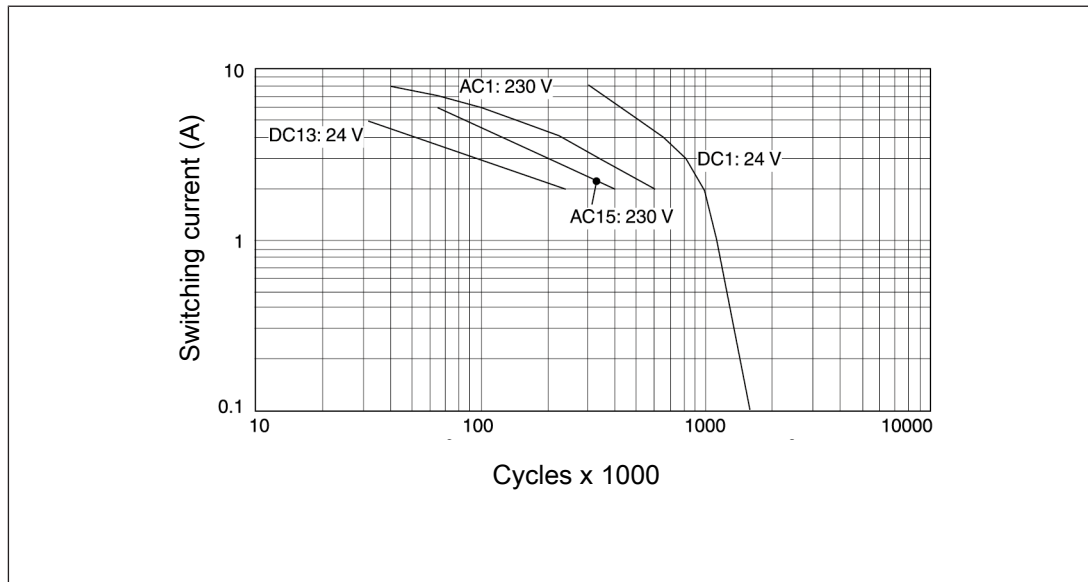
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 contacts, 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

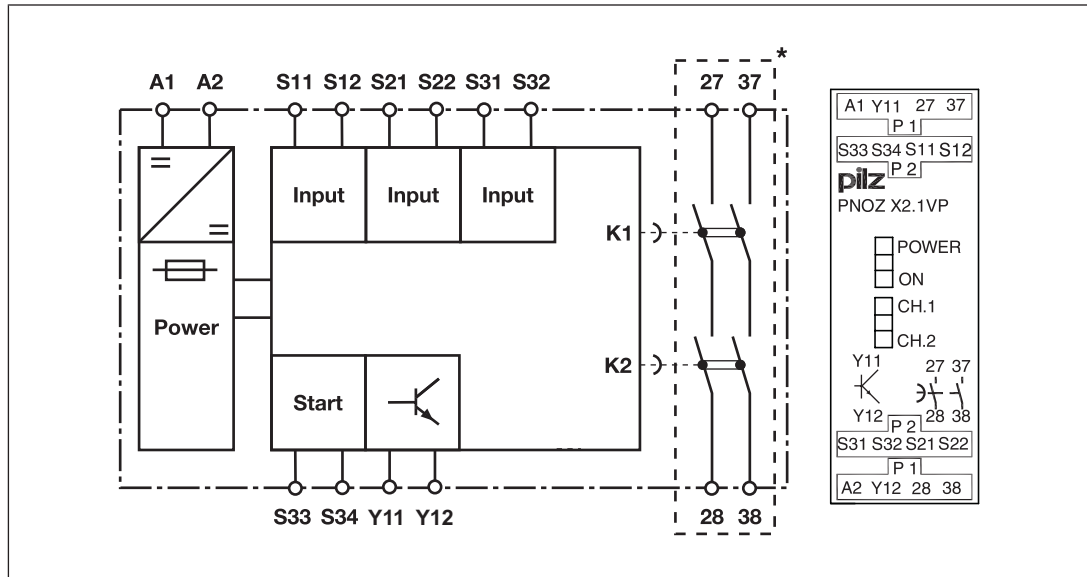


Unit features

- ▶ 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 (over-voltage 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.

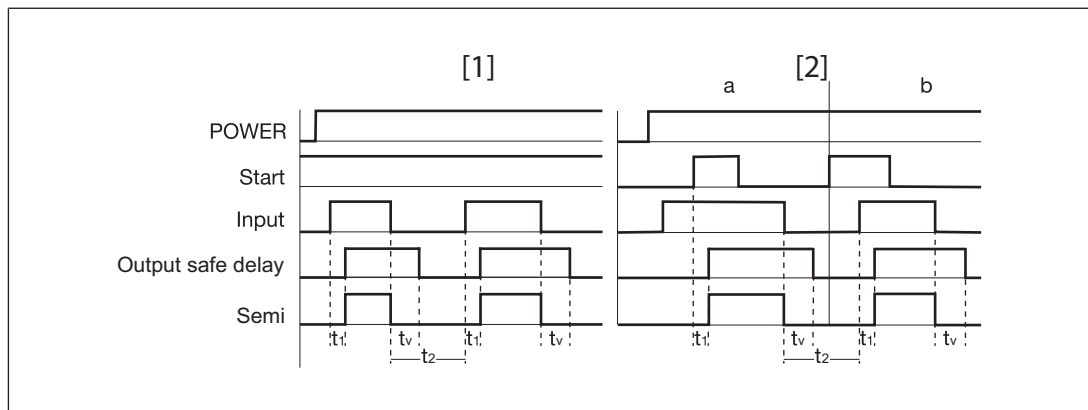
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - The LEDs "CH.1" and "CH.2" are lit.
 - Safety contacts 27-28 and 37-38 are closed. The unit is active.
 - The semiconductor output Y11-Y12 is enabled.
 - The "ON" LED is lit.
- ▶ Input circuit is opened (e.g. E-STOP pushbutton operated):
 - 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:

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

$R_{l_{\max}}$ = 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

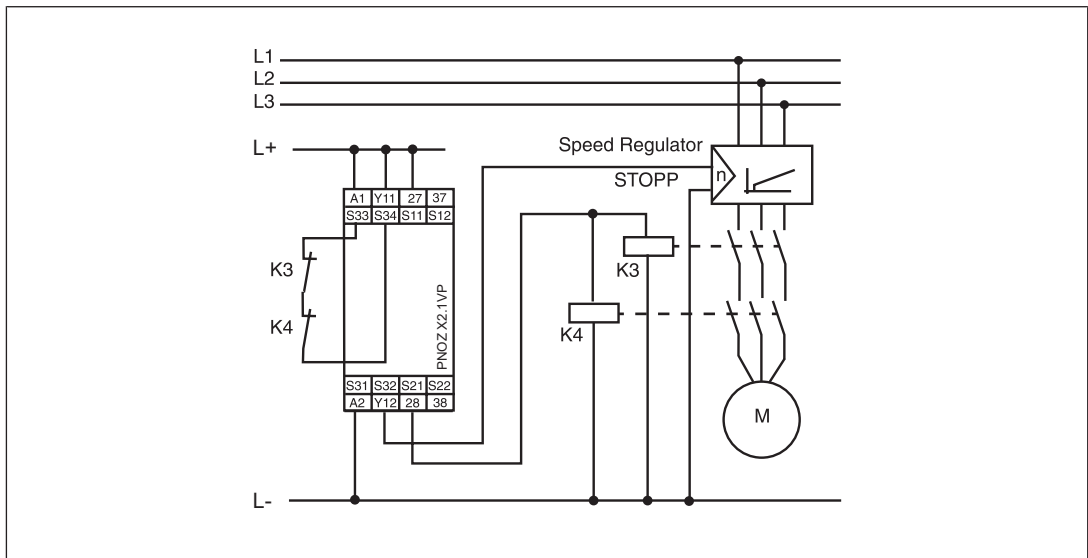
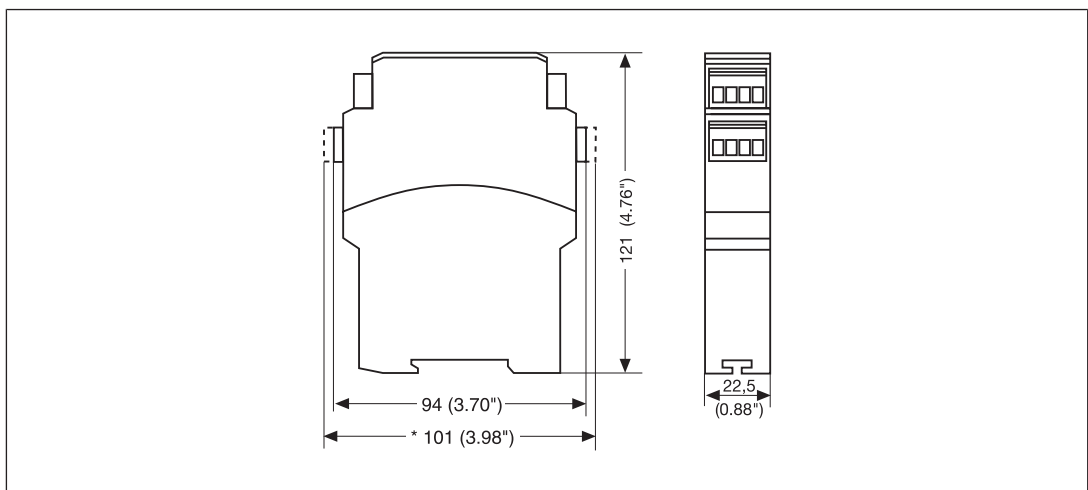


Fig.: Variable frequency inverter with semiconductor output

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 RI-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.

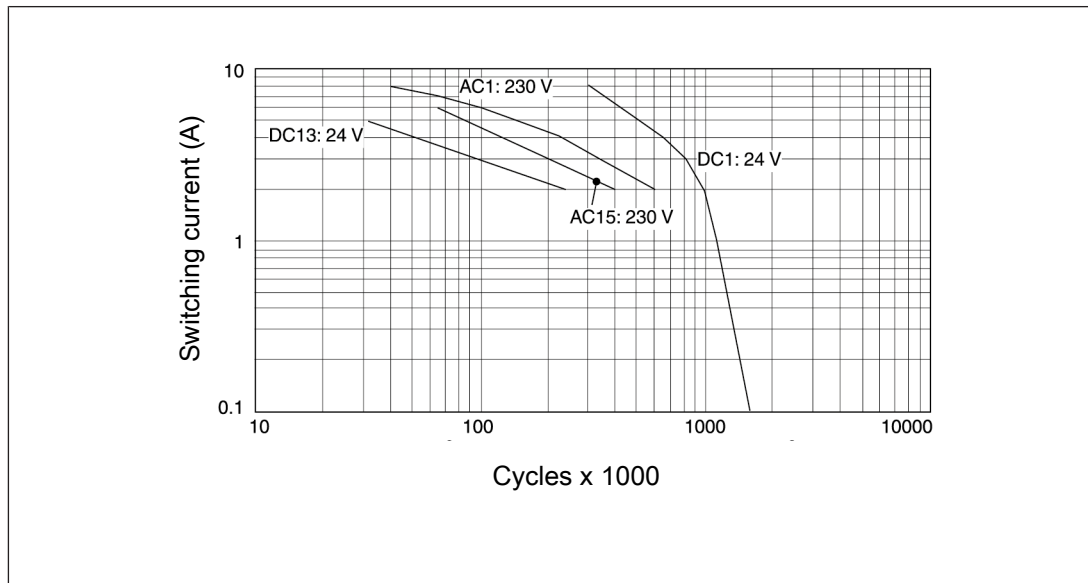
Supplementary data

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 contacts, 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

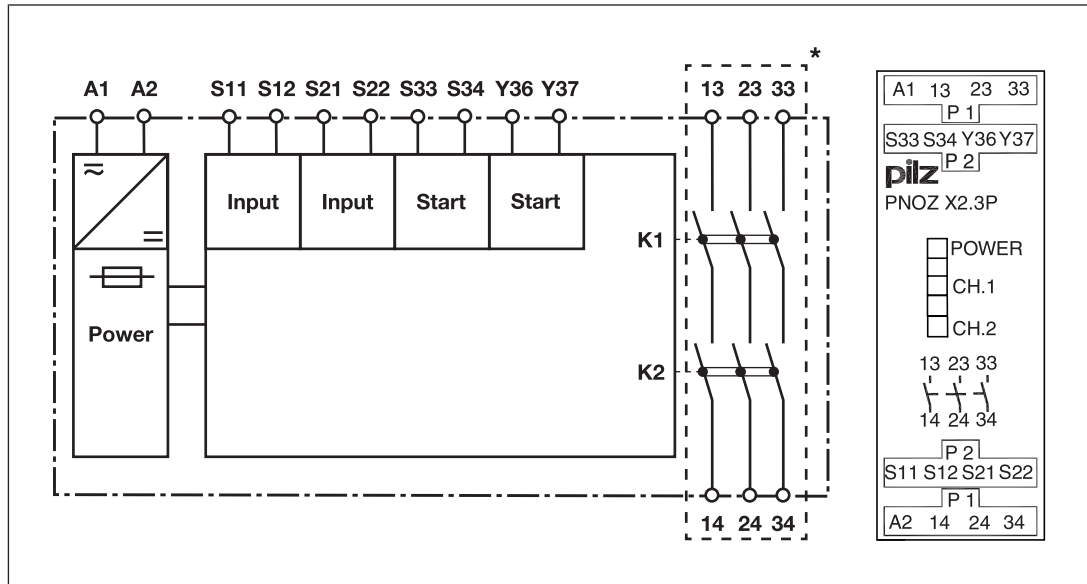


Unit features

- ▶ 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 (over-voltage 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.

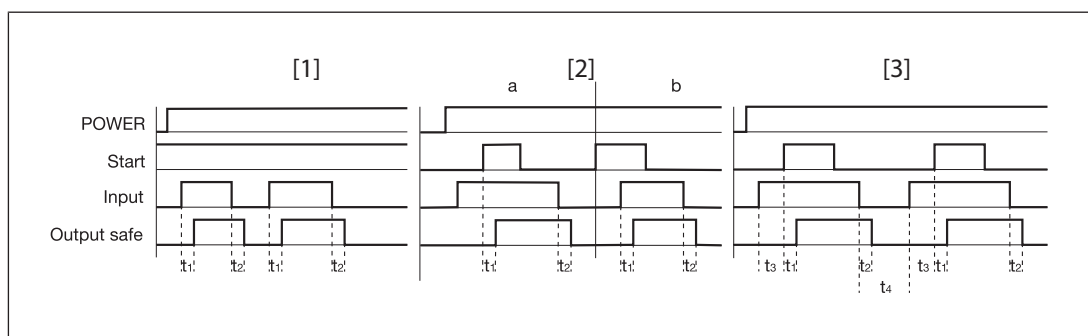
Operating modes

- ▶ 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:

$$l_{\max} = \frac{R_{l_{\max}}}{R_i / \text{km}}$$

$R_{l_{\max}}$ = max. overall cable resistance (see Technical details [📖 60])

R_i / 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

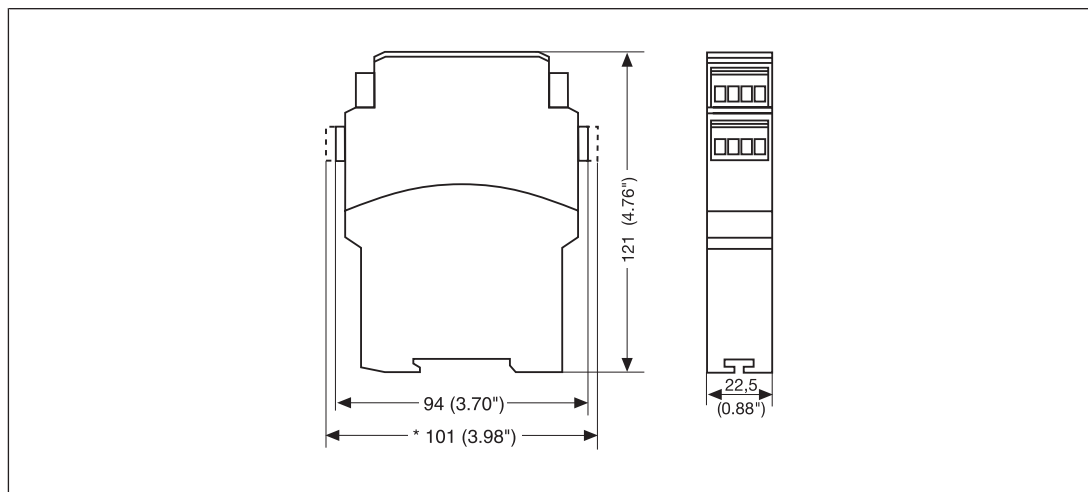
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

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 RI-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), instantaneous	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 A ² s	100 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	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.

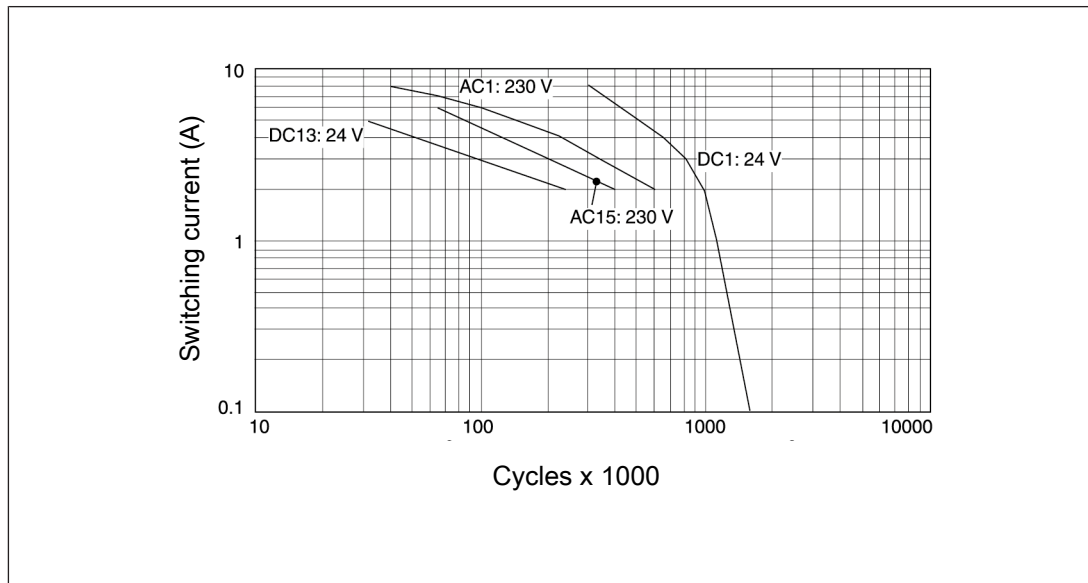
Supplementary data

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 contacts, 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

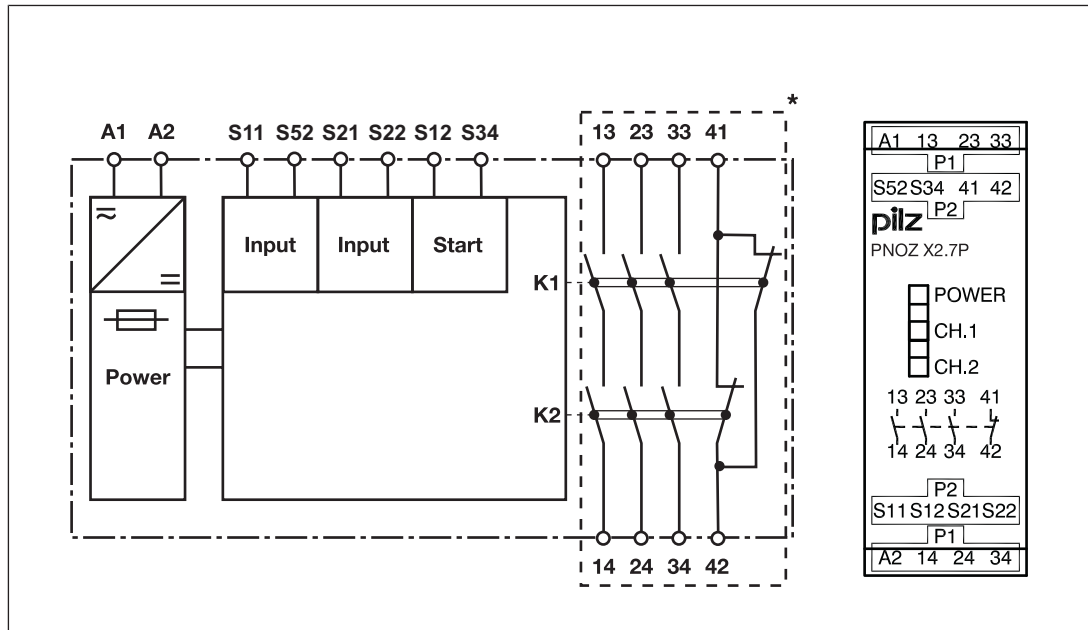
- ▶ Positive-guided relay outputs:
 - 3 safety contacts (N/O), instantaneous
 - 1 auxiliary contact (N/C), instantaneous
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start button
 - Light guards and safety switches
- ▶ LED display for:
 - Supply voltage
 - Switch 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

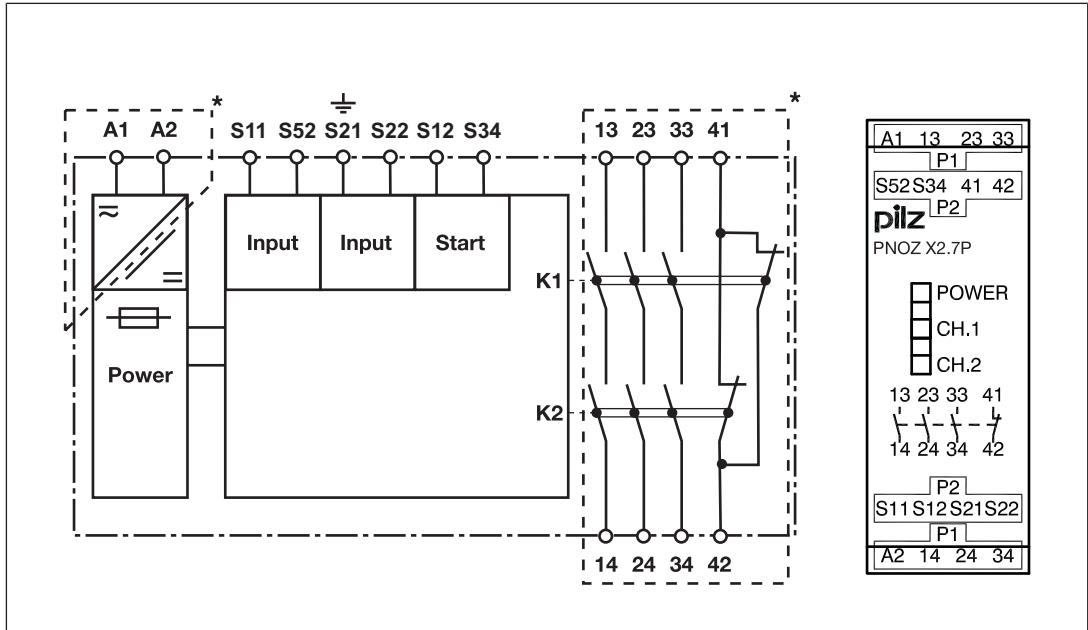


*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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 (over-voltage 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.

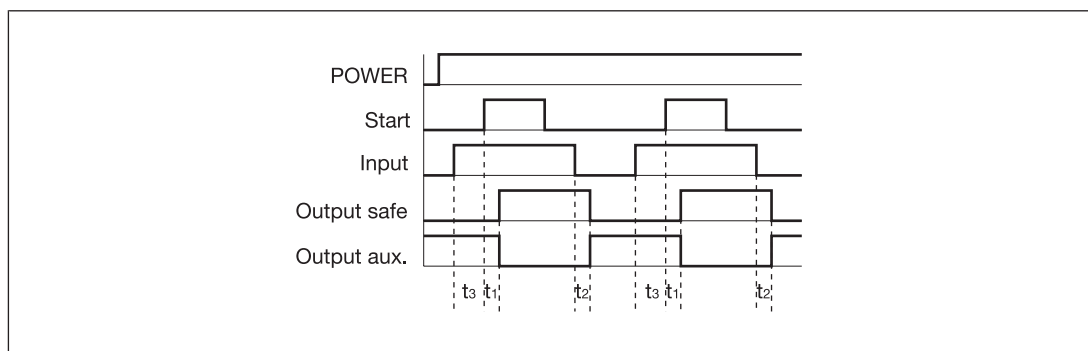
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - LEDs "CH1" and "CH2" will light.
 - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- ▶ Input circuit is opened (e.g. E-STOP pushbutton operated):
 - The LEDs "CH1" and "CH2"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

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

$R_{l_{\max}}$ = 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

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

Preparing for operation

Supply voltage	AC	DC
$U_B = 24 \text{ VAC/DC}$; Order no. 777305, 787305		
$U_B = 24 - 240 \text{ VAC/DC}$; 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 $U_B = 24 \text{ VDC}$); Order no. 777305, 787305)		
Start circuit	Single-channel	Dual-channel
Monitored start		
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

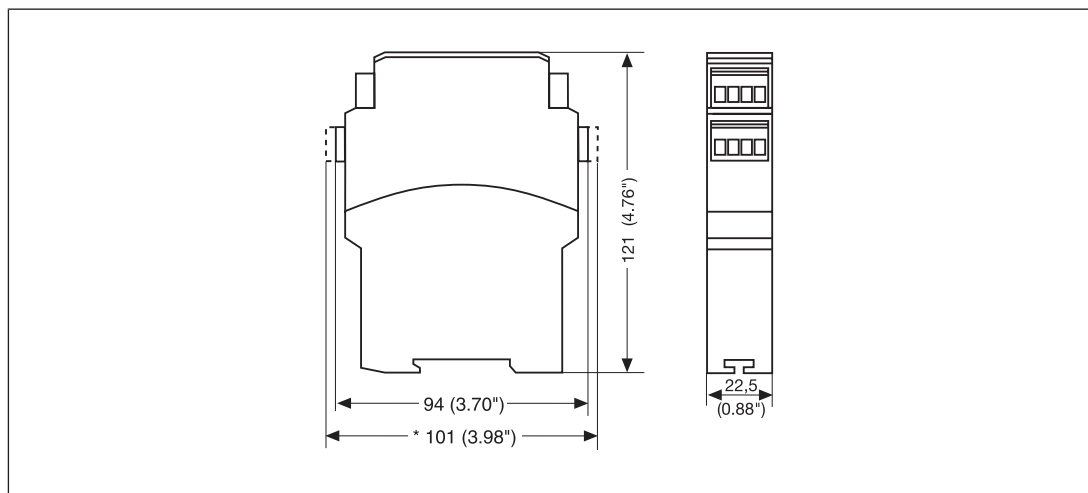
Legend

- ▶ 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 RI-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 A ² s	66 A ² s
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 A ² s	66 A ² s
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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 I _K	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 con- tacts		
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 con- tacts		
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 con- tacts		
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 con- tacts		
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
I _{th} 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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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

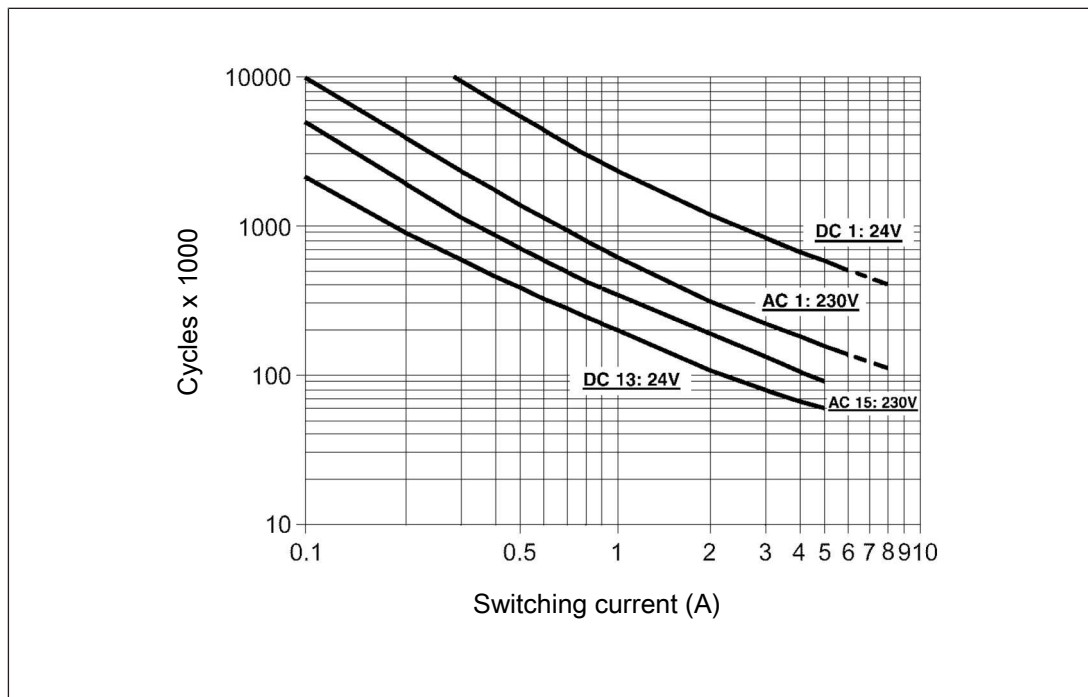


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X PNOZ X2.7P

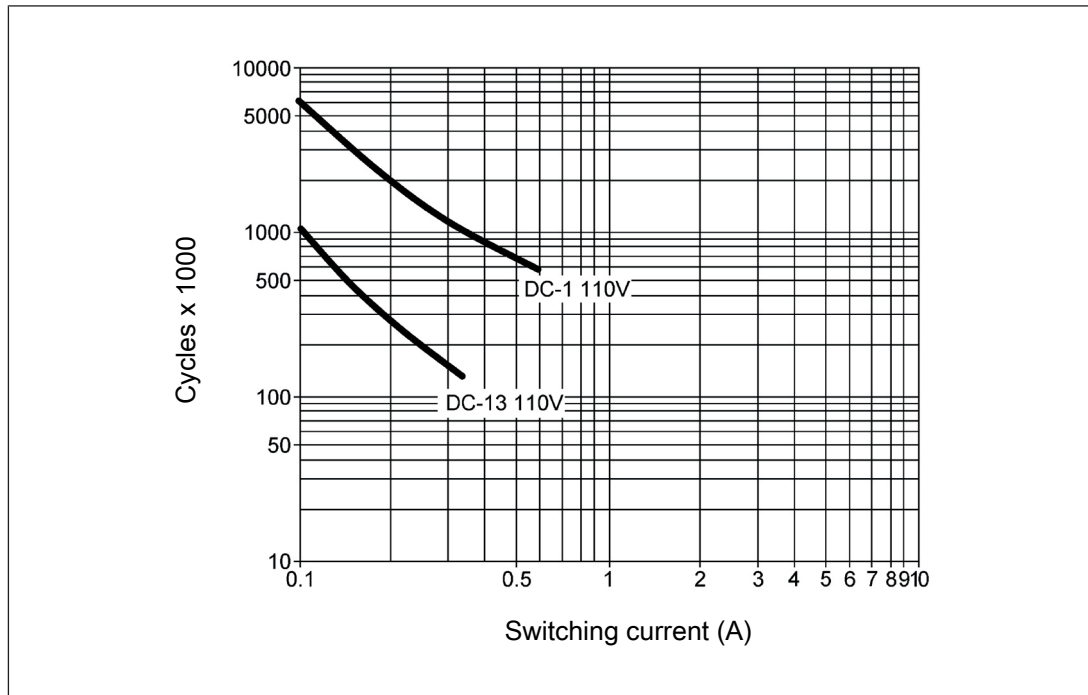


Fig.: Service life graphs at 110 V DC

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

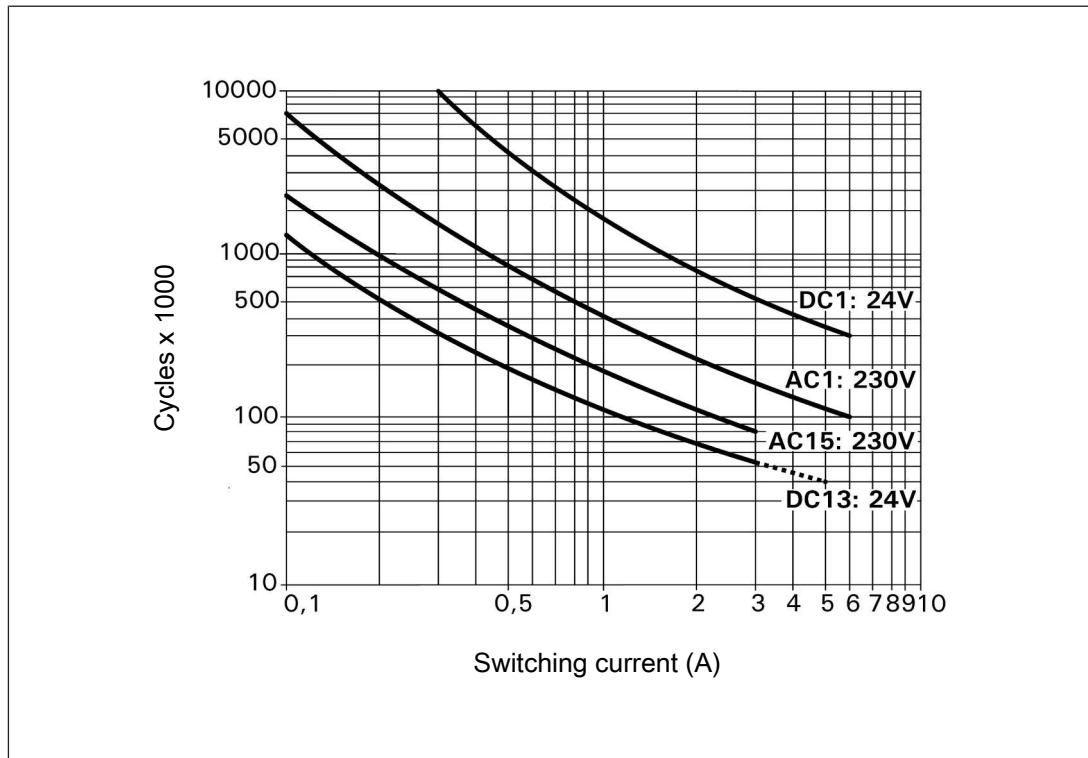


Fig.: Service life graphs at 24 V DC and 230 V AC

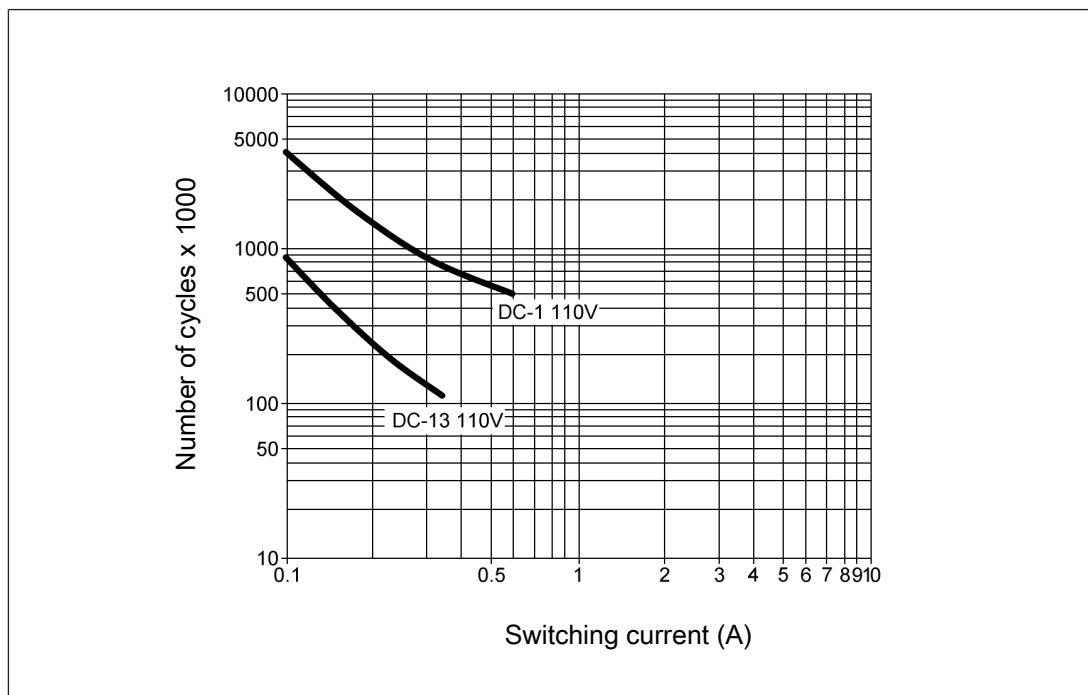


Fig.: Service life graphs at 110 V DC

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

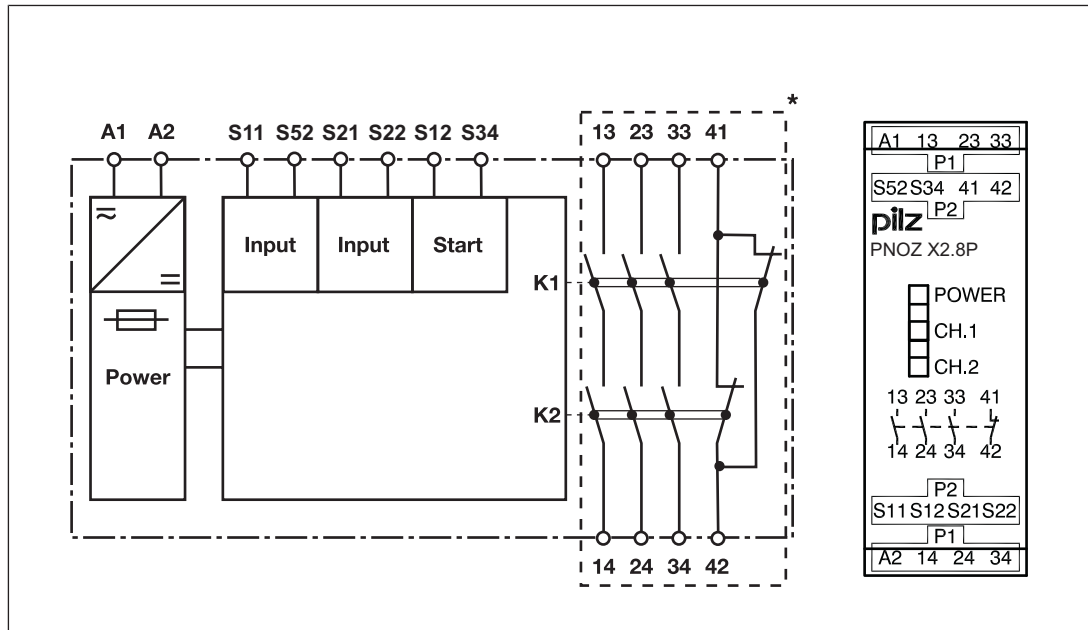
- ▶ Positive-guided relay outputs:
 - 3 safety contacts (N/O), instantaneous
 - 1 auxiliary contact (N/C), instantaneous
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start button
 - Light guards and safety switches
- ▶ LED display for:
 - Supply voltage
 - Switch 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

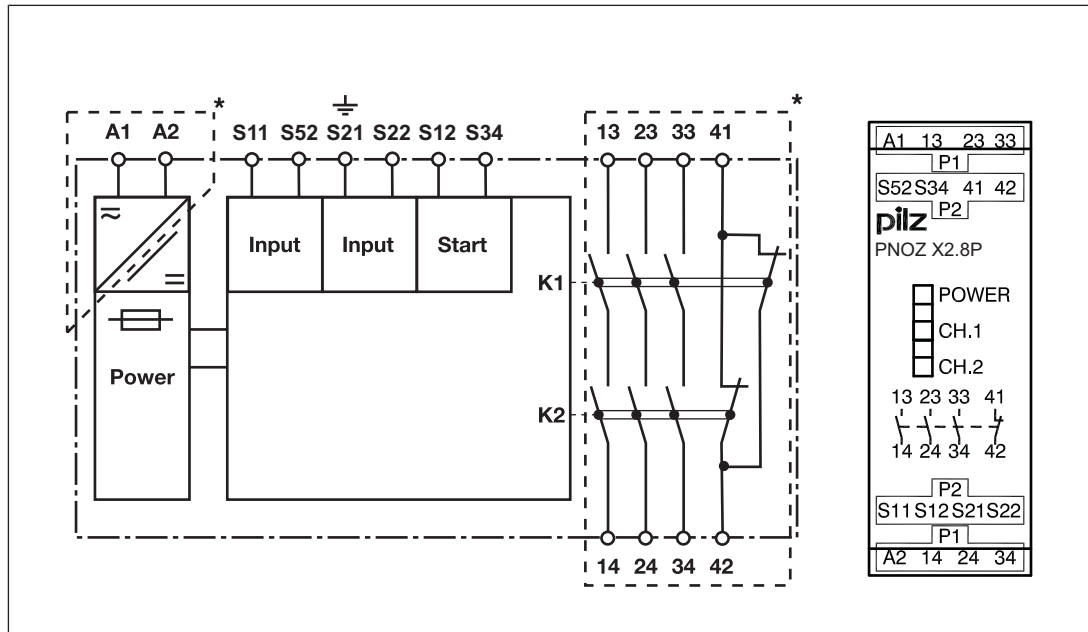


*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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 (over-voltage 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.

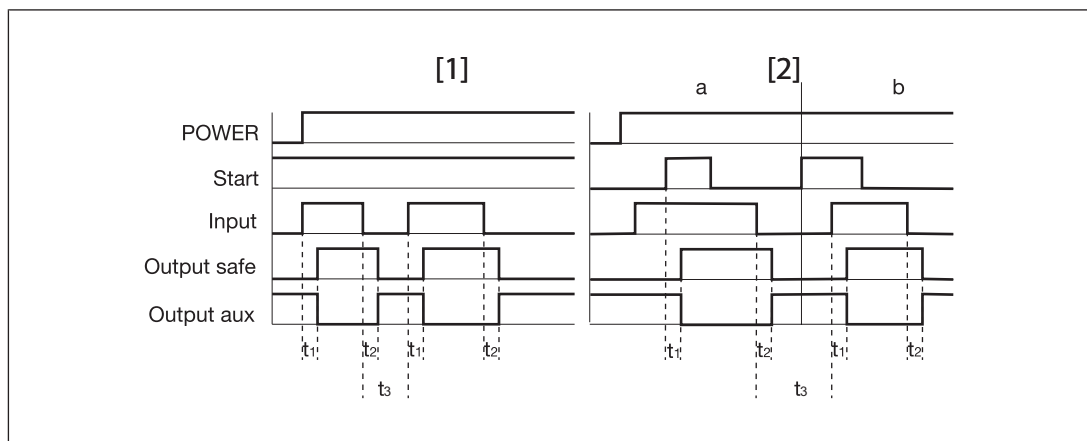
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - LEDs "CH1" and "CH2" will light.
 - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- ▶ Input circuit is opened (e.g. E-STOP pushbutton operated):
 - The LEDs "CH1" and "CH2"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

Safety relays PNOZ X PNOZ X2.8P

- ▶ 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:

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

$R_{l_{\max}}$ = 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
$U_B = 24 \text{ VAC/DC}$; Order no. 777301, 787301		
$U_B = 24 - 240 \text{ VAC/DC}$; 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, de- tection of shorts across contacts via ESPE (only when $U_B = 24 \text{ VDC}$); 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		

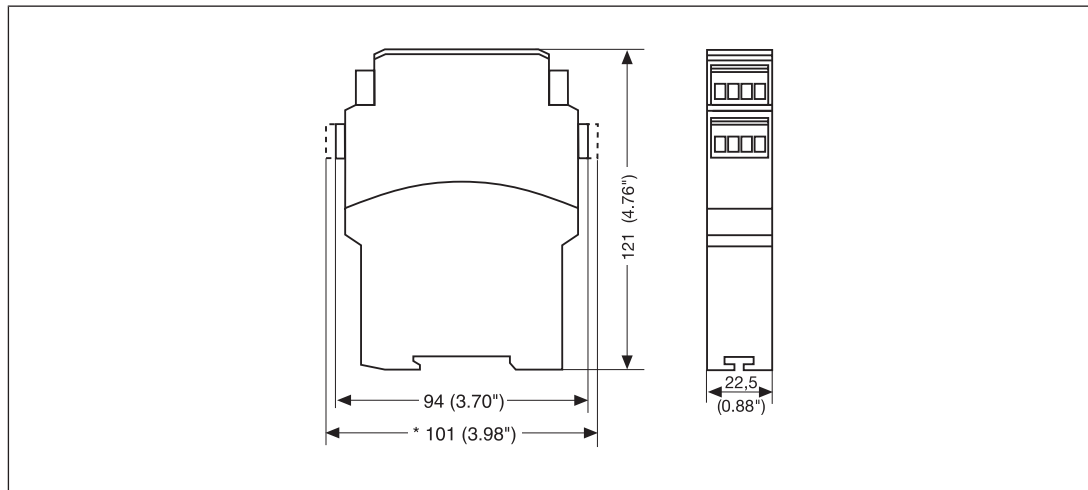
Legend

- ▶ 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 RI-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 A ² s	66 A ² s
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 A ² s	66 A ² s
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
I _{th} 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
I _{th} 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 RI-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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
–	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

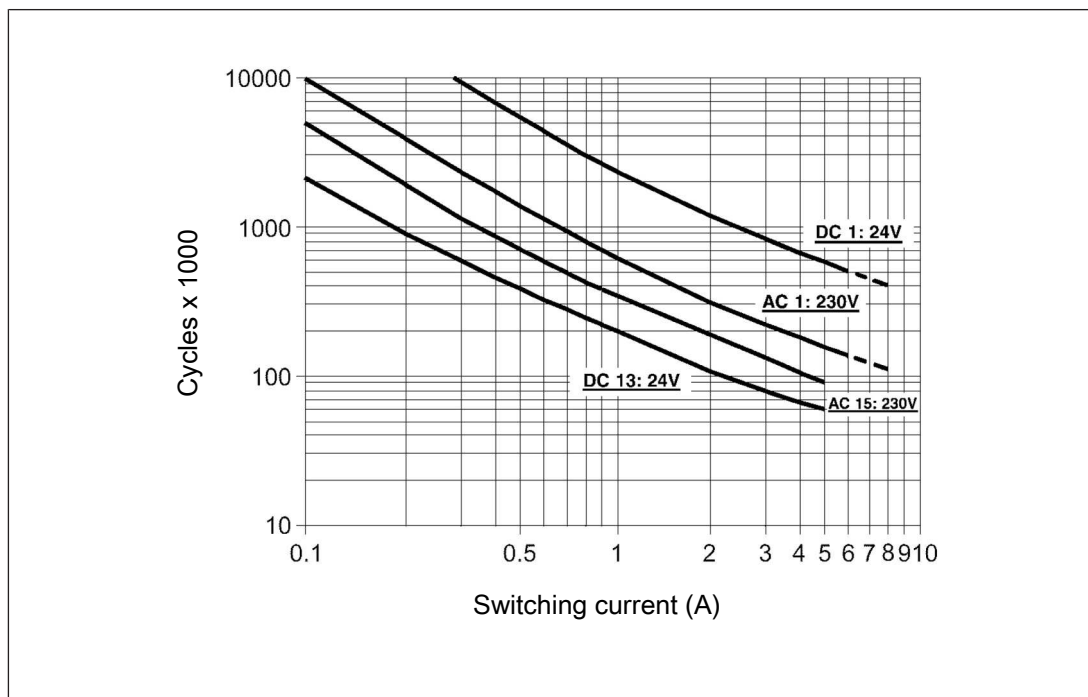


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X PNOZ X2.8P

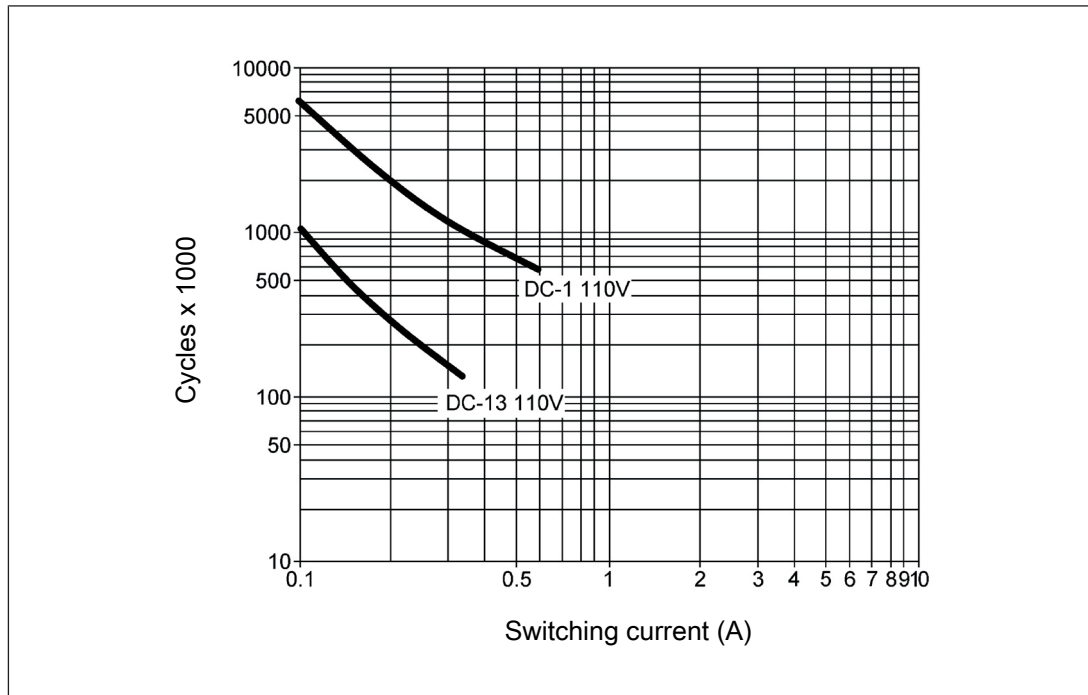


Fig.: Service life graphs at 110 V DC

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

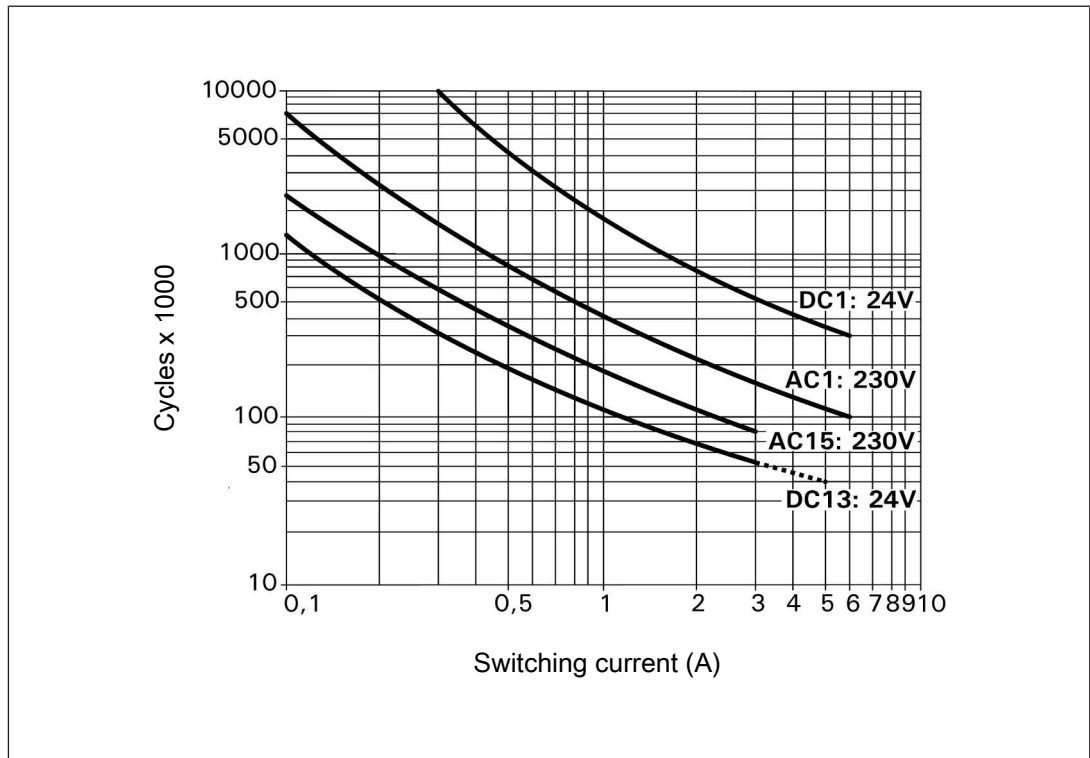


Fig.: Service life graphs at 24 V DC and 230 V AC

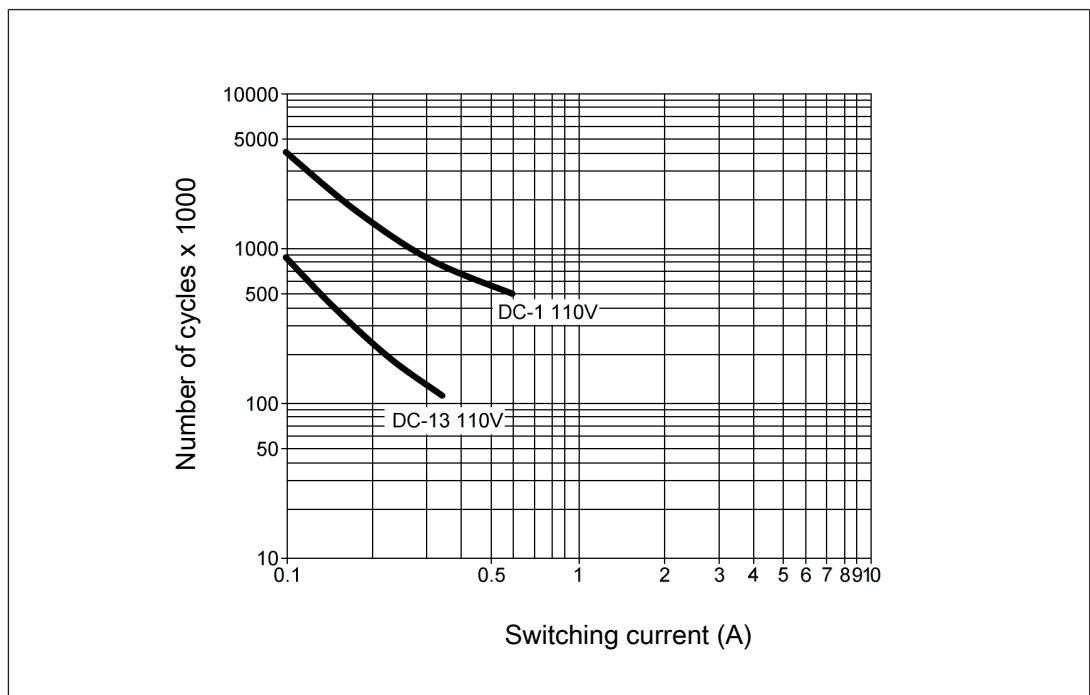


Fig.: Service life graphs at 110 V DC

Safety relays PNOZ X PNOZ X2.8P

Example

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

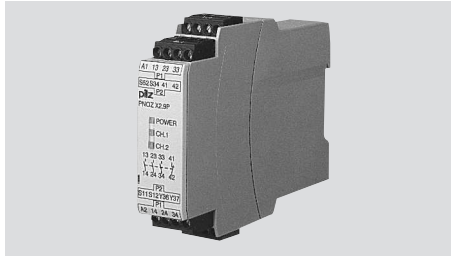
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see [Technical details \[96\]](#)) can be used in the calculation.

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



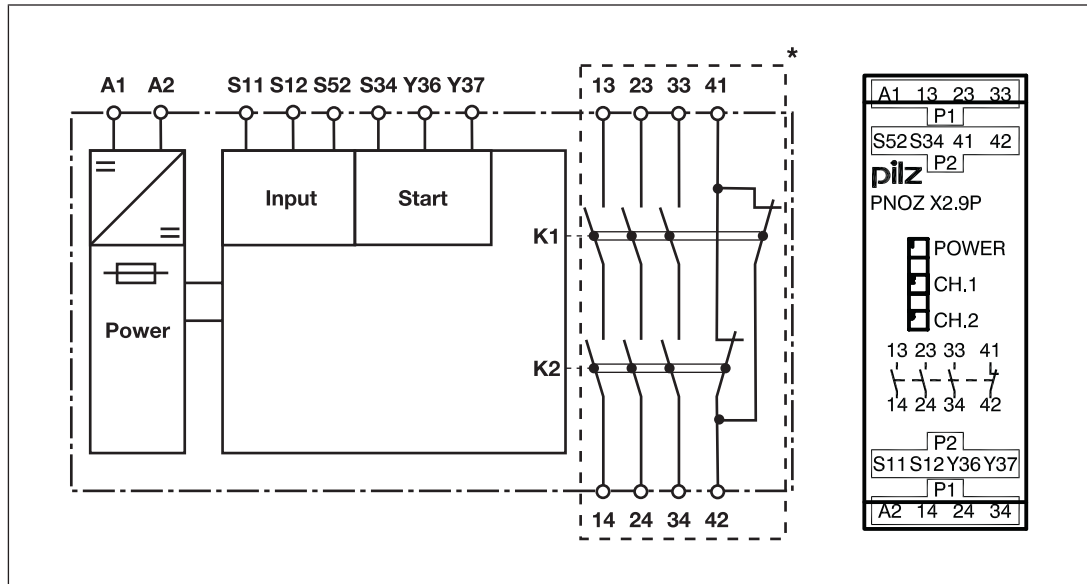
Unit features

- ▶ 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 (over-voltage 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.

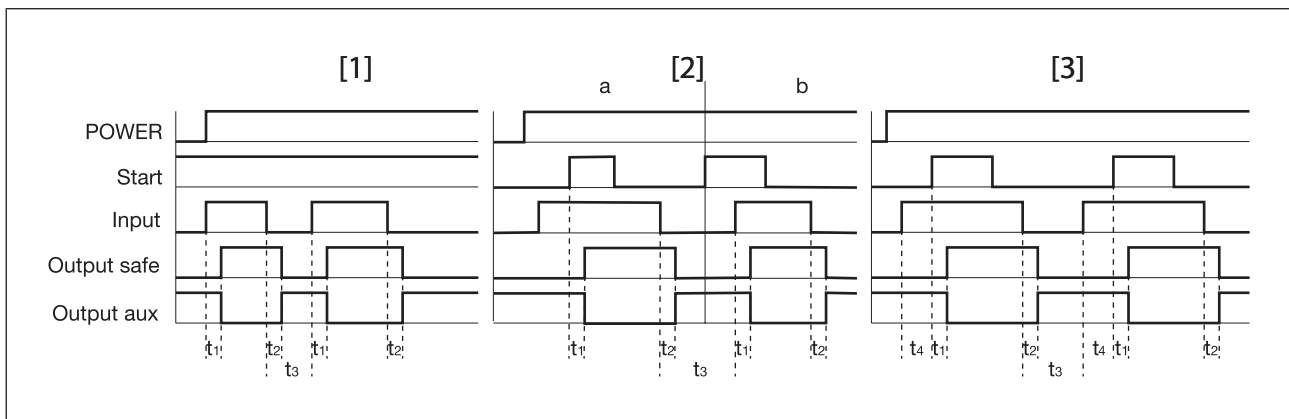
Operating modes

- ▶ 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:

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

$R_{l_{\max}}$ = 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, de- tection 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		

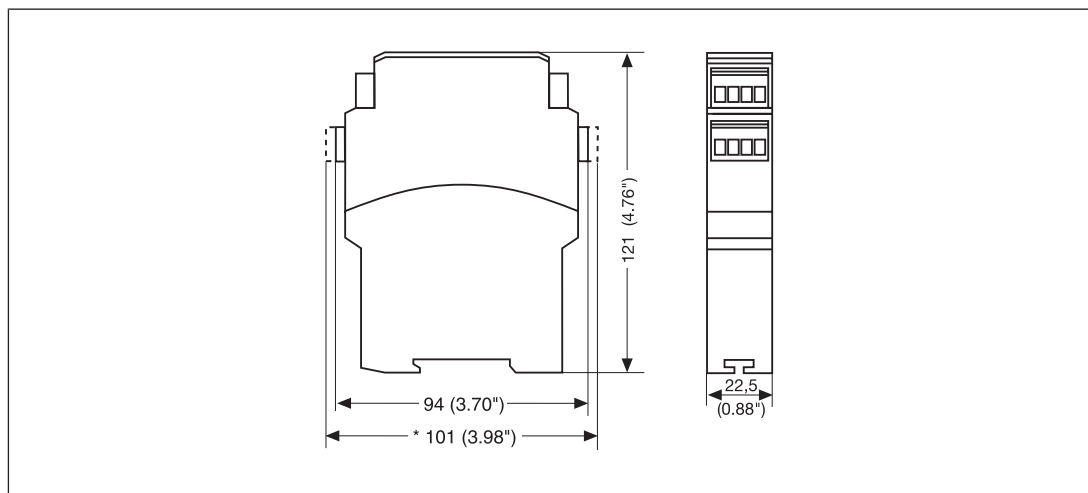
Legend

- ▶ 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 RI-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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	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

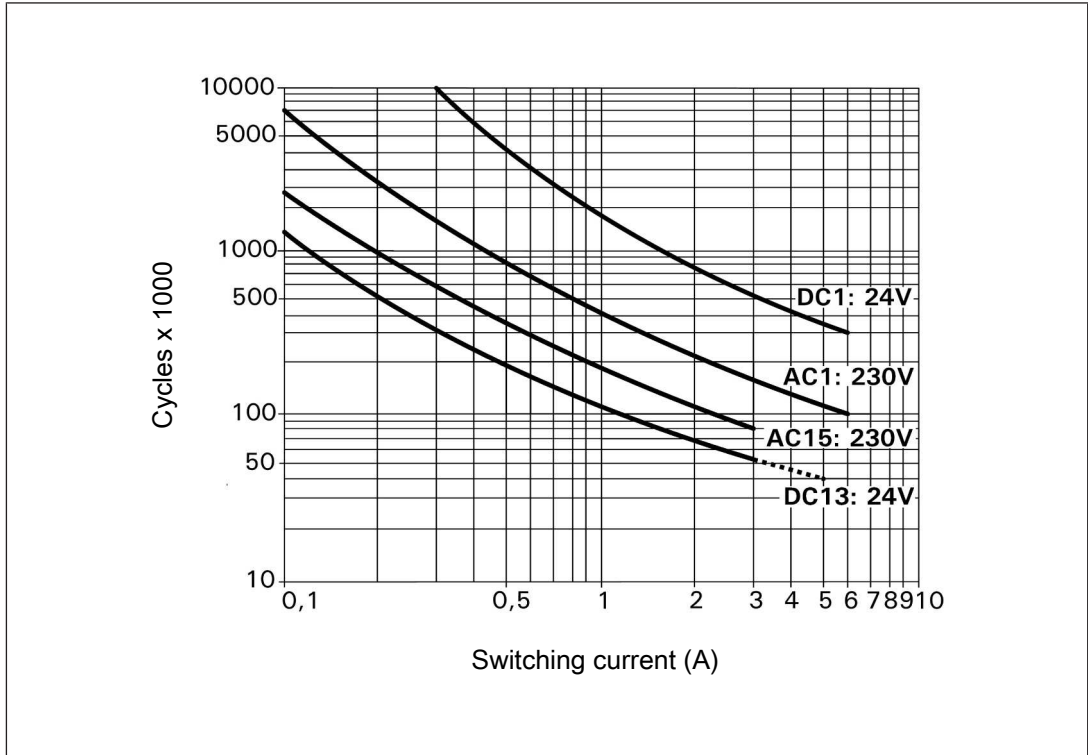


Fig.: Service life graphs at 24 VDC and 230 VAC

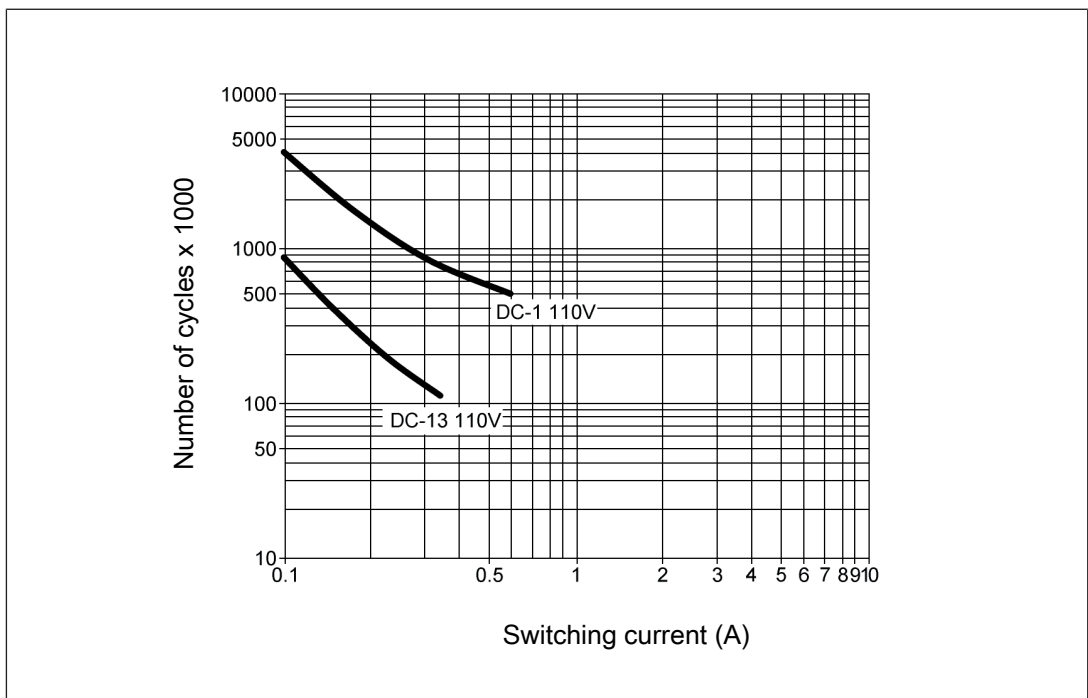


Fig.: Service life graphs at 110 VDC

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

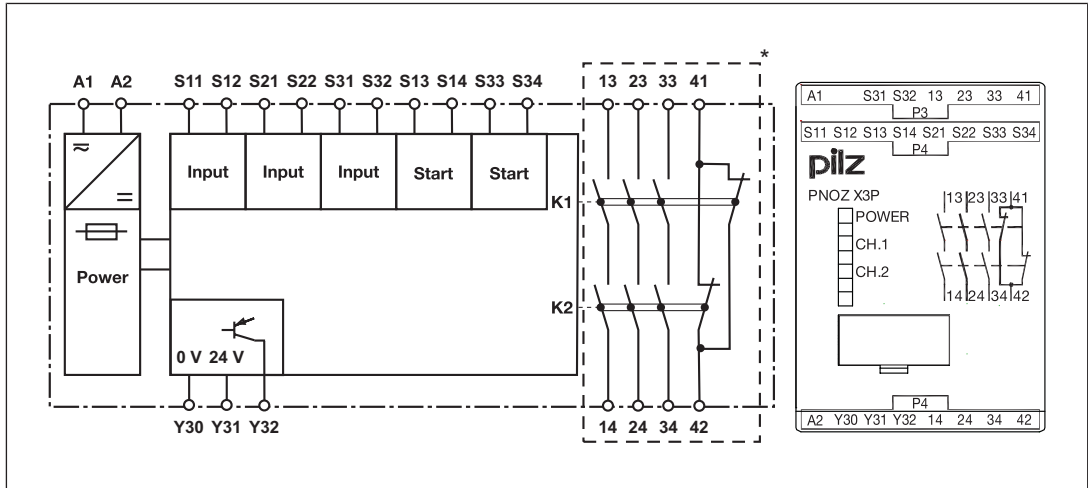
- ▶ Positive-guided relay outputs:
 - 3 safety contacts (N/O), instantaneous
 - 1 auxiliary contact (N/C), instantaneous
- ▶ 1 semiconductor output
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start button
 - Light guards and safety switches
- ▶ LED display for:
 - 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

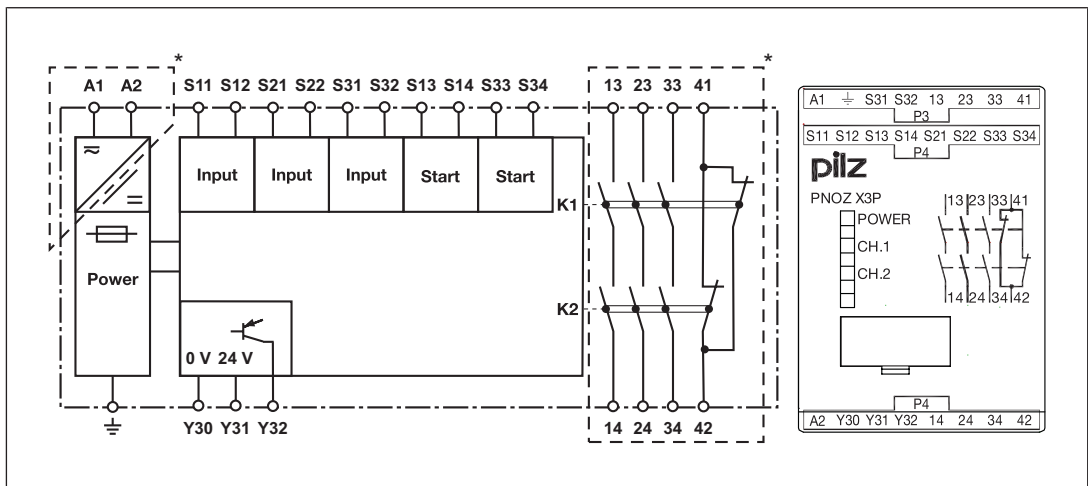
- ▶ U_B : 24 VAC/DC; Order no. 777310, 787310



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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 (over-voltage 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.

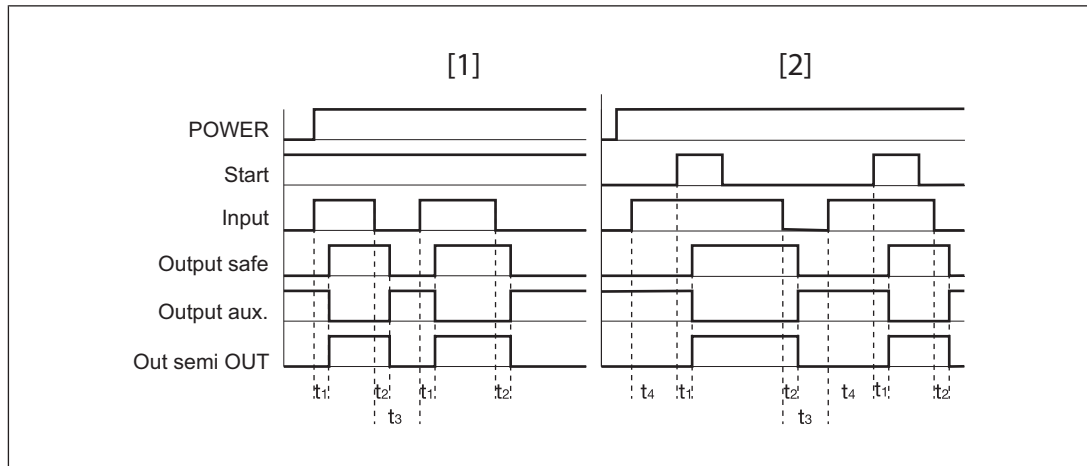
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
 - The LEDs "CH.1" and "CH.2" are lit.
 - A high signal is present at the semiconductor output switch state Y32.
- ▶ Input circuit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

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

$R_{l_{\max}}$ = 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

	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Start circuit		
Automatic start		
Monitored start		
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		
Semiconductor output		

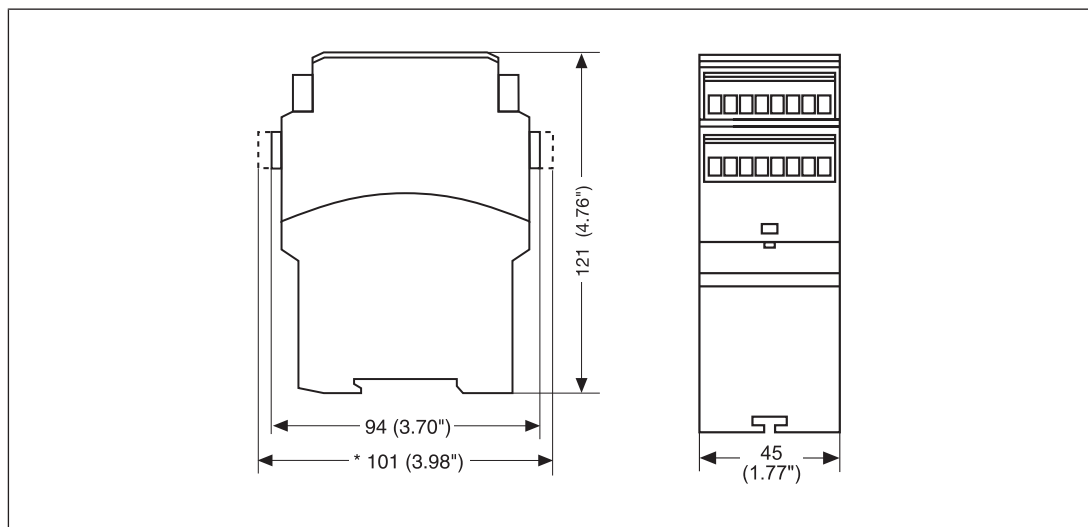
Legend

- ▶ 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 RI-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 con- tacts		
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 con- tacts		
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 con- tacts		
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 con- tacts		
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
I _{th} 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
I _{th} 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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	787310	787313
I _{th} 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
I _{th} 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	EN ISO 13849-1: 2015	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.

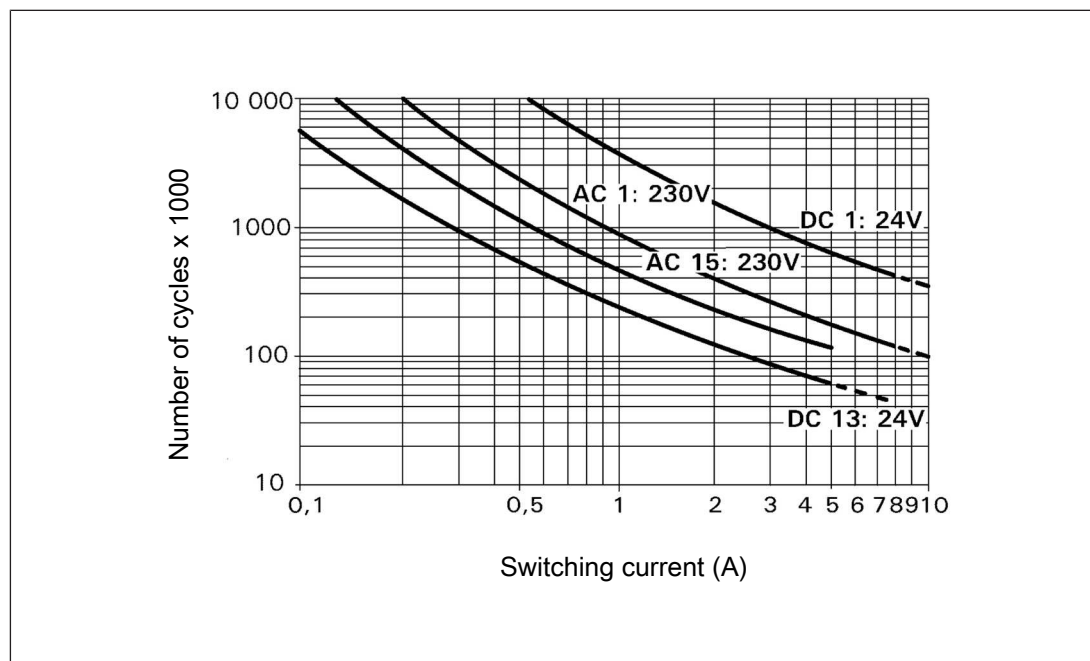
Safety relays PNOZ X PNOZ X3P

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.

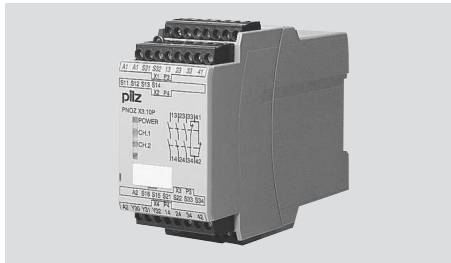
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

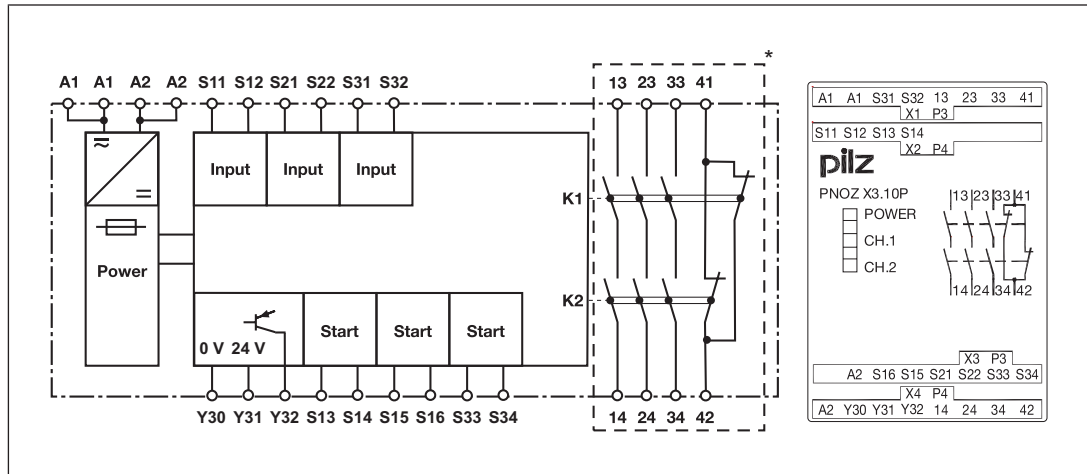


Unit features

- ▶ 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 (over-voltage 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.

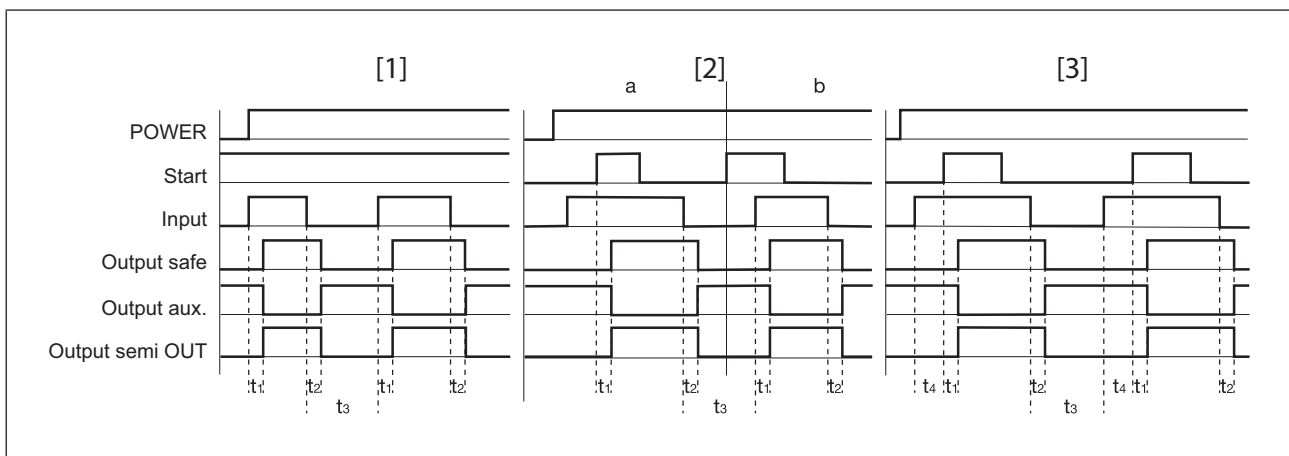
Operating modes

- ▶ 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:

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

$R_{l_{\max}}$ = 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

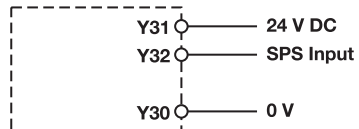
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		
Safety gate with detection of shorts across contacts		

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

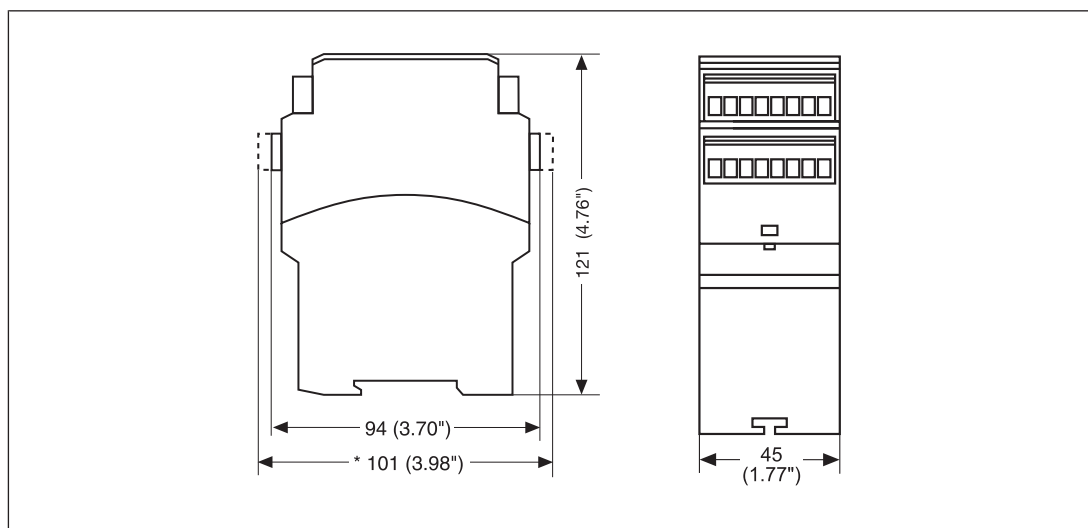


Legend

- ▶ 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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777314	787314
I _{th} 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
I _{th} 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.

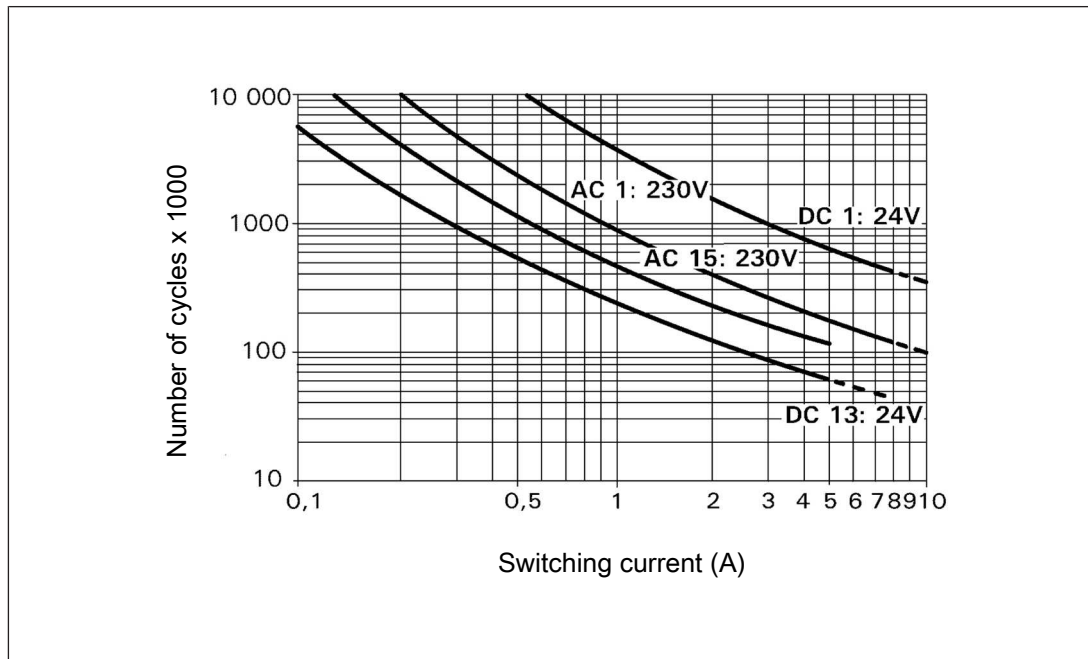
Supplementary data

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

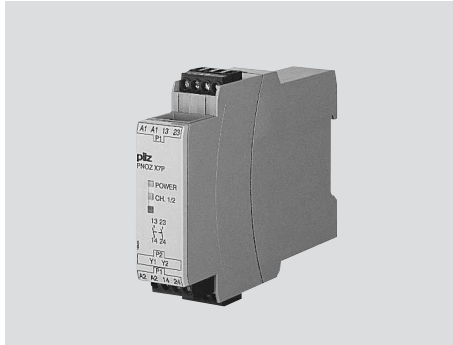
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

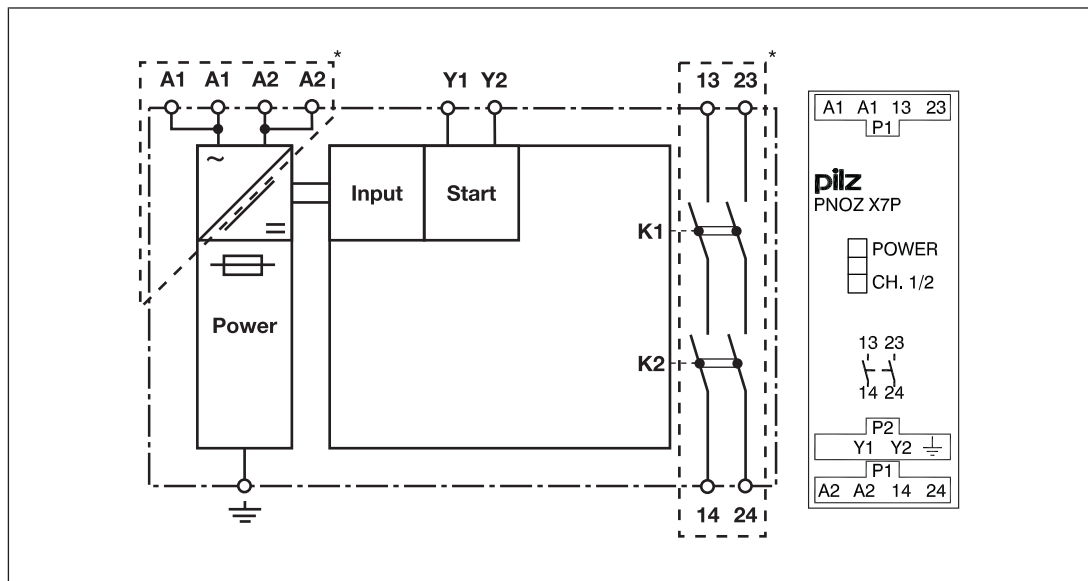
- ▶ Positive-guided relay outputs:
 - 2 safety contacts (N/O), instantaneous
- ▶ Connection options for:
 - E-STOP pushbutton
 - Safety gate limit switch
 - Start button
- ▶ LED display for:
 - Supply voltage
 - Switch status of the safety contacts
- ▶ Plug-in connection terminals
- ▶ See order reference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

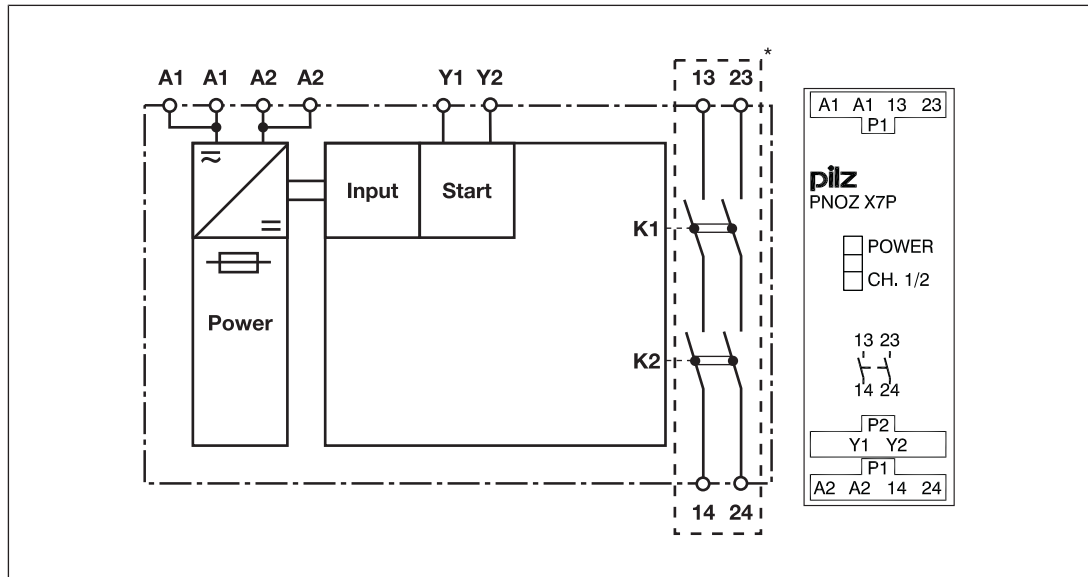


*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (over-voltage category II)

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 (over-voltage 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.

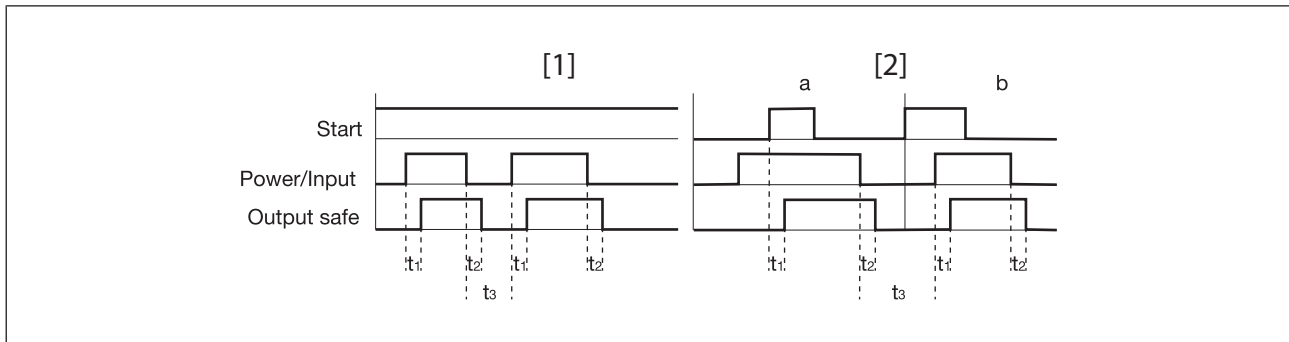
- ▶ Input circuit is closed (e.g. E-STOP pushbutton not operated):
 - The LED "CH. 1/2" lights.
 - Safety contacts 13-14 and 23-24 are closed. The unit is active.
- ▶ Input circuit is opened (e.g. E-STOP pushbutton operated):
 - The LED "CH. 1/2" goes out.
 - Safety contacts 13-14 and 23-24 are redundantly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

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

$R_{I_{max}}$ = 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:

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

$C_{I_{max}}$ = 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 $C_{I_{max}}$ (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

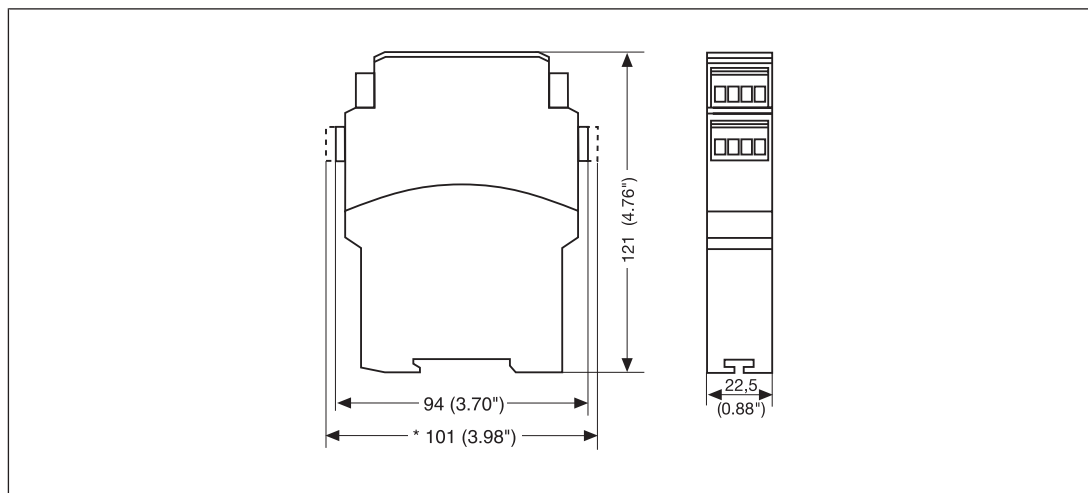
- ▶ S1: E-STOP/safety gate switch
- ▶ S3: Start button
- ▶ : Gate open

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 R _{lmax}			
Single-channel at UB DC	–	–	15 Ohm
Single-channel at UB AC	–	–	15 Ohm
Max. overall line capacitance C _{lmax}	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 I _K	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 A ² s	240 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777053	777056	777059
I _{th} 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 R _{lmax}			
Single-channel at UB DC	–	–	15 Ohm
Single-channel at UB AC	–	–	15 Ohm
Max. overall line capacitance C _{lmax}	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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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.

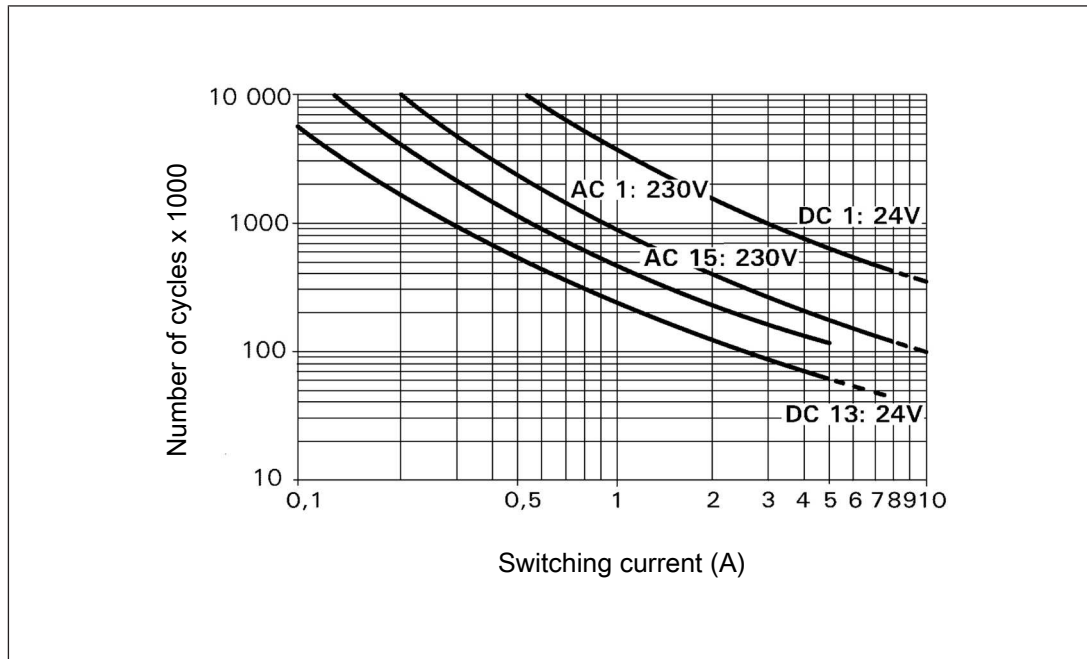
Supplementary data

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

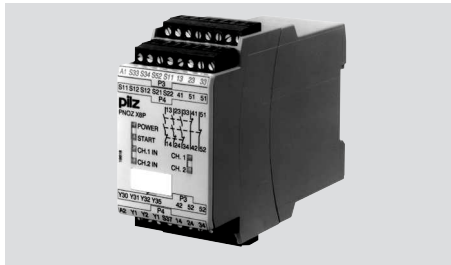
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

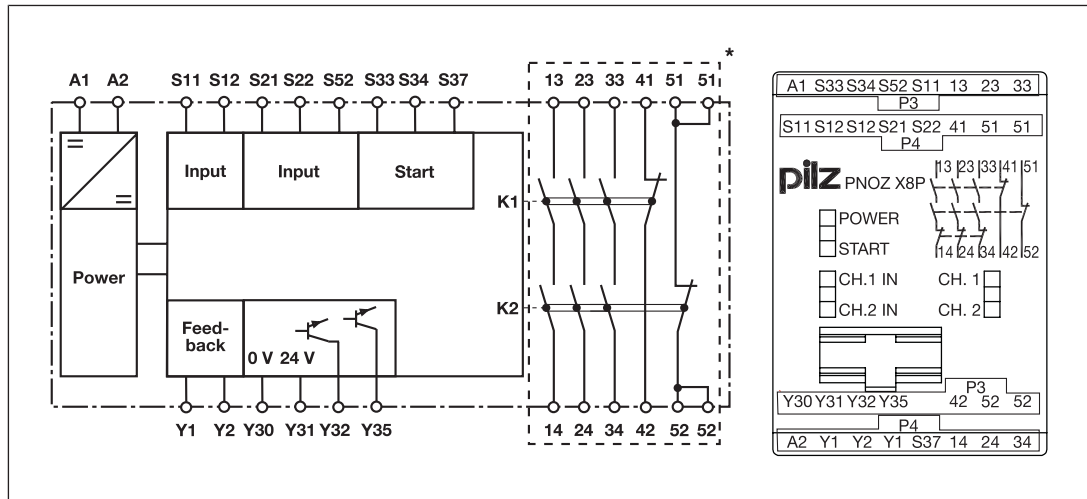
- ▶ Positive-guided relay outputs:
 - 3 safety contacts (N/O), instantaneous
 - 2 auxiliary contacts (N/C), instantaneous
- ▶ 2 semiconductor outputs
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start button
 - Light guards and safety switches
- ▶ LED indicator for:
 - 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

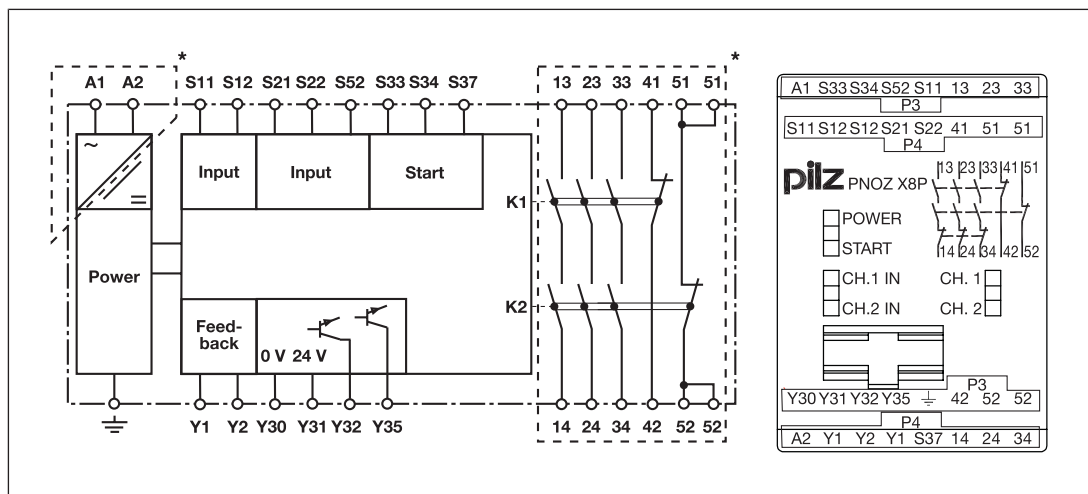


*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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 (over-voltage 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

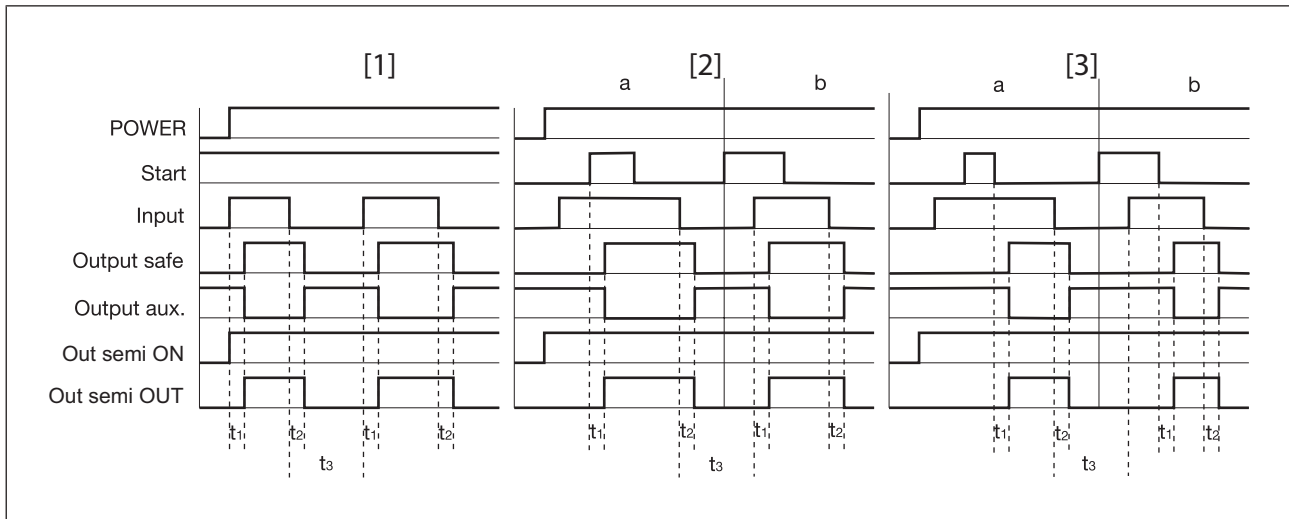
- ▶ A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

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:

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

R_{\max} = 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

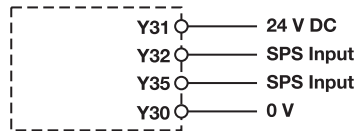
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		<p>Simultaneity S1 and S2: 150 ms</p>
Safety gate with detection of shorts across contacts		
Light guard or safety switch, detection of shorts across contacts via ESPE		

Safety relays PNOZ X PNOZ X8P



	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)
Start circuit		
Automatic start		
Automatic start with start-up test		
Manual start		
Monitored start		
Feedback loop	without feedback loop monitor- ing	with feedback loop monitoring
Link or contacts from external contactors		

Safety relays PNOZ X PNOZ X8P

Semiconductor output

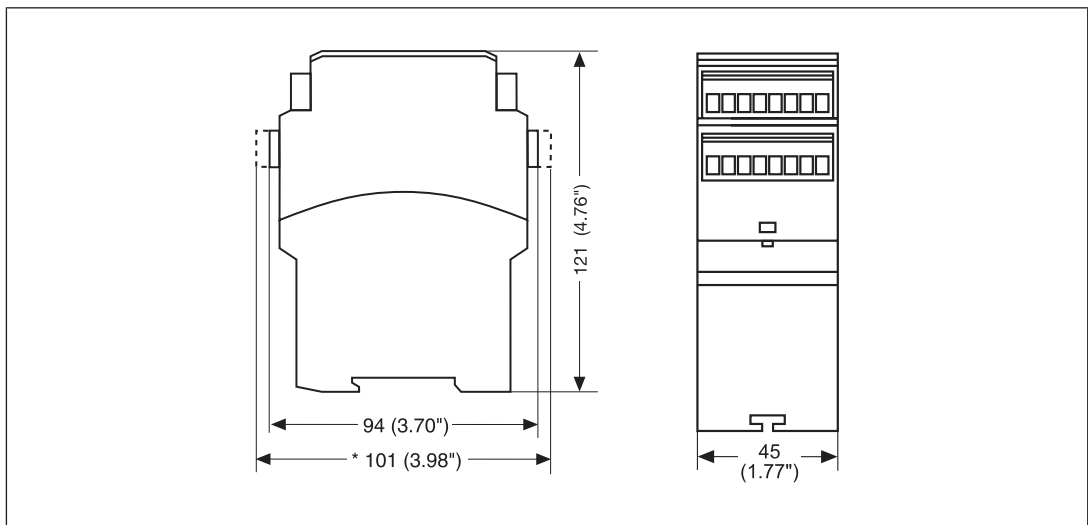


Legend

- ▶ 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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 A ² s	240 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777760	777764	777765
I _{th} 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
I _{th} 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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 A ² s	240 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777766	777768	777770
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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 I _K	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
I _{th} 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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	787768	787770
I _{th} 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	EN ISO 13849-1: 2015	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	Category					
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

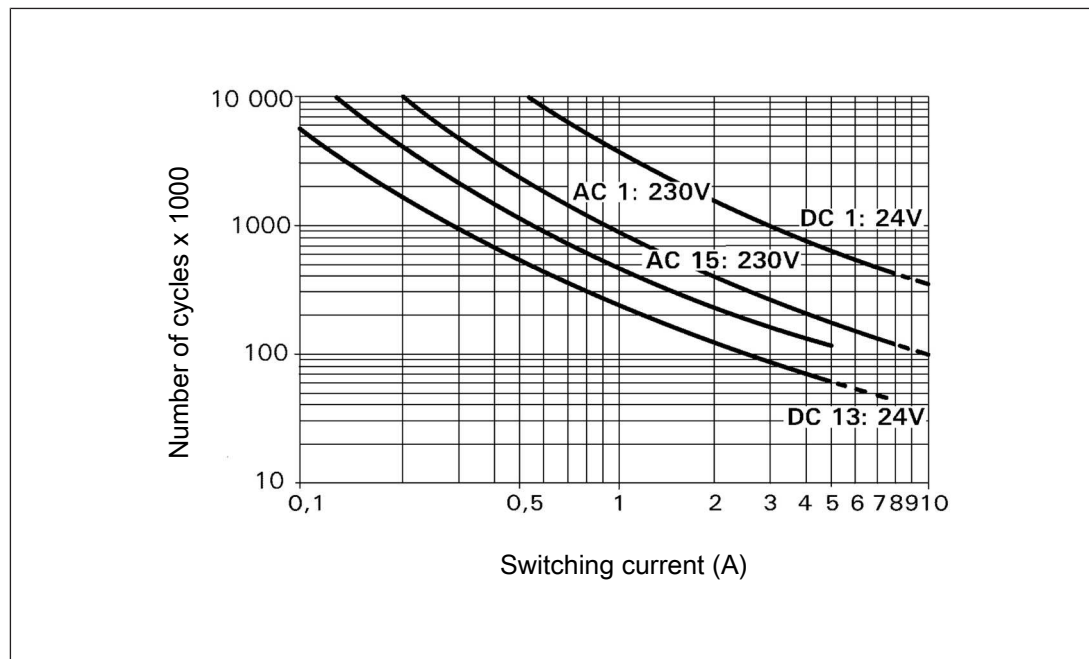
All the units used within a safety function must be considered when calculating the safety characteristic data.

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

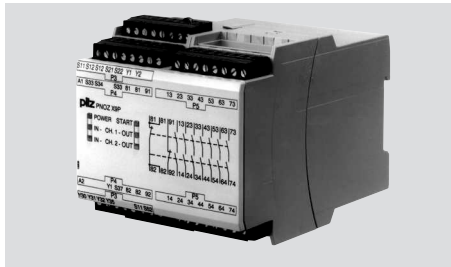
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

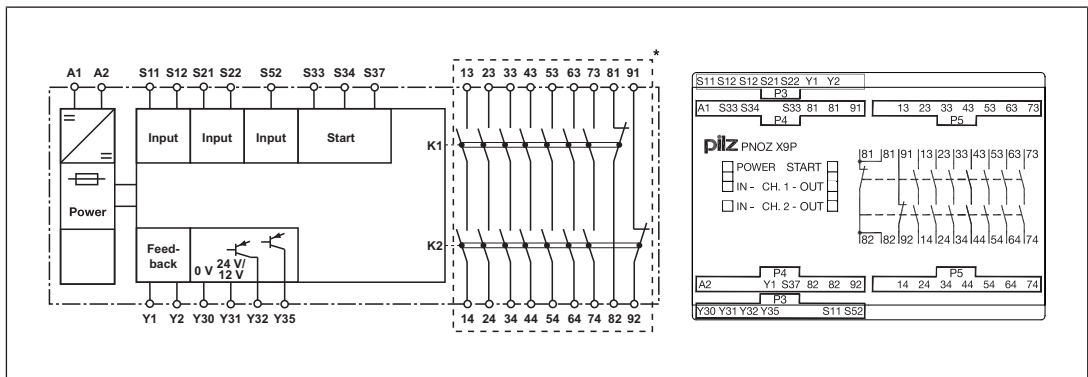
- ▶ Positive-guided relay outputs:
 - 7 safety contacts (N/O), instantaneous
 - 2 auxiliary contacts (N/C), instantaneous
- ▶ 2 semiconductor outputs
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start buttons
 - Light grids and safety switches with detection of shorts 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

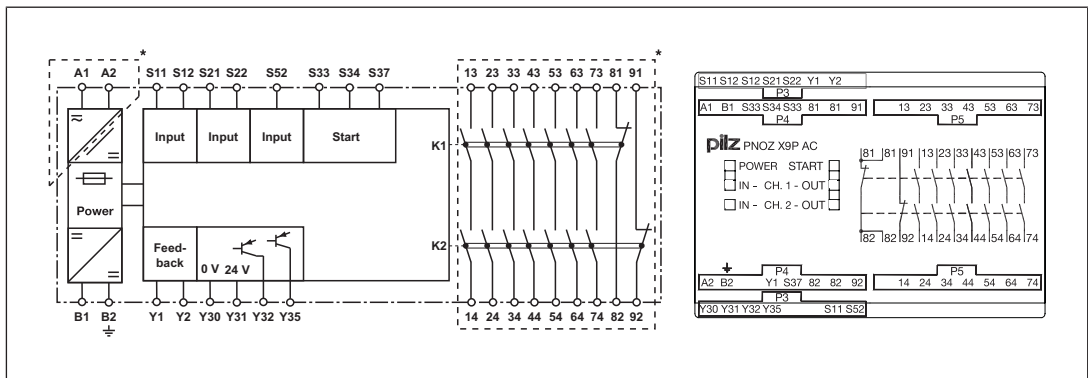
- ▶ U_B : 12 VDC; Order no. 777607
- ▶ U_B : 24 VDC; Order no. 777609, 787609



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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 (over-voltage 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.

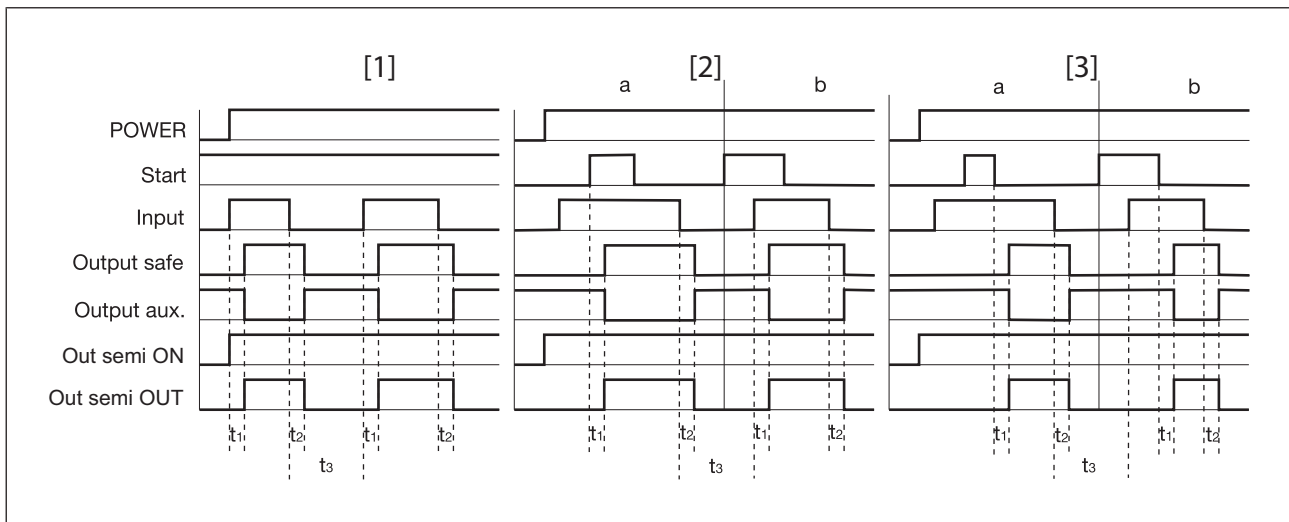
Operating modes

- ▶ 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:

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

$R_{l_{\max}}$ = 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
<p>▶ Order no. 777606, 787606 U_B: 24-240 V AC/DC via A1 and A2</p>		
<p>▶ Order no. 777606, 787606 U_B: 24 V DC via B1 and B2</p>		
Supply voltage	AC	DC
<p>▶ Order no. 777607 U_B: 12 V DC</p> <p>▶ Order no. 777609, 787609 U_B: 24 VDC</p>		

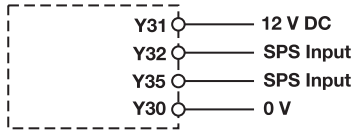
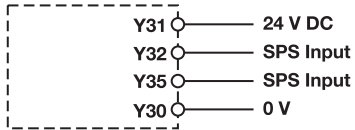
Safety relays PNOZ X PNOZ X9P

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

	Single-channel, dual-channel without detection of shorts across contacts	Dual-channel with detection of shorts across contacts
Start circuit		
Automatic start		
Automatic start with start-up test (safety gate, dual-channel)		
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

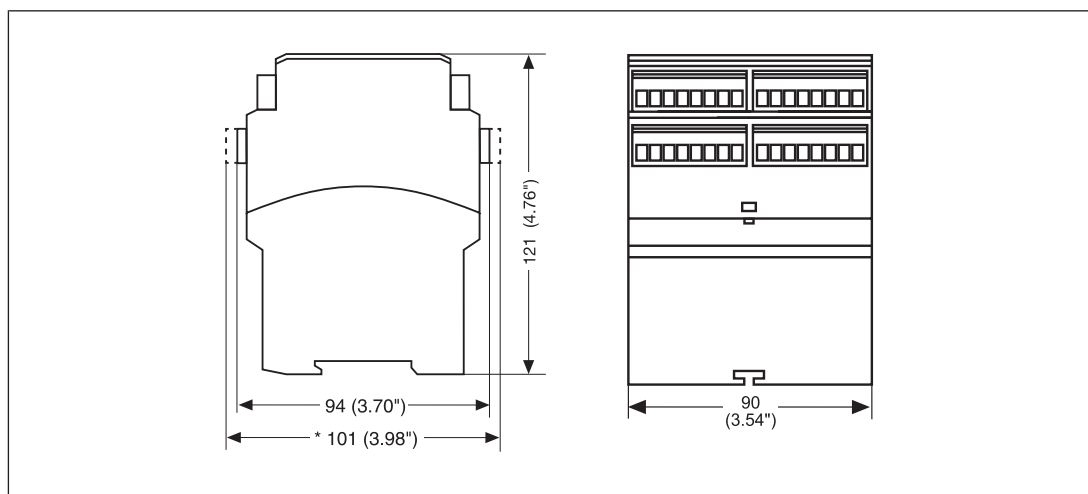
Semiconductor output	U _B : 12 V DC	U _B : 24 V DC; 24-240 V AC/DC
Y31, Y30: External supply voltage	 <p>Y31 ○ — 12 V DC Y32 ○ — SPS Input Y35 ○ — SPS Input Y30 ○ — 0 V</p>	 <p>Y31 ○ — 24 V DC Y32 ○ — SPS Input Y35 ○ — SPS Input Y30 ○ — 0 V</p>

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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777606	787606
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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 A ² s	240 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777607	777609	787609
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 mm ² , 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.

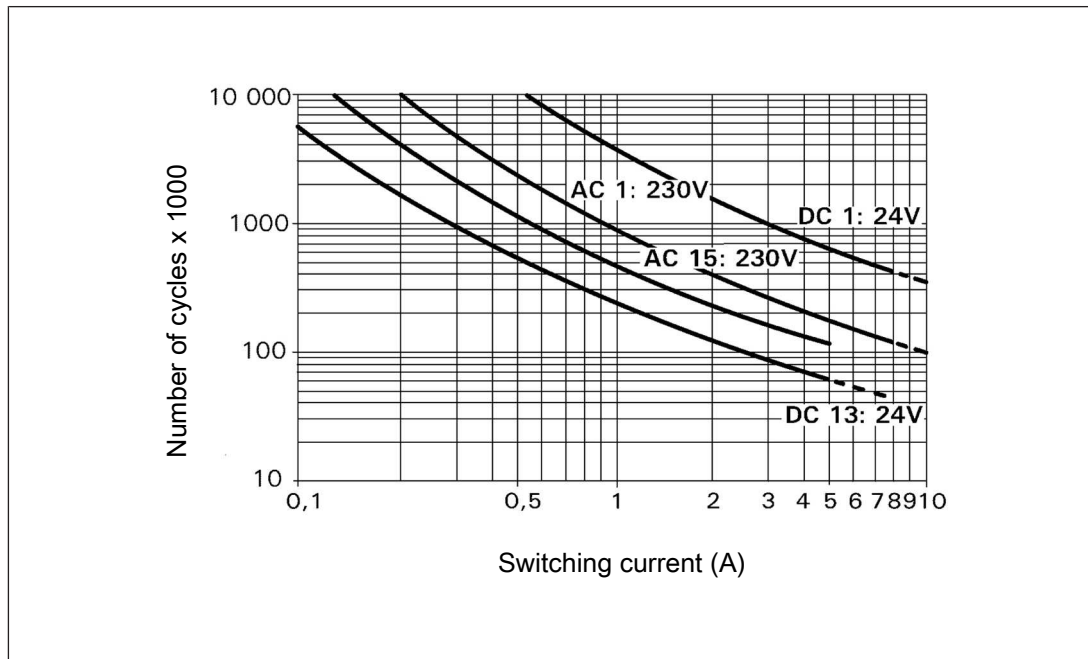
Supplementary data

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.

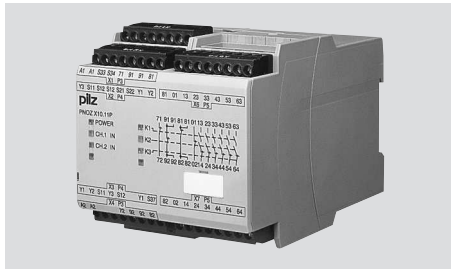
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

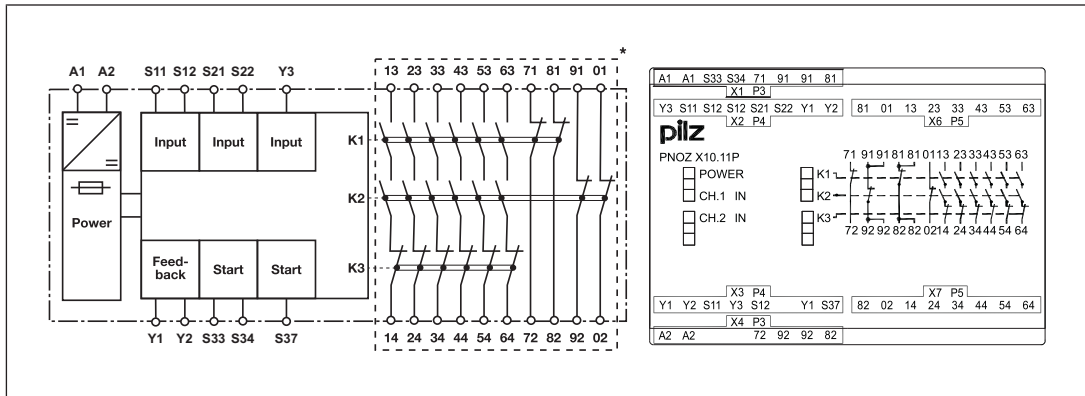


Unit features

- ▶ 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.

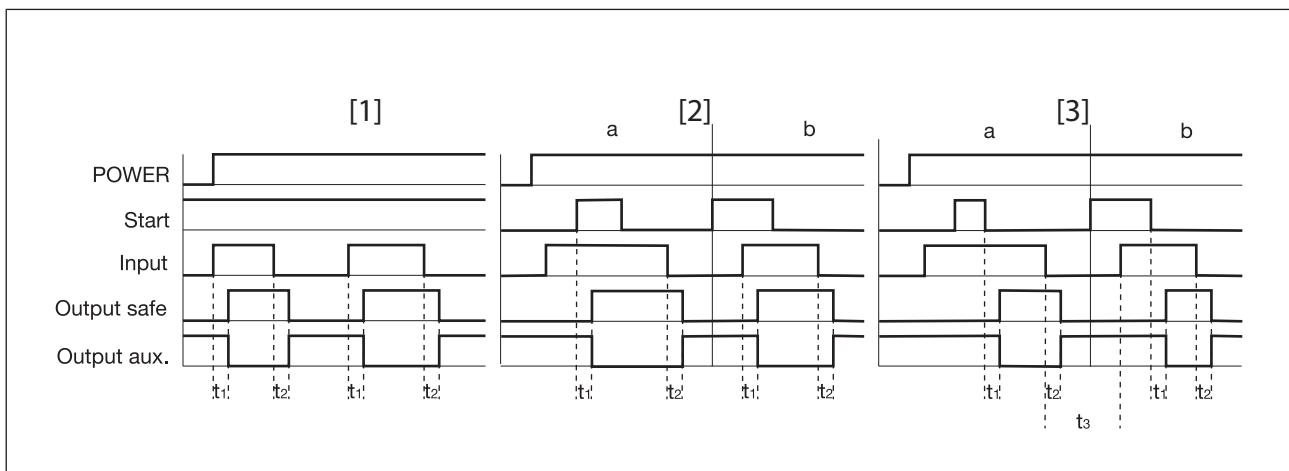
Operating modes

- ▶ 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

Safety relays PNOZ X PNOZ X10.11P

- ▶ 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:

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

$R_{l_{\max}}$ = 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, de-tection of shorts across contacts via ESPE (only when $U_B = 24\text{ VDC}$)		
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		
Manual start		
Monitored start		

Safety relays PNOZ X PNOZ X10.11P

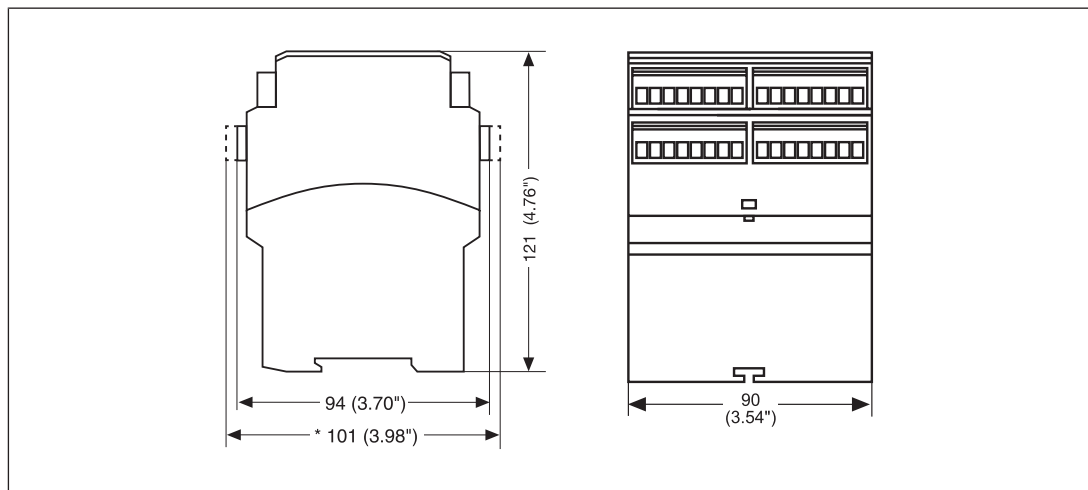
Feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Link or contacts from external contactors		

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 RI-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 I _K	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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	EN 62061 SIL CL	EN 62061 PFH _D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015
	PL	Category					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.

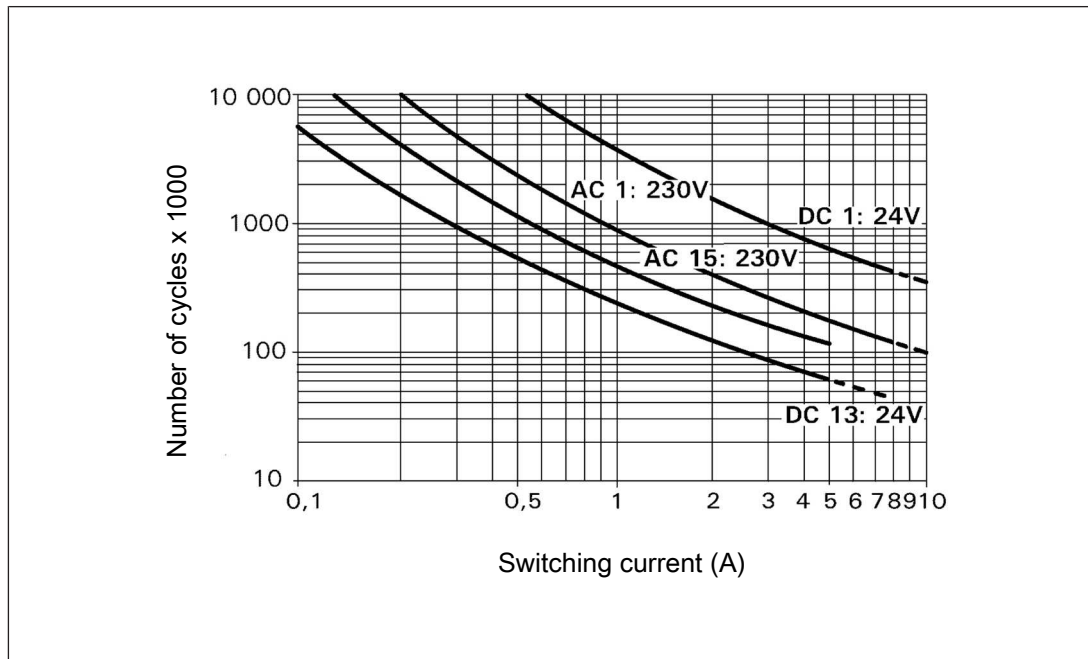
Supplementary data

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

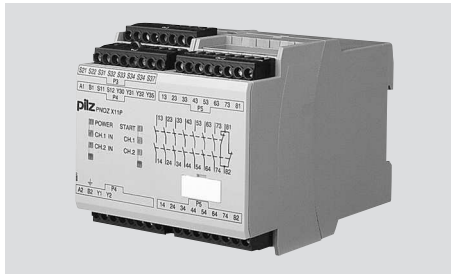
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

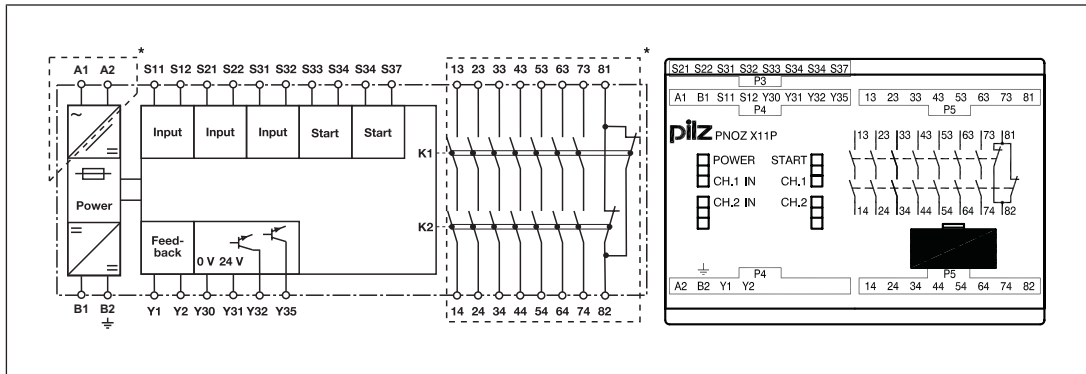


Unit features

- ▶ 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 (over-voltage 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.

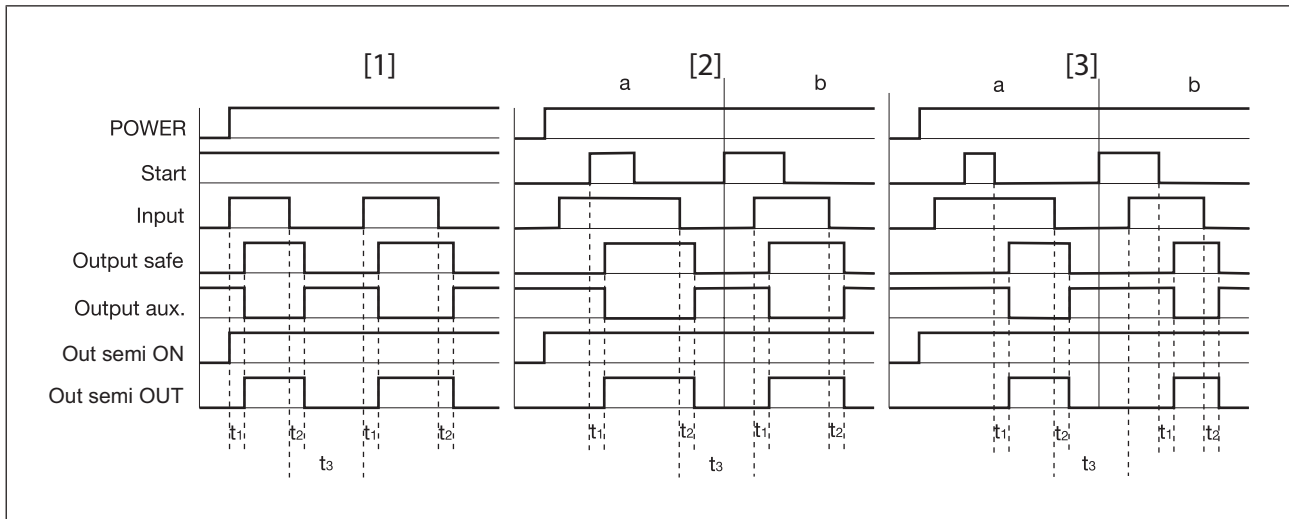
Safety relays PNOZ X PNOZ X11P

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:

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

$R_{l_{\max}}$ = 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

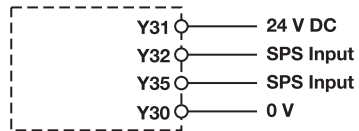
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		
Safety gate with detection of shorts across contacts		

Safety relays PNOZ X PNOZ X11P



	E-STOP wiring (single-channel, dual-channel)	
Start circuit	Safety gate (single-channel)	Safety gate (dual-channel)
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 X11P

Semiconductor output

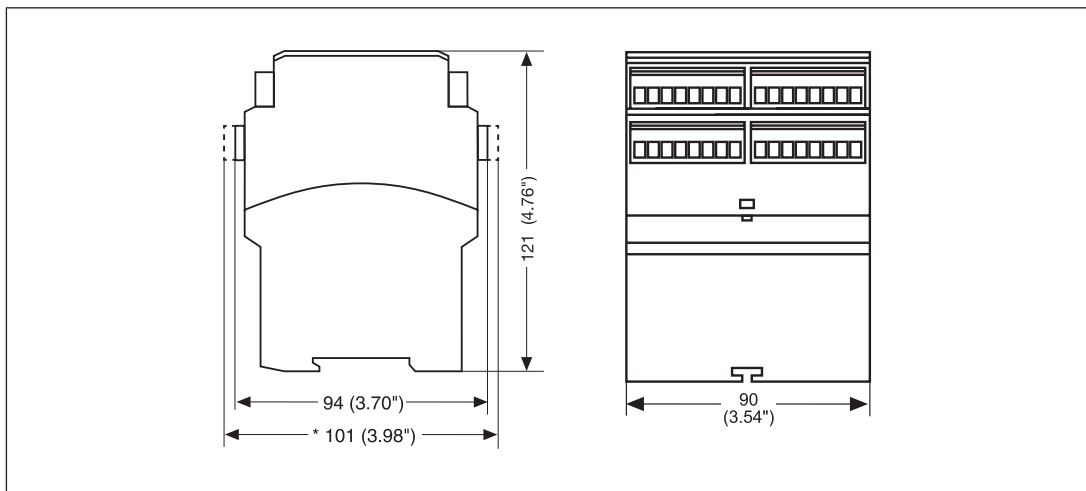


Legend

- ▶ 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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
I _{th} 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
I _{th} 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			
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 R _{lmax}			
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 I _K	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
I _{th} 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
I _{th} 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			
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.

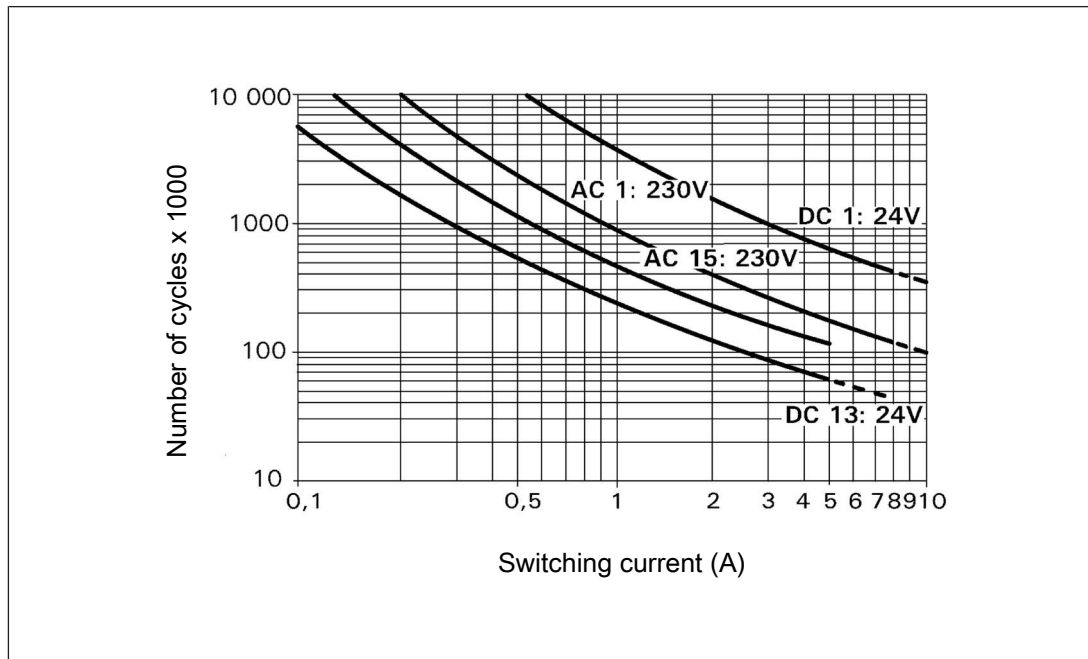
Supplementary data

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

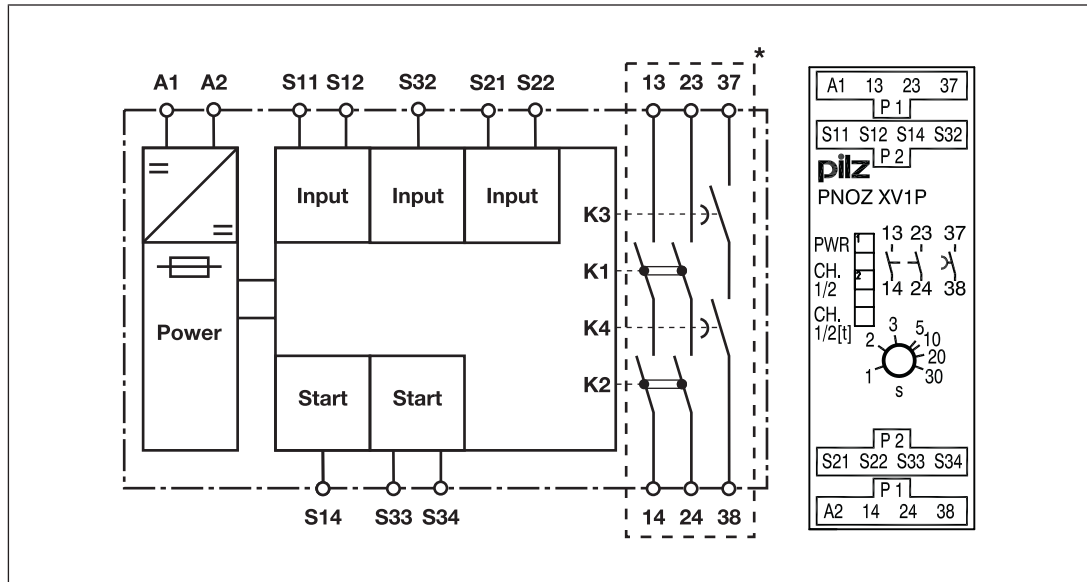


Unit features

- ▶ 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 (over-voltage 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:

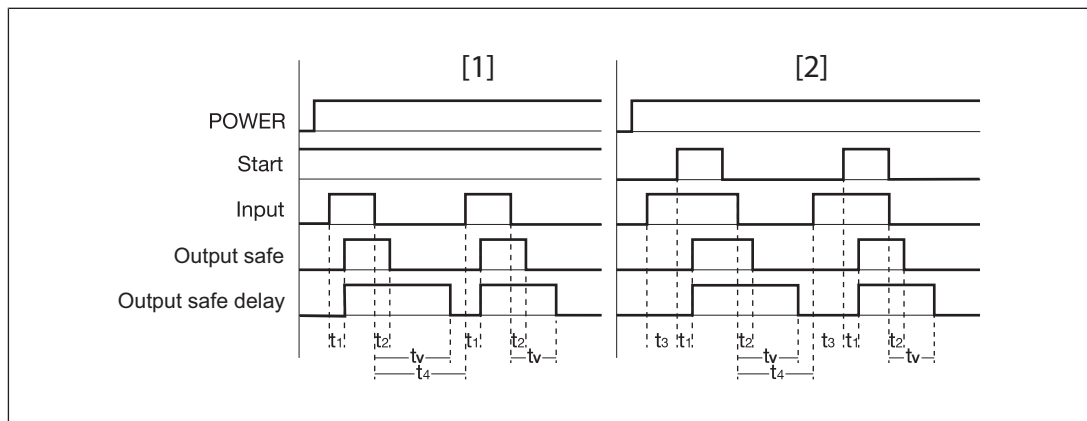
The delay time for safety contact 37-38 can be set on the front of the unit using a screw-driver.

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

Safety relays PNOZ X PNOZ XV1P

- ▶ 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:

$$l_{\max} = \frac{R_{l_{\max}}}{R_1 / \text{km}}$$

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[📖 279\]](#))

R_1 / 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		
Monitored start		
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

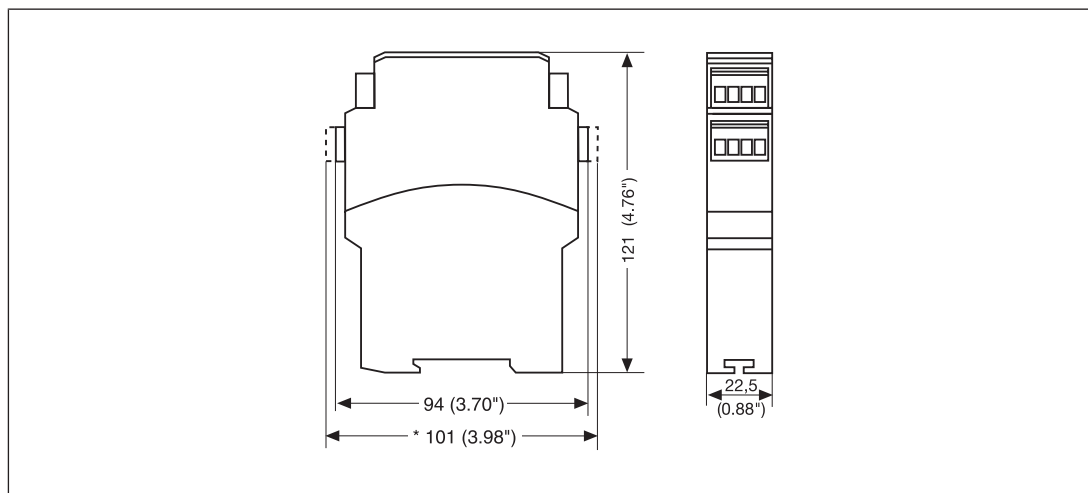
Legend

- ▶ 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 RI-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 A ² s	66 A ² s
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 A ² s	66 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au

Safety relays PNOZ X PNOZ XV1P

Conventional thermal current while loading several contacts	777601	777602
I _{th} 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 RI-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
I _{th} 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

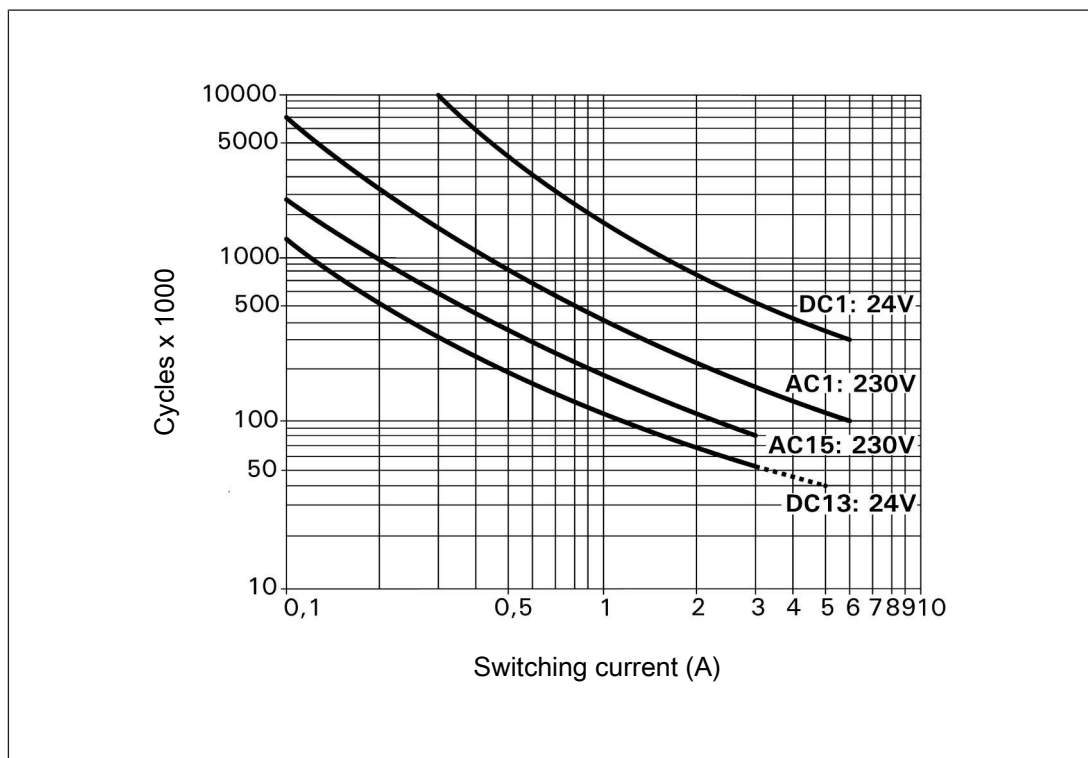
The PFH value depends on the switching frequency and the load on the relay output. If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates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

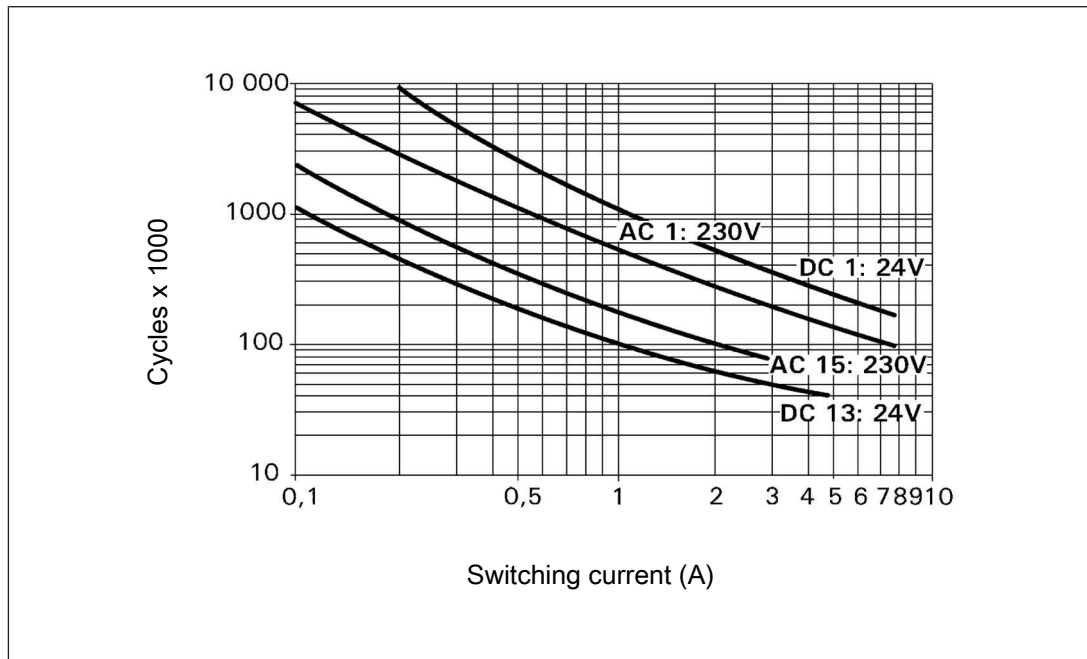
- ▶ Inductive load: 0.2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 1 000 000 cycles

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

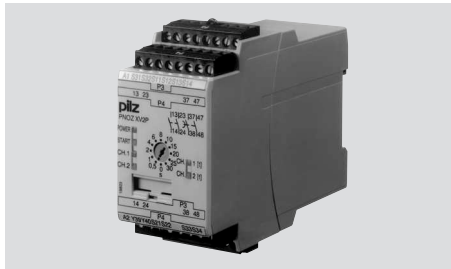
Provided the application to be implemented requires fewer than 900 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

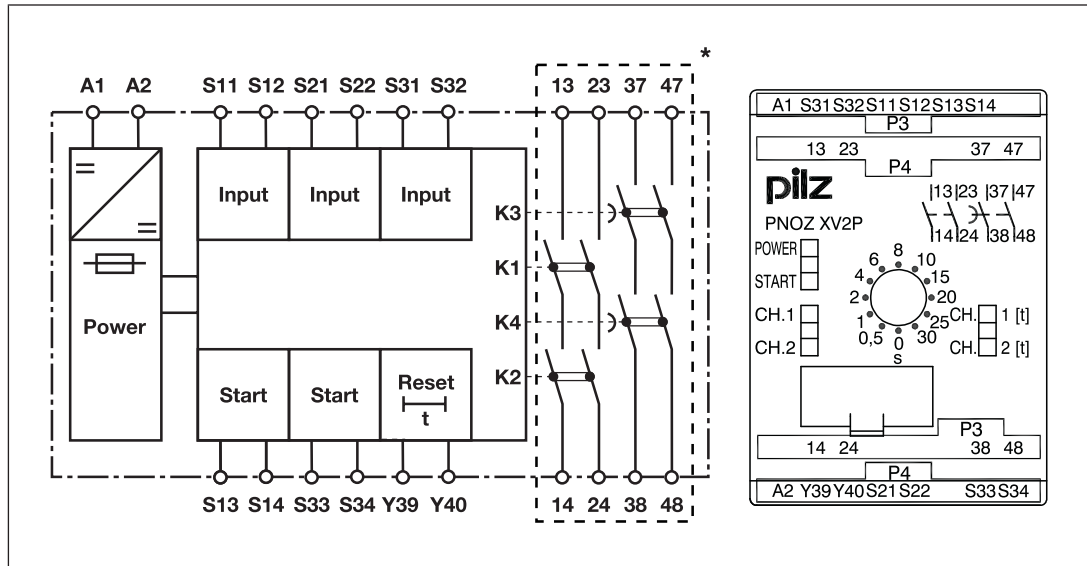


Unit features

- ▶ 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 (over-voltage 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

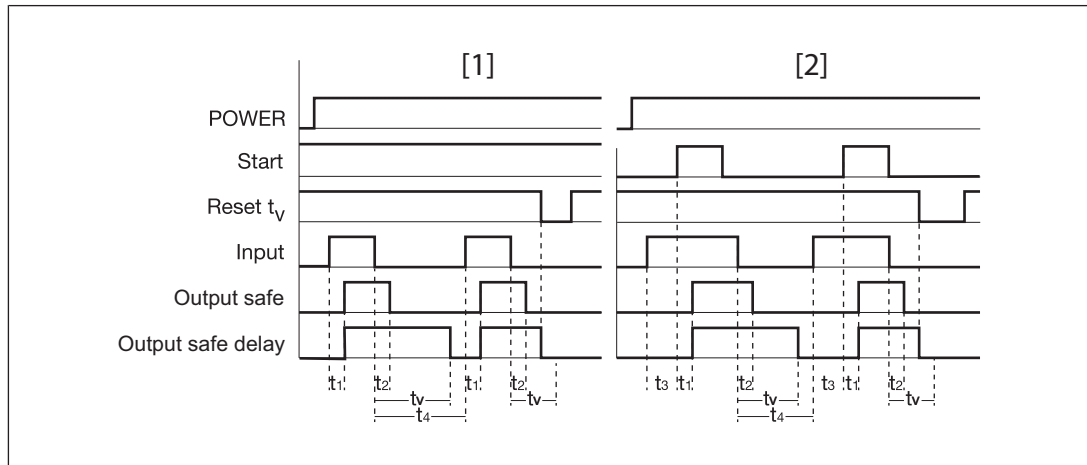
Reset function:

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

Safety relays PNOZ X PNOZ XV2P

- ▶ [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 undesigned 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:

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

$R_{l_{\max}}$ = 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		
Monitored start		
Reset delay time	Without reset	With reset
Link or N/C contact		

Safety relays PNOZ X PNOZ XV2P

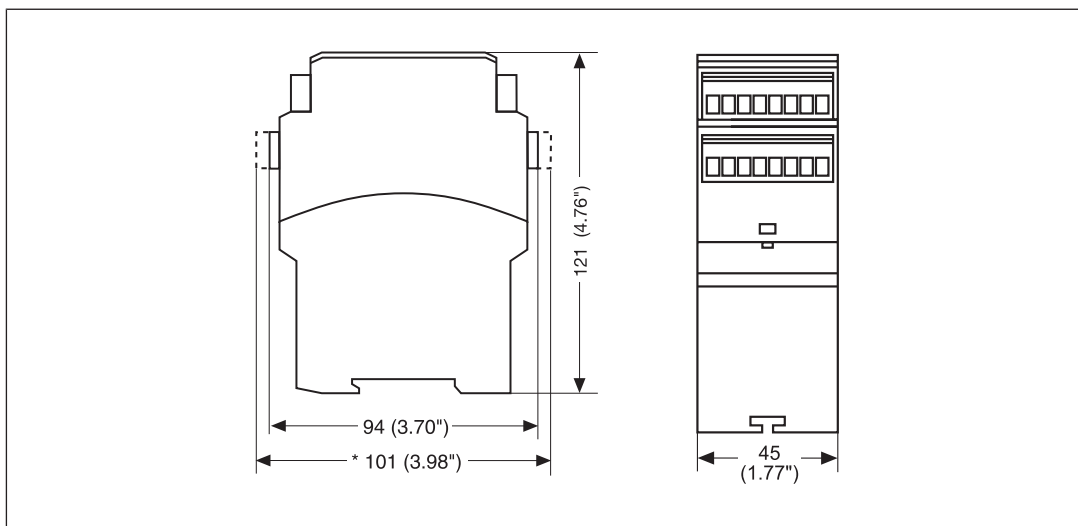
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

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 R _{lmax}			
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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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
I _{th} 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 RI-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), instantaneous	2	2
Safety contacts (N/O), delayed	2	2
Max. short circuit current I _K	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
I _{th} 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.

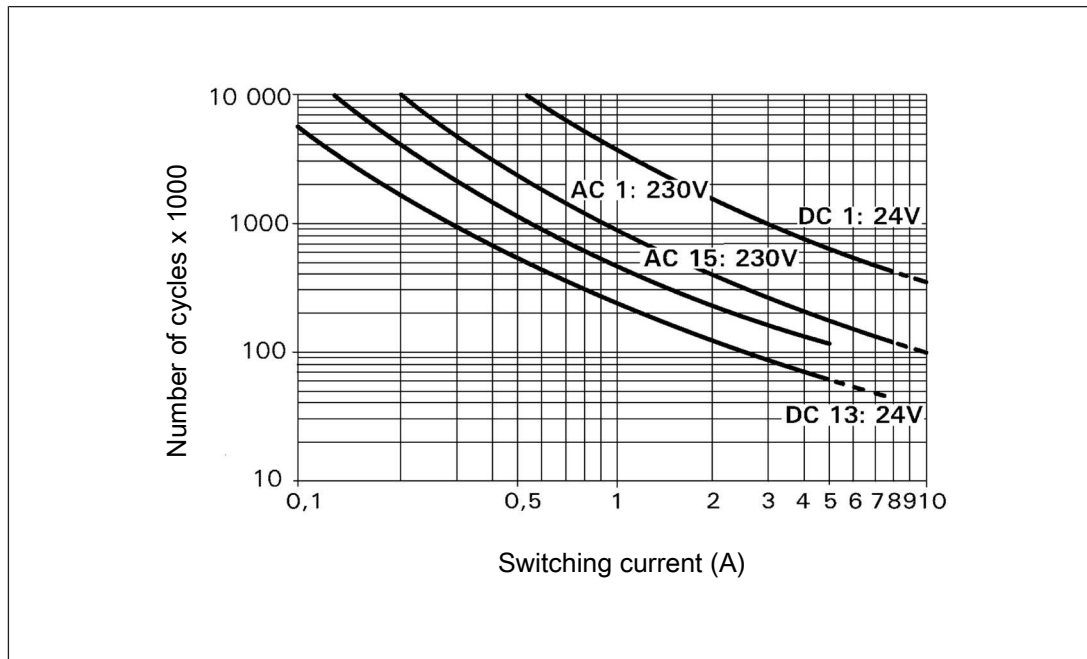
Supplementary data

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.

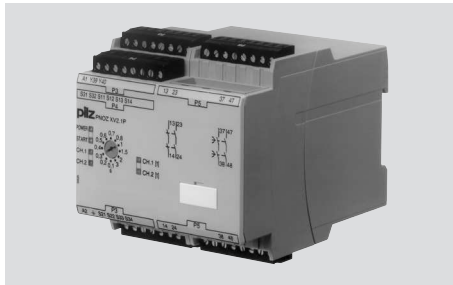
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

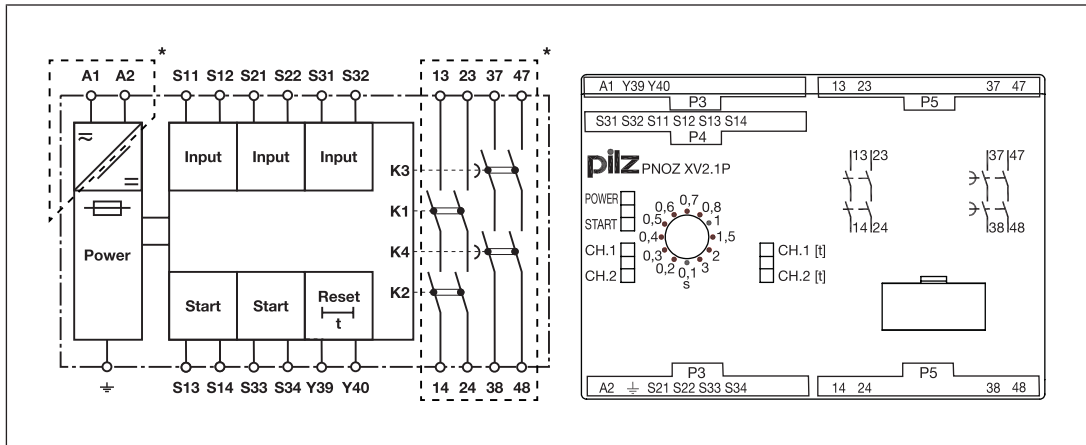


Unit features

- ▶ 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 (over-voltage 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:

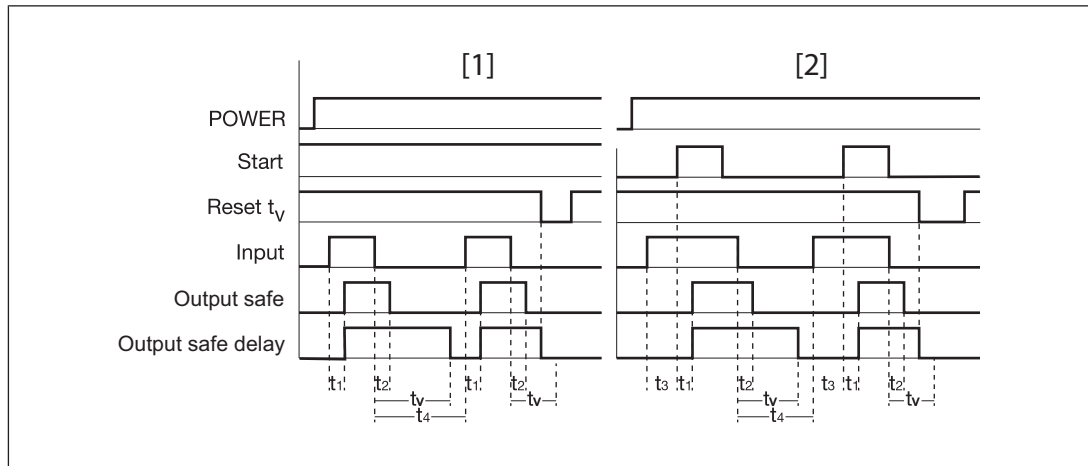
The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

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:

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

$R_{l_{\max}}$ = 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

	E-STOP wiring	
Start circuit	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		

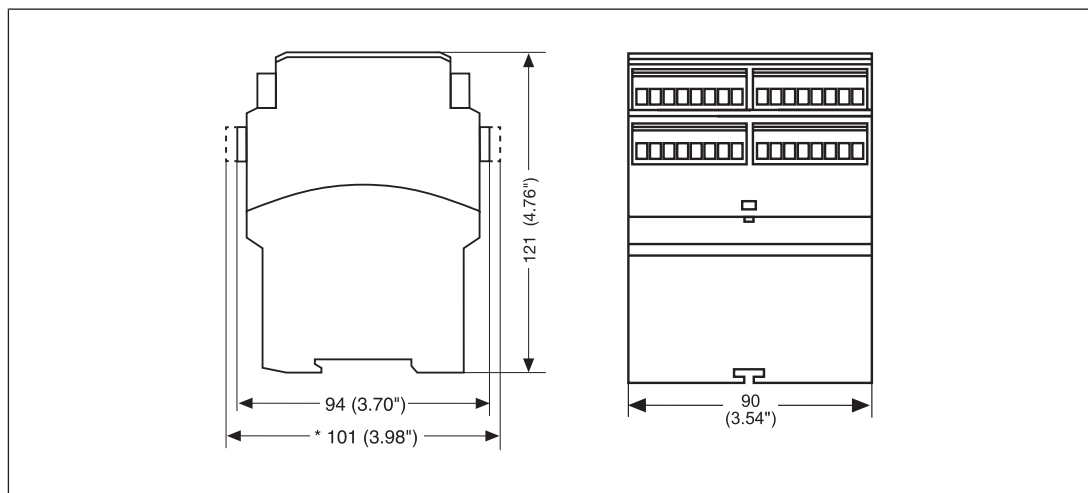
Legend

- ▶ 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 (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), 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 R _{lmax}			
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 I _K	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 A ² s	240 A ² s	240 A ² s
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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777548	787540
I _{th} 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
I _{th} 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 RI-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 A ² s	240 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	787542	787548
I _{th} 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.

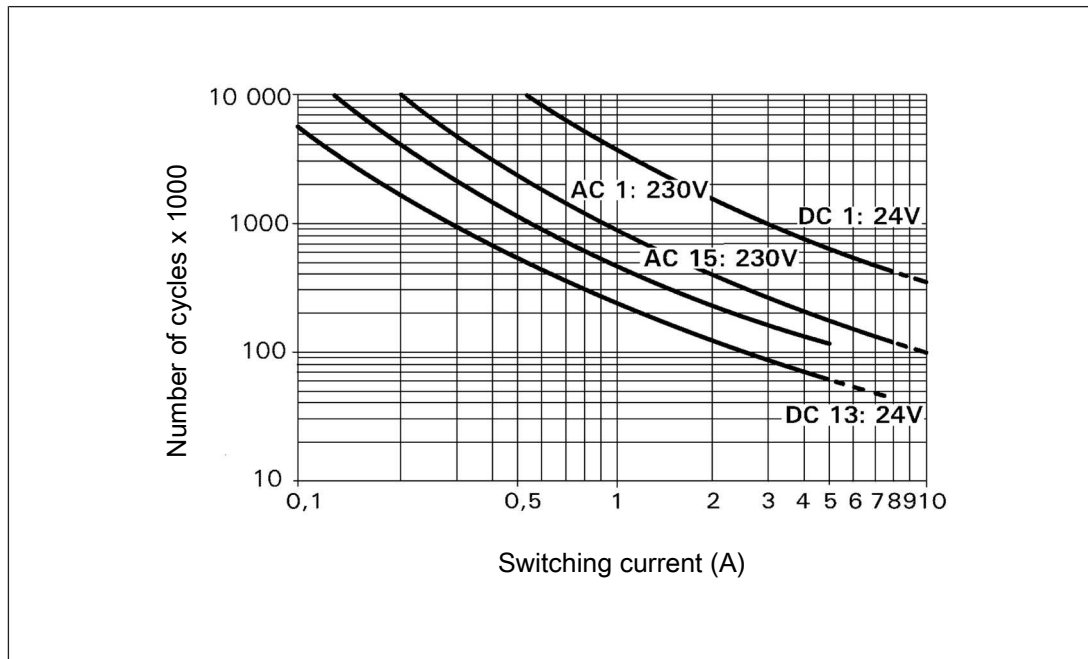
Supplementary data

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.

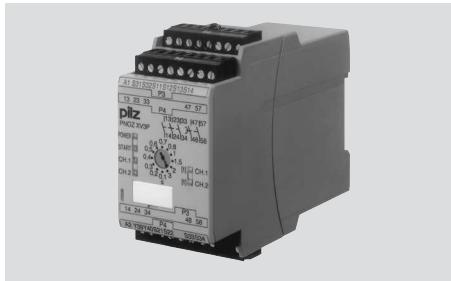
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

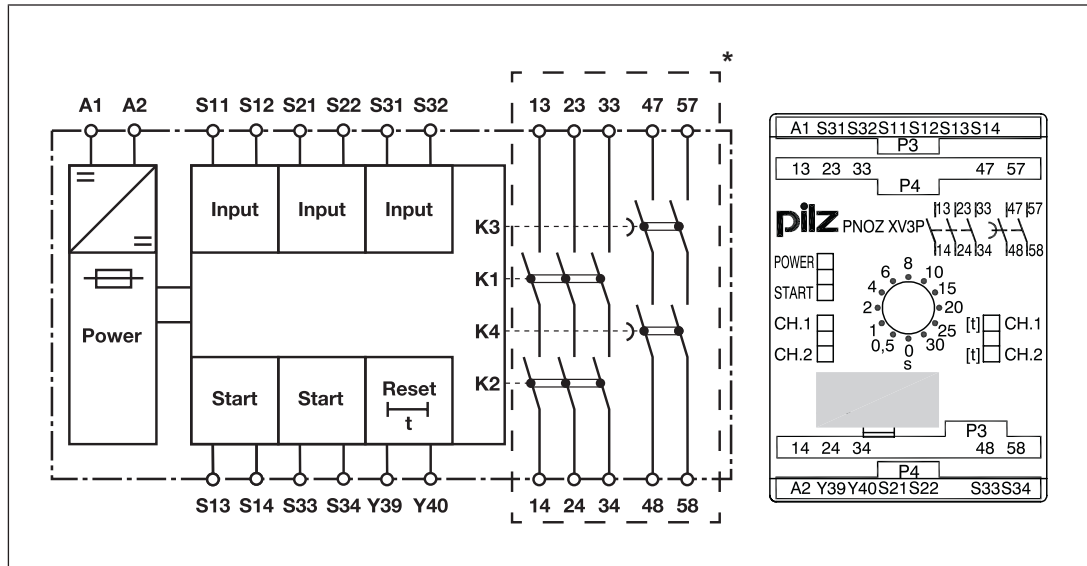


Unit features

- ▶ 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:

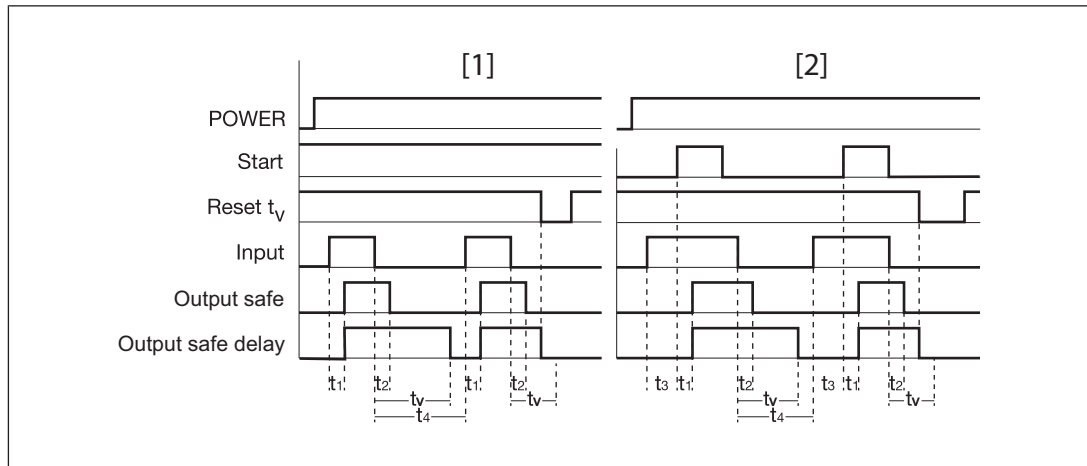
The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

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:

$$l_{\max} = \frac{R_{l_{\max}}}{R_1 / \text{km}}$$

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[352\]](#))

R_1 / 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

	E-STOP wiring	
Start circuit	Safety gate without start-up test	Safety gate with start-up test
Automatic start		<p>Simultaneity S1 and S2: max. 3 s</p>
Monitored start		
Reset delay time	Without reset	With reset
Link or N/C contact		
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

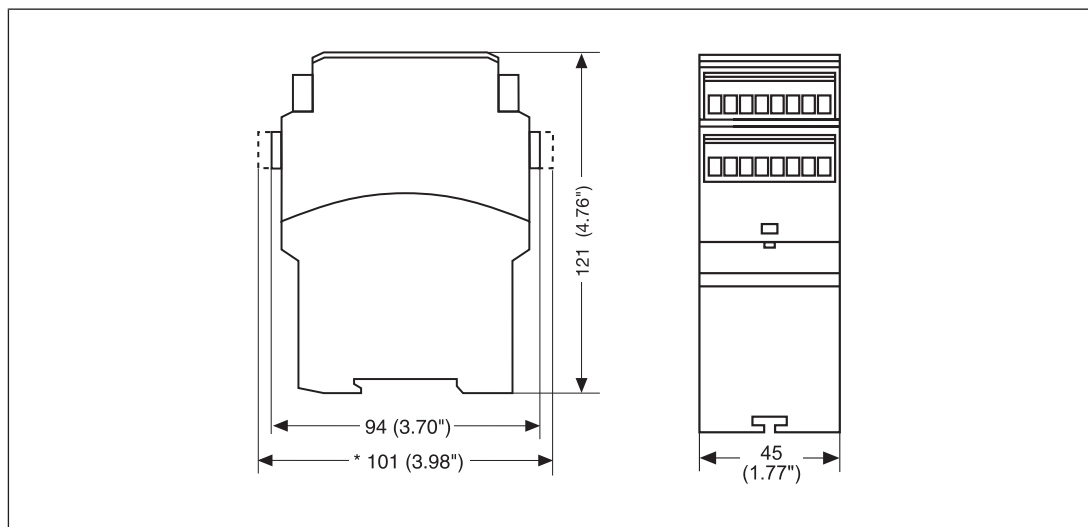
Legend

- ▶ 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 (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), 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 impulse			
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 R _{lmax}			
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 I _K	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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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
I _{th} 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 t _v	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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 im-pulse			
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 R _{lmax}			
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 de-tection of shorts across contacts at UB DC	10 Ohm	10 Ohm	10 Ohm
Relay outputs	787510	787512	787518
Number of output con-tacts			
Safety contacts (N/O), instantaneous	3	3	3
Safety contacts (N/O), delayed	2	2	2
Max. short circuit current I _K	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
I _{th} 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.

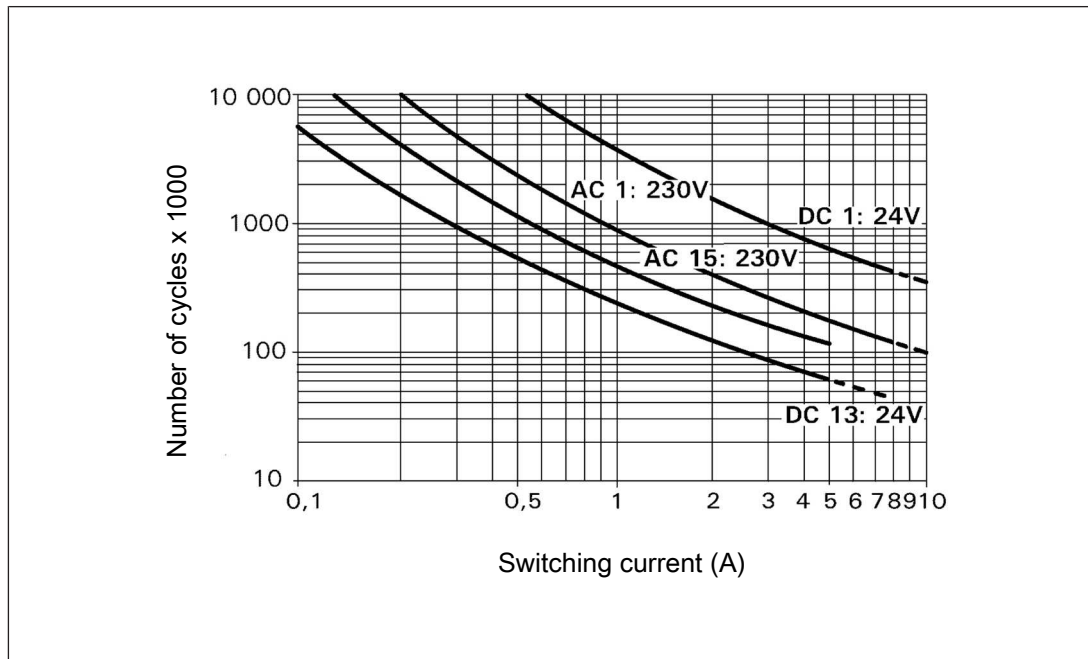
Supplementary data

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.

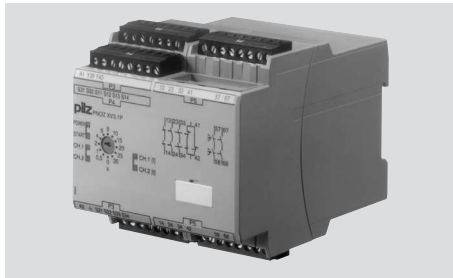
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

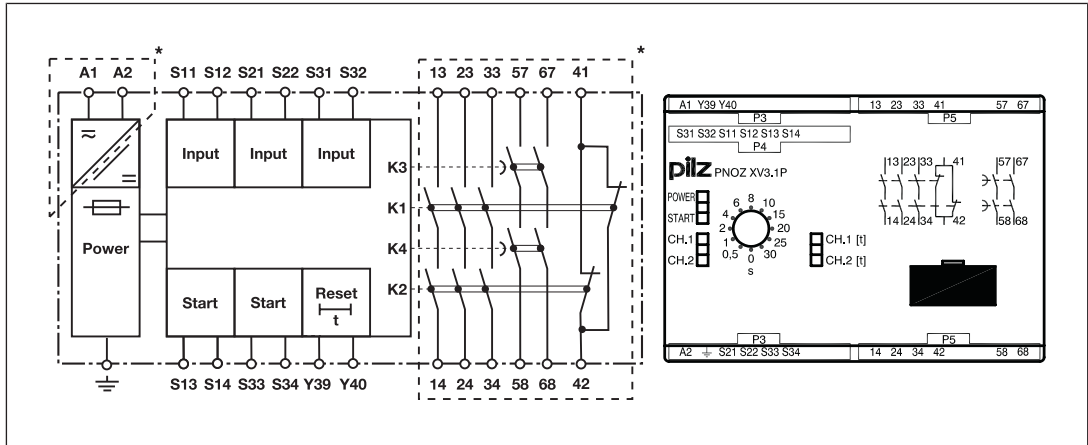
- ▶ Positive-guided relay outputs:
 - 3 safety contacts (N/O), instantaneous
 - 2 safety contacts (N/O), delay-on de-energisation
 - 1 auxiliary contact (N/C), instantaneous
- ▶ Connection options for:
 - E-STOP pushbuttons
 - Safety gate limit switches
 - Start buttons
 - Light grids and safety switches 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

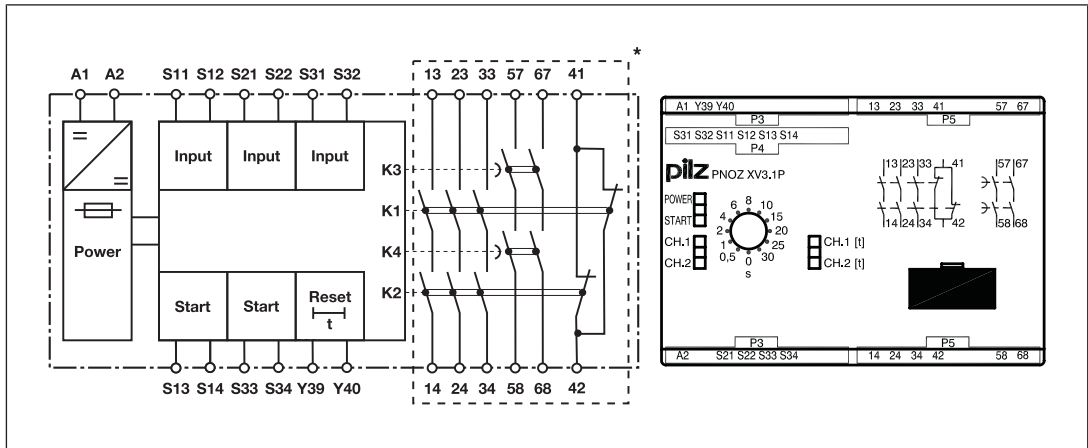
- ▶ U_B : 24 - 240 VAC/DC; Order no. 777530, 787530, 777532, 787532, 777538, 787538



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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 (over-voltage 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.

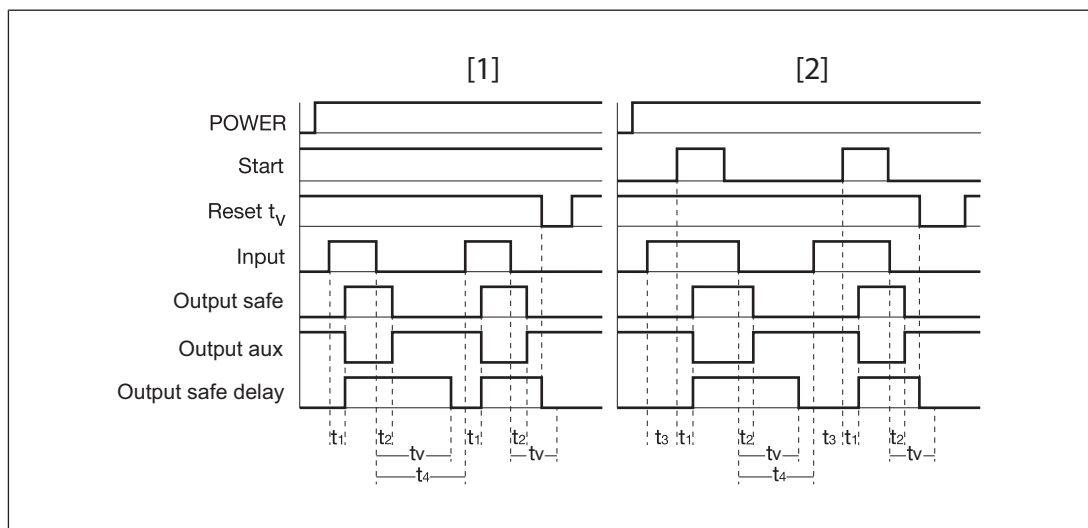
Operating modes

- ▶ 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:

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

$R_{l_{\max}}$ = 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 $U_B = 24\text{ VDC}$)		

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

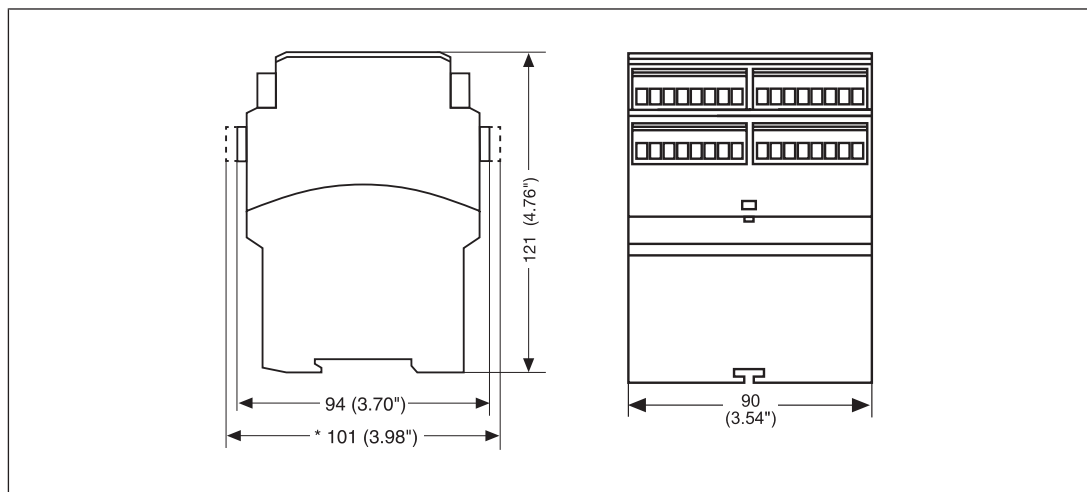
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

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 R _{lmax}			
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 A ² s	240 A ² s	240 A ² s
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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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 I _K	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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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 I _K	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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI-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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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.

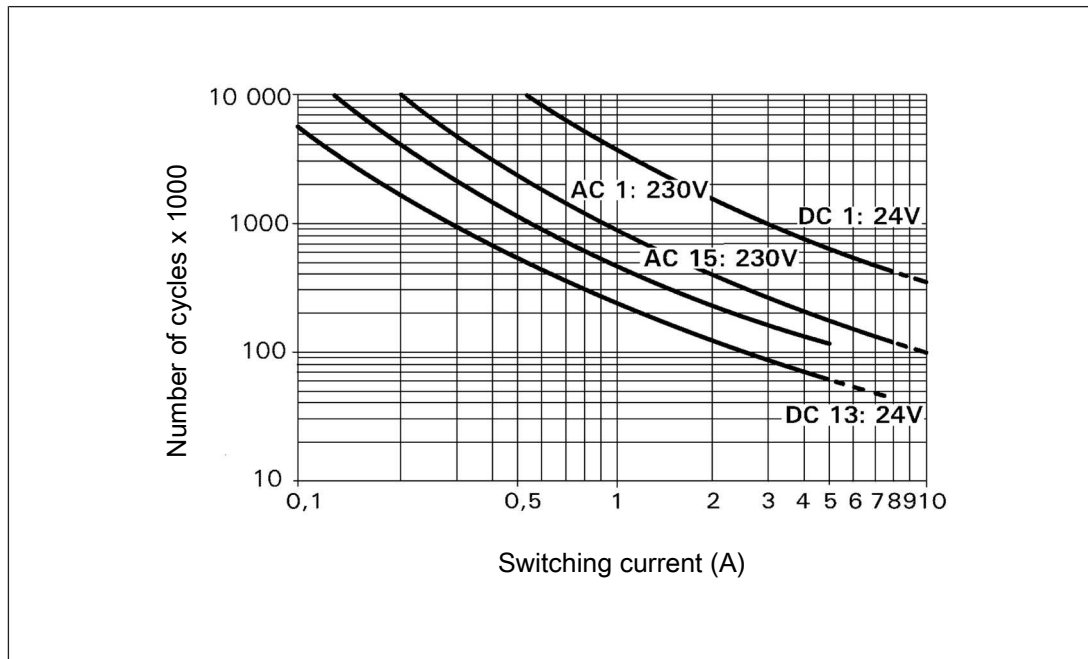
Supplementary data

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

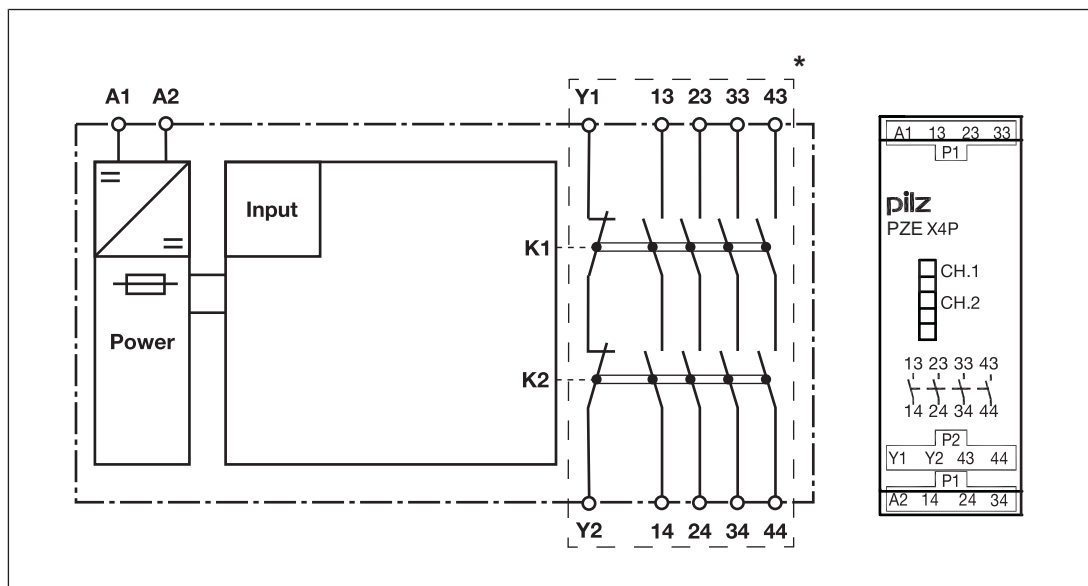
Safety relays PNOZ X PZE X4P



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 (over-voltage 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:

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

$R_{l_{\max}}$ = 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.

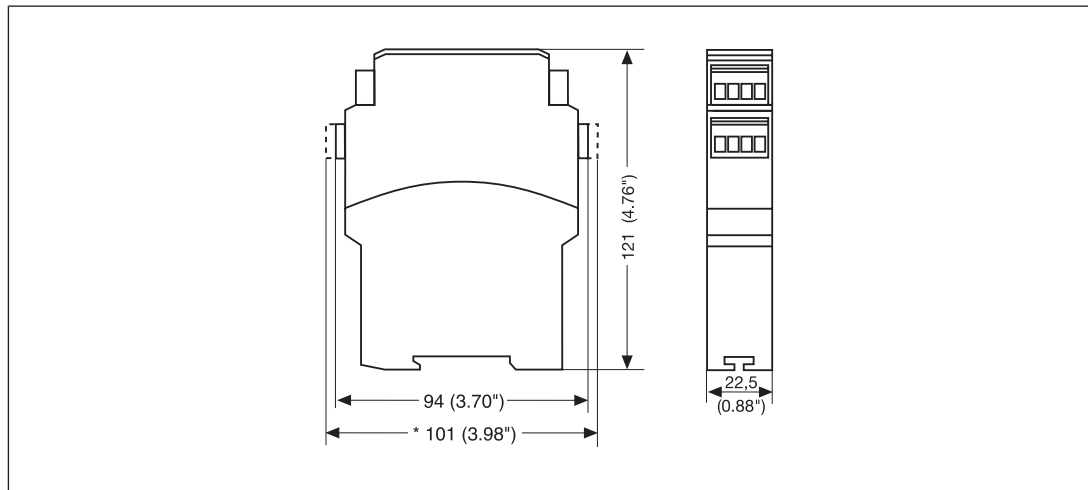
Preparing for operation

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 RI-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
I _{th} 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	EN ISO 13849-1: 2015	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.

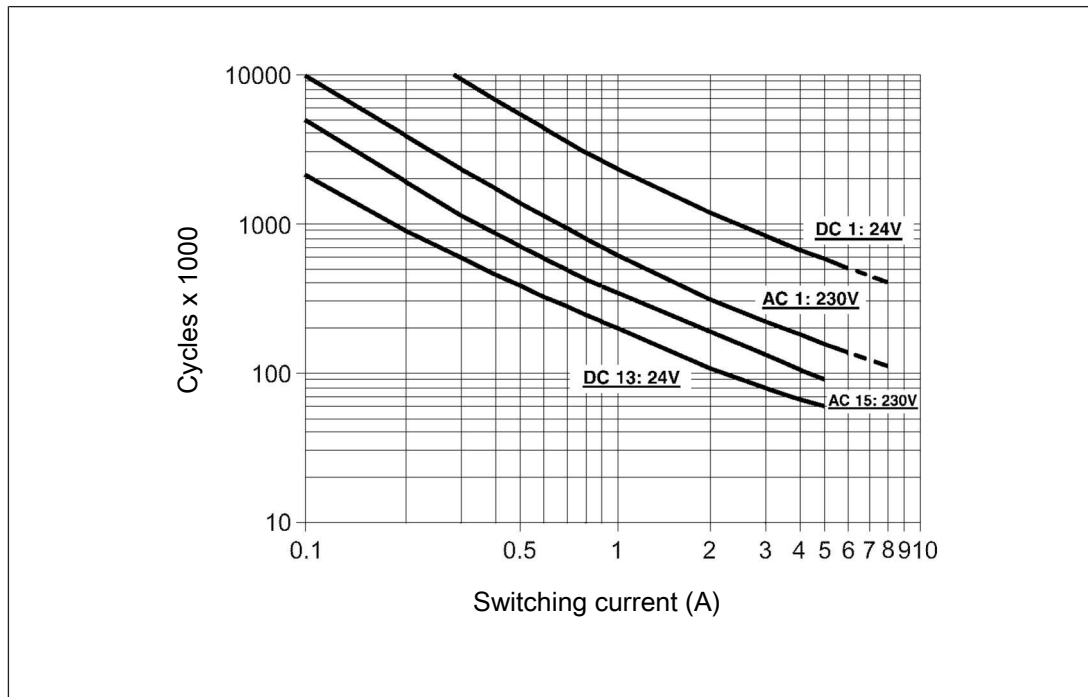


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X PZE X4P

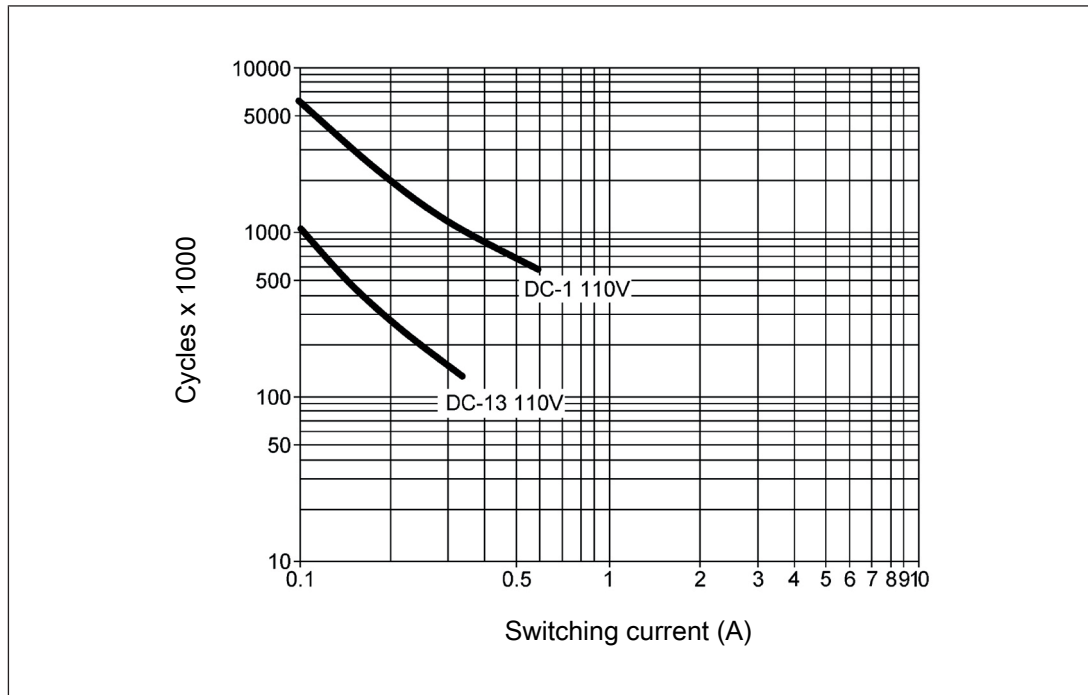


Fig.: Service life graphs at 110 V DC

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

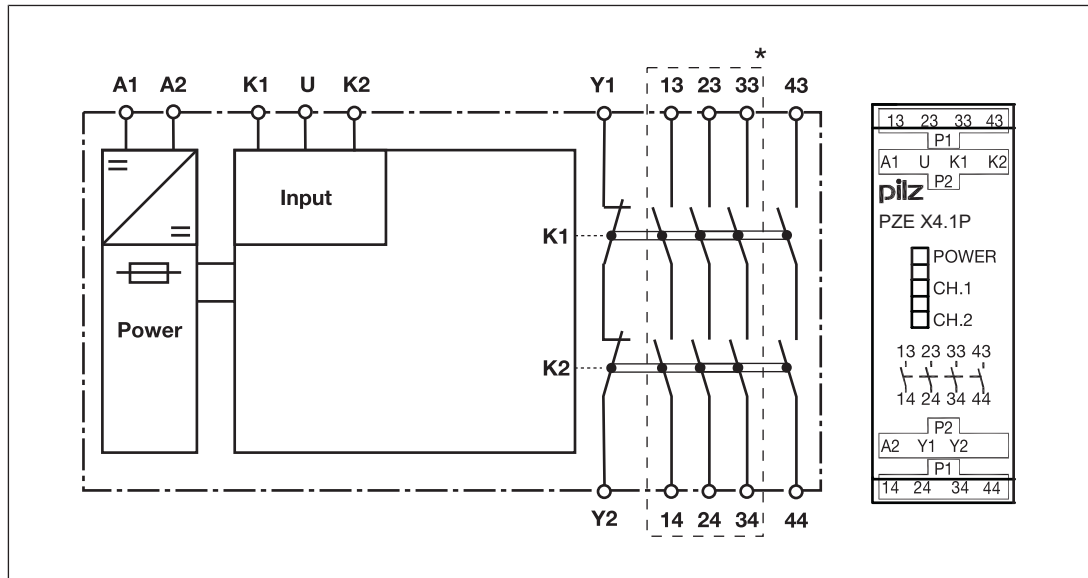
- ▶ Positive-guided relay outputs:
 - 4 safety contacts (N/O), instantaneous
- ▶ LED display for:
 - Supply voltage
 - Switch status of the safety contacts
- ▶ Connection for feedback loop
- ▶ Suitable to be driven via OSSD
- ▶ Operation: Single or dual-channel
- ▶ Plug-in connection terminals (either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

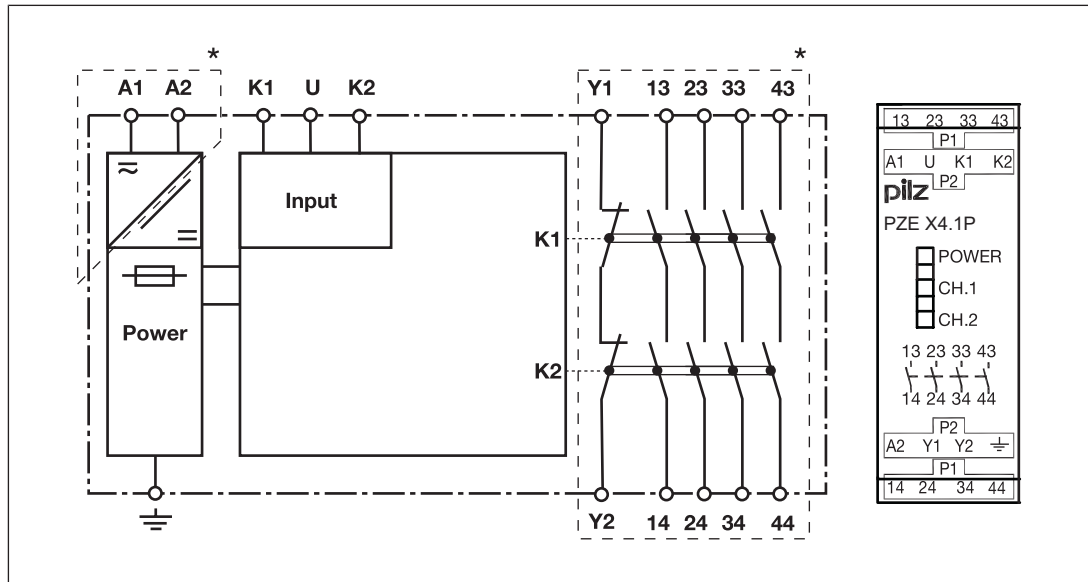


*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

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 (over-voltage 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:

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

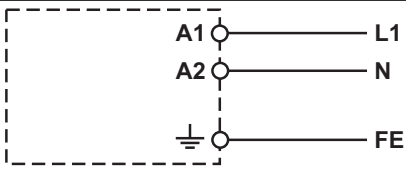
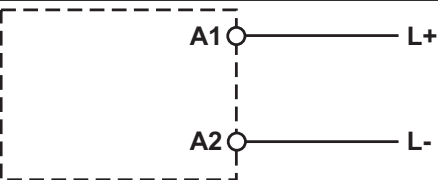
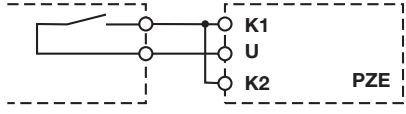
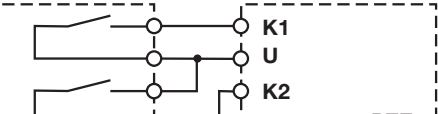
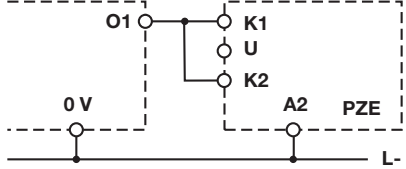
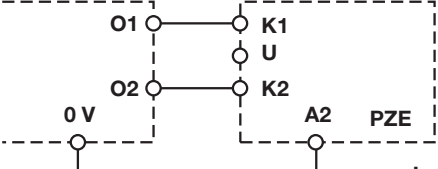
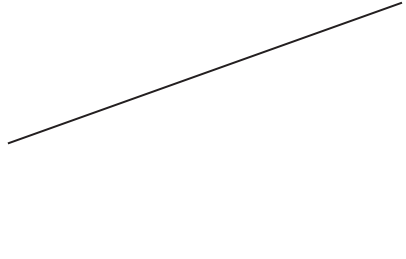
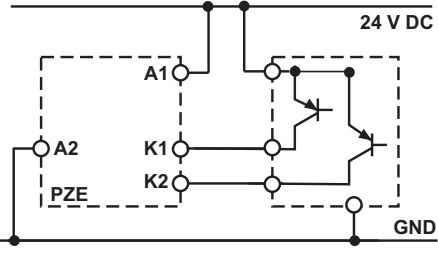
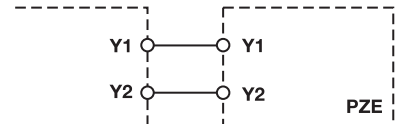
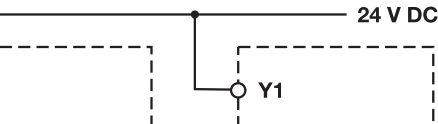
$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[424\]](#))

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

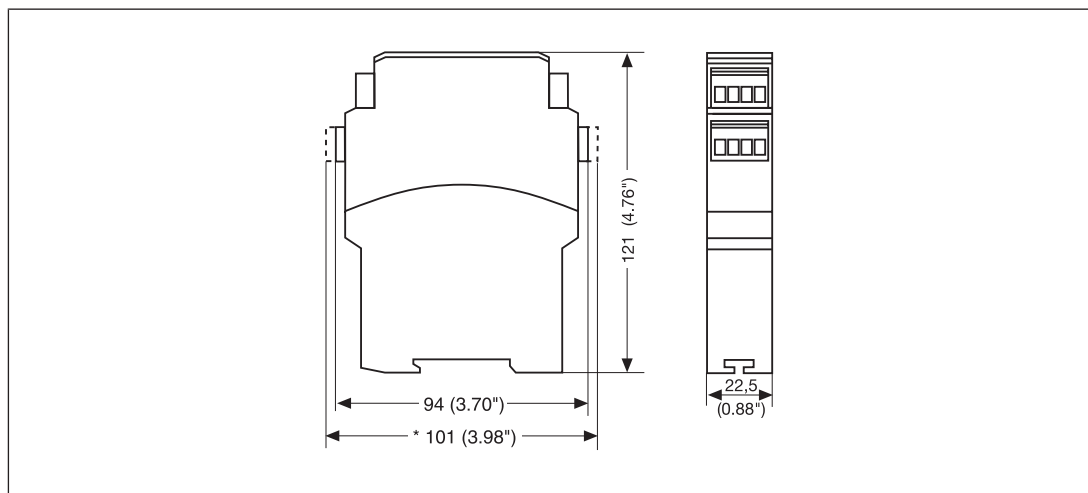
Preparing for operation

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 RI-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 I _K	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
I _{th} 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 mm ² , 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 RI-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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	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.

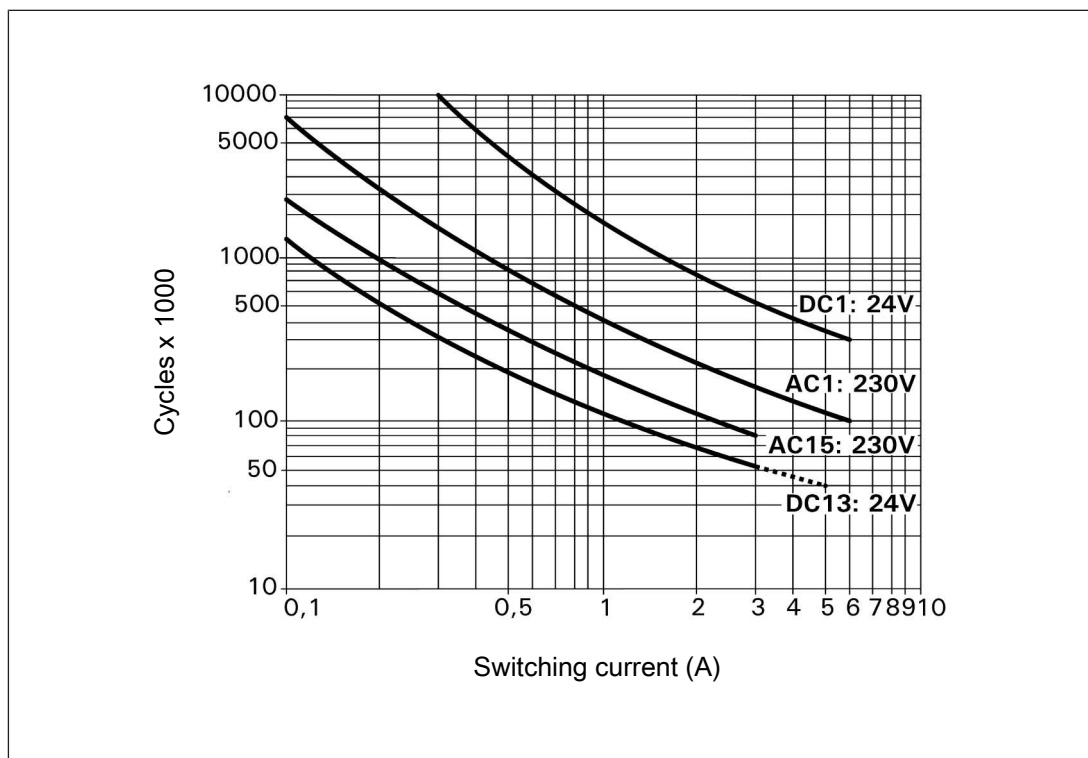


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X PZE X4.1P

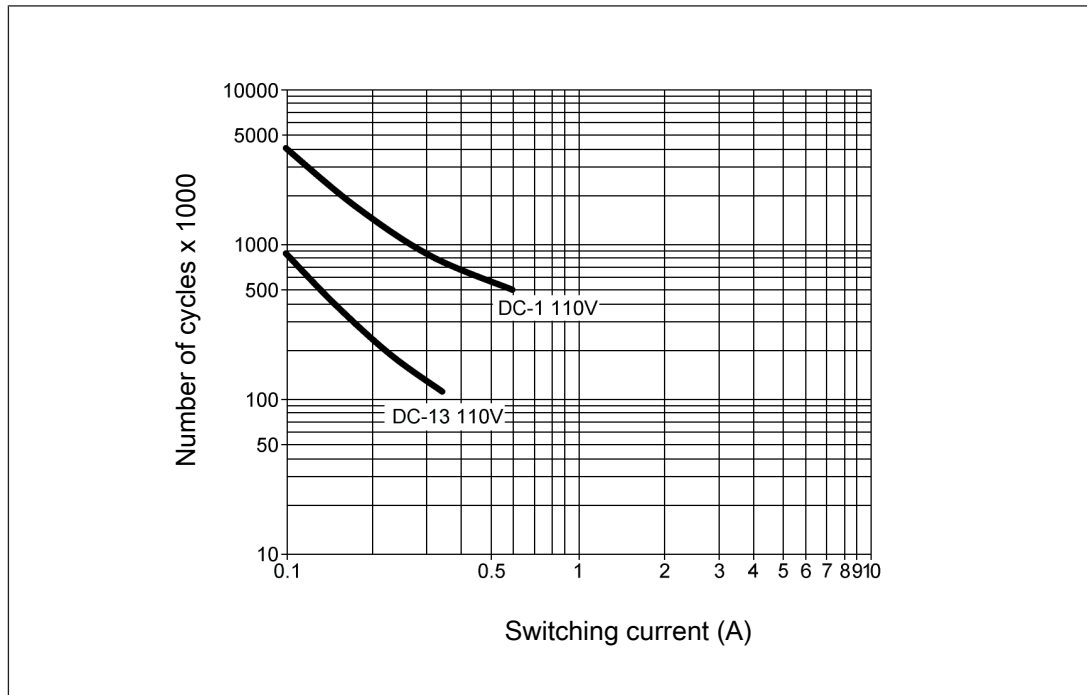


Fig.: Service life graphs at 110 VDC

Example

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

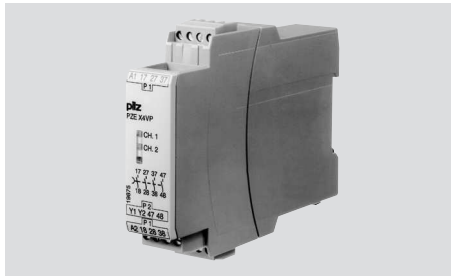
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see [Technical details \[424\]](#)) can be used in the calculation.

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

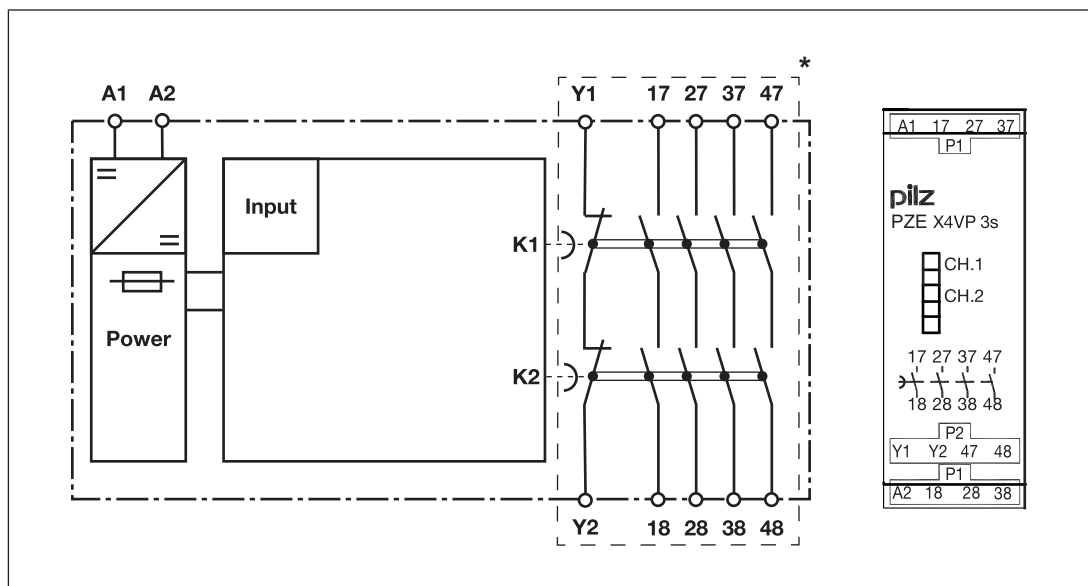
Safety relays PNOZ X PZE X4VP



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:

$$l_{\max} = \frac{R_{l_{\max}}}{R_1 / \text{km}}$$

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[438\]](#))

R_1 / 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.

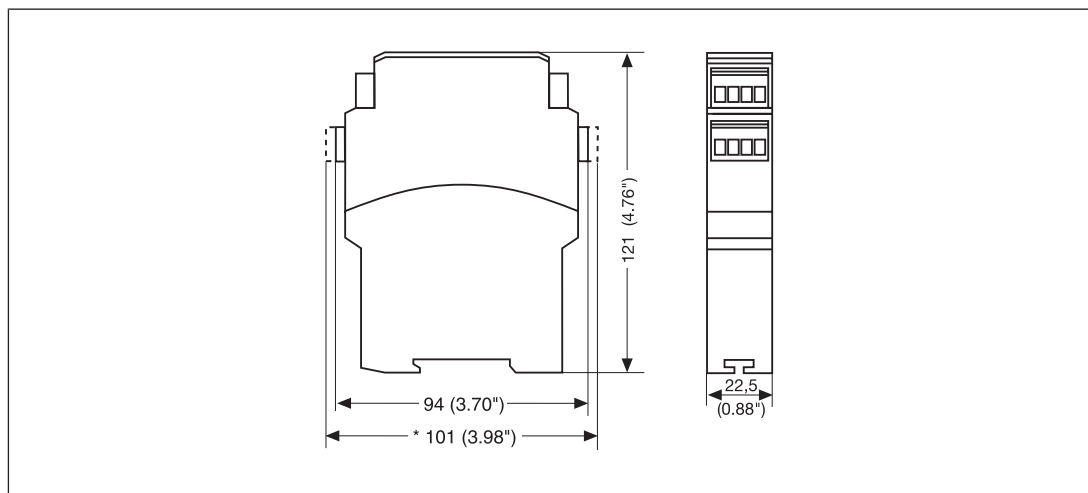
Preparing for operation

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 R _{lmax}			
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 I _K	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 A ² s	66 A ² s	66 A ² s
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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 R _{lmax}			
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 I _K			
	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 A ² s	66 A ² s	66 A ² s
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
I _{th} 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 t _v	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 R _{I-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 I _K	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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
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.

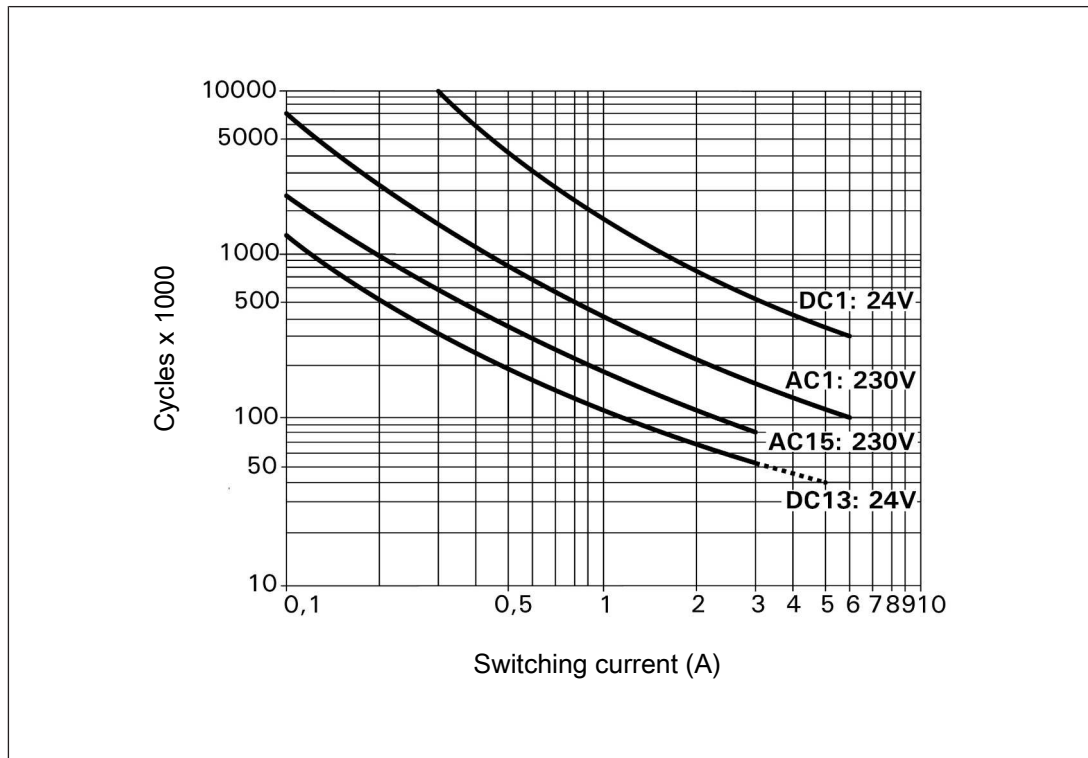


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X PZE X4VP

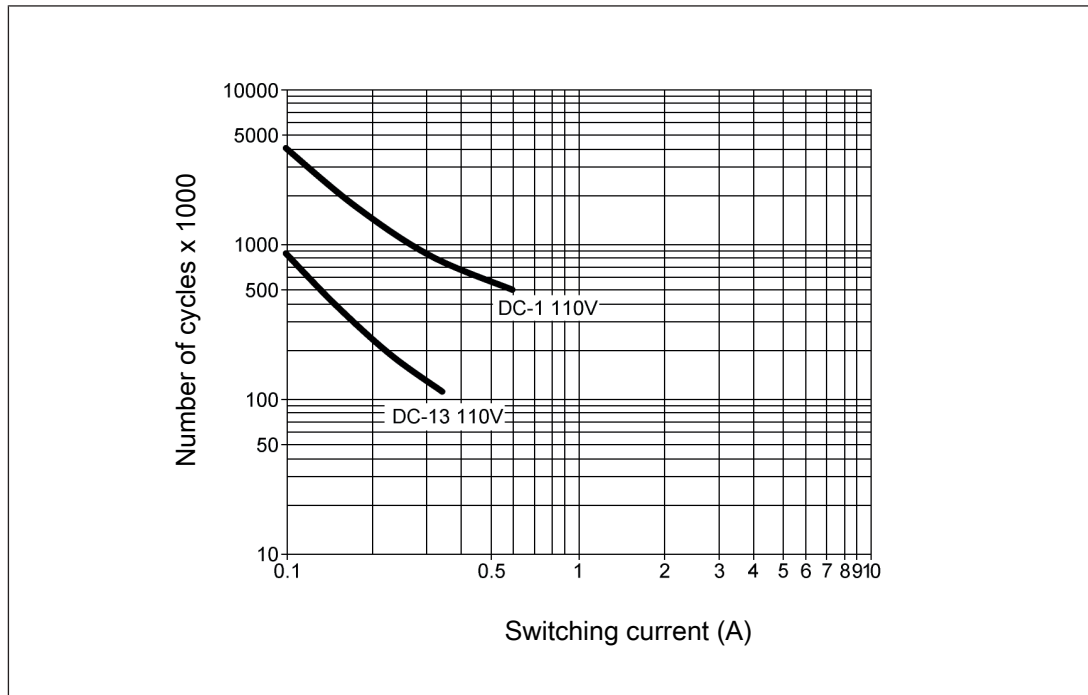


Fig.: Service life graphs at 110 VDC

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.

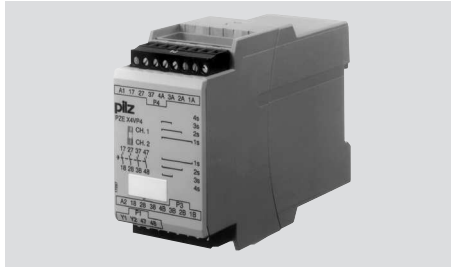
To increase the service life, sufficient spark suppression must be provided on all relay contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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

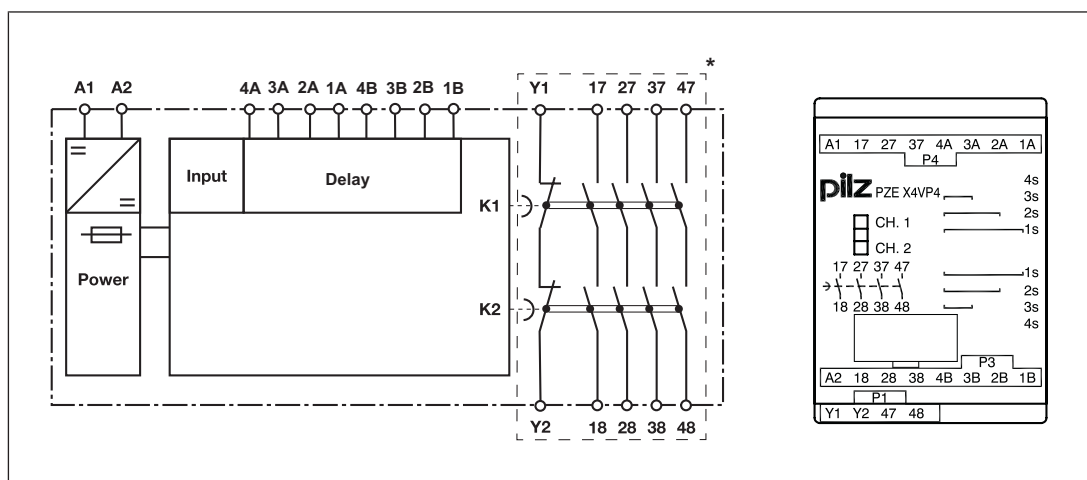
Safety relays PNOZ X PZE X4VP4



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 (over-voltage 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 !\[\]\(dce81645e0100714e86d66fe4d06ecba_img.jpg\) 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 !\[\]\(2f7100595fe61fbdc3e7ec71332af01e_img.jpg\) 457](#)).
- ▶ Calculation of the max. cable length l_{\max} in the input circuit:

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

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\) 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		

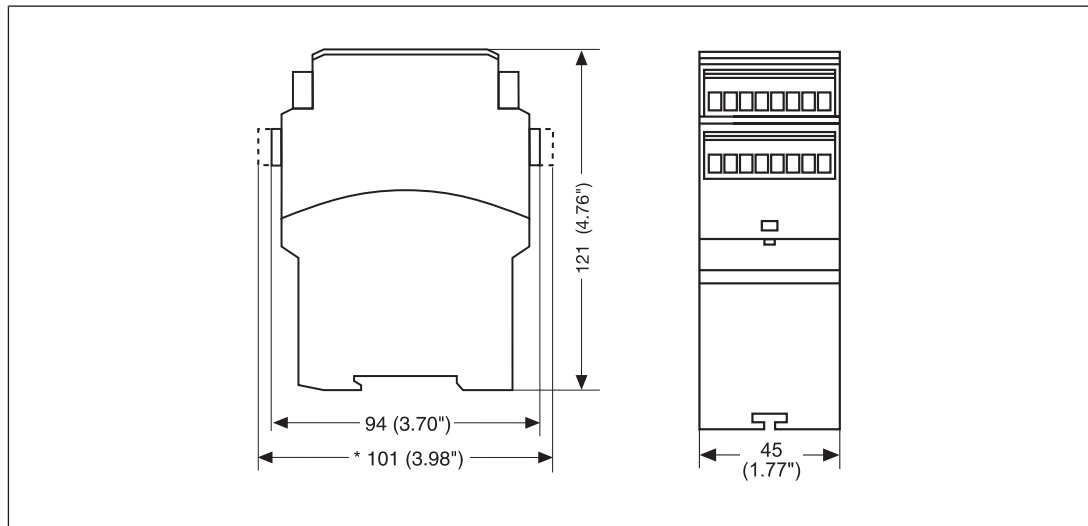
Setting the delay time

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 RI-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 A ² s	100 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 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.

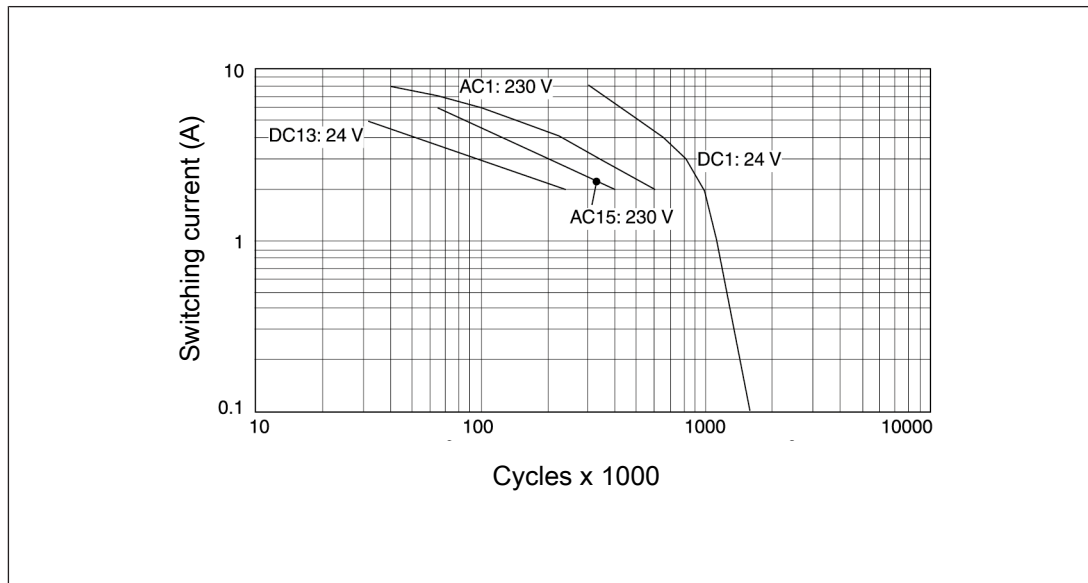
Supplementary data

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

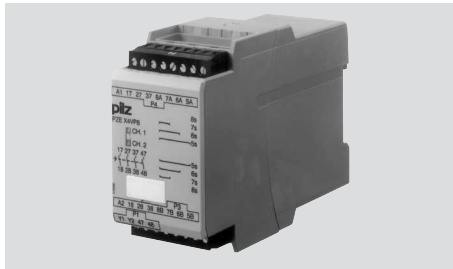
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 contacts, 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

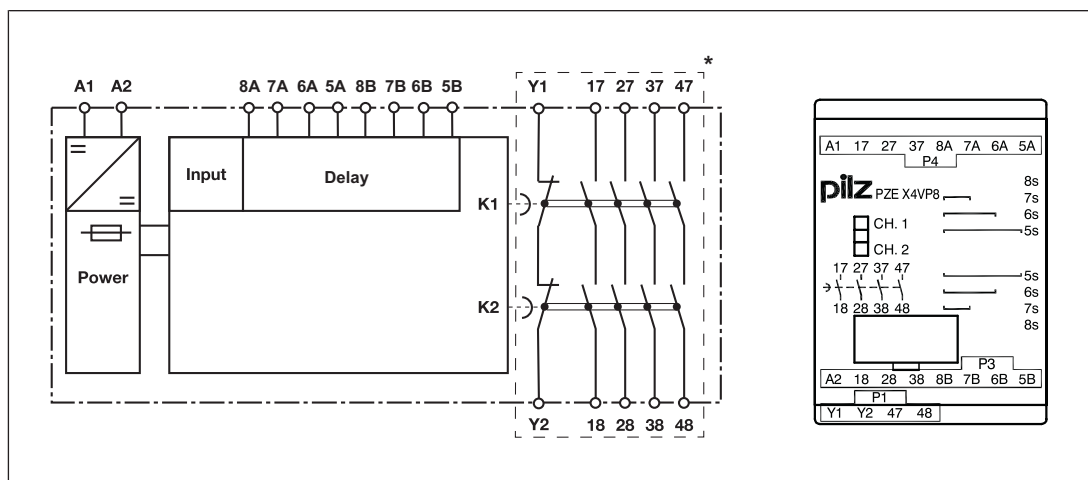
Safety relays PNOZ X PZE X4VP8



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 (over-voltage 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:

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

$R_{l\max}$ = 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		

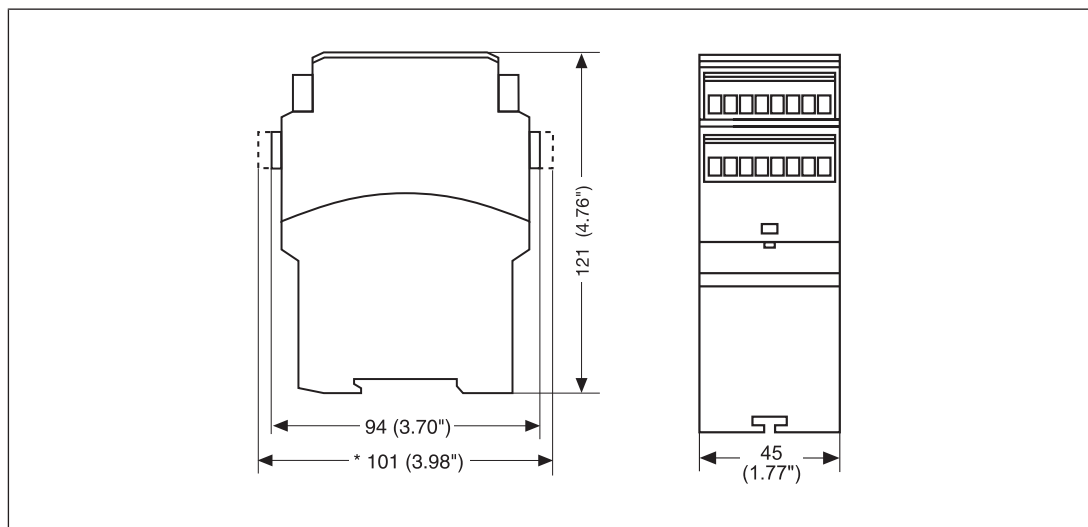
Setting the delay time

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 RI-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 A ² s	100 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 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.

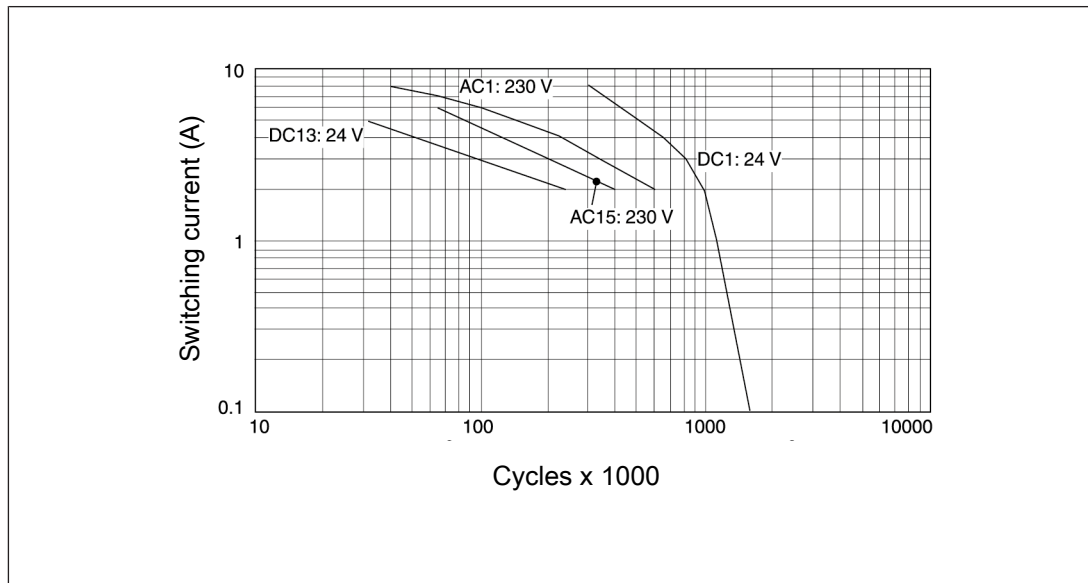
Supplementary data

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

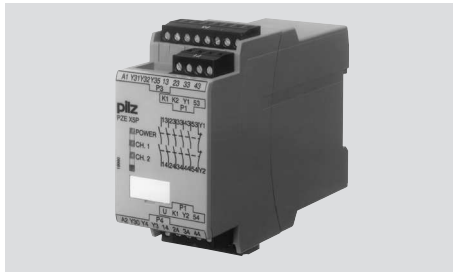
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

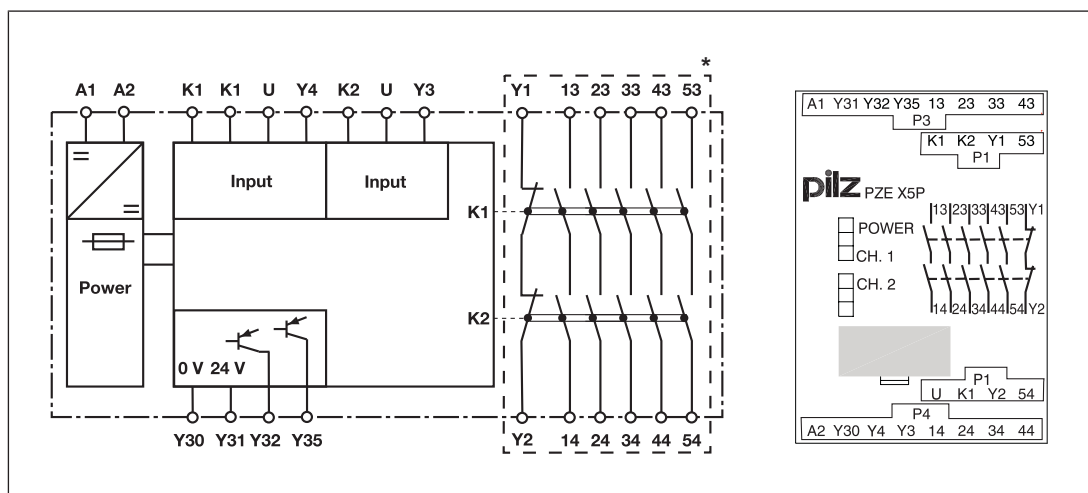
Safety relays PNOZ X PZE X5P



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:

$$l_{\max} = \frac{R_{l_{\max}}}{R_1 / \text{km}}$$

$R_{l_{\max}}$ = max. overall cable resistance (see [Technical details \[475\]](#))

R_1 / 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.

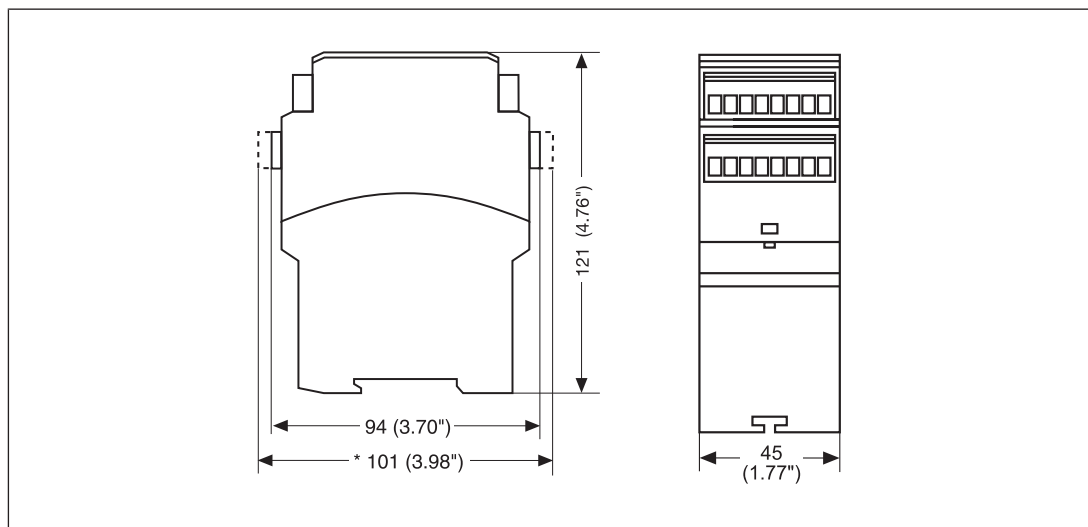
Preparing for operation

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 RI-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 I _K	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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	777150	787150
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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	EN ISO 13849-1: 2015	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.

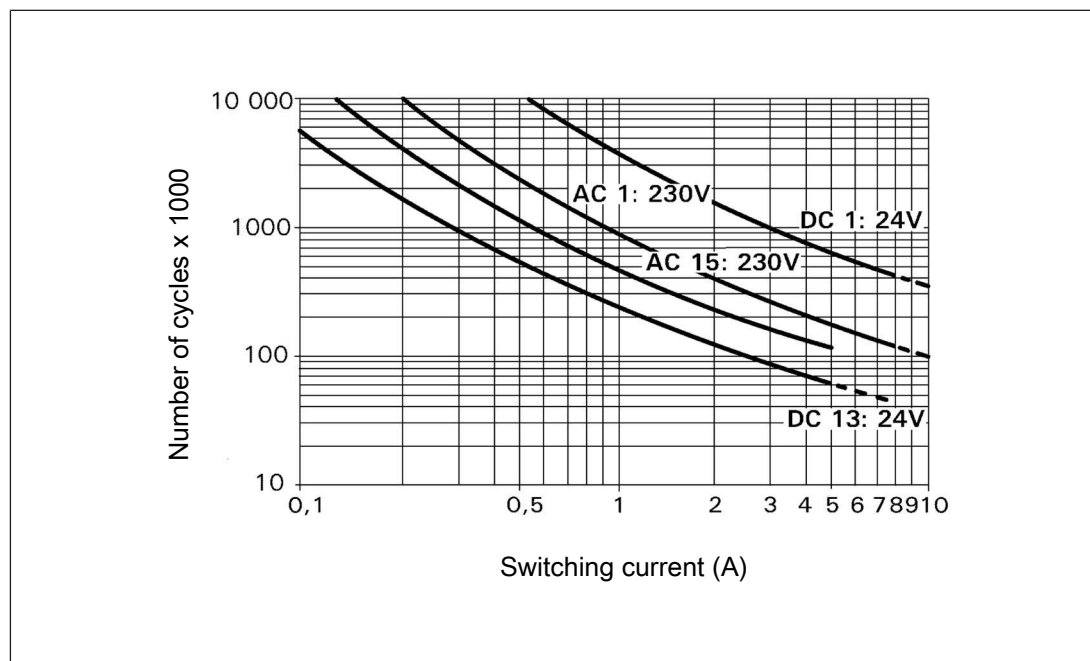
Safety relays PNOZ X PZE X5P

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.

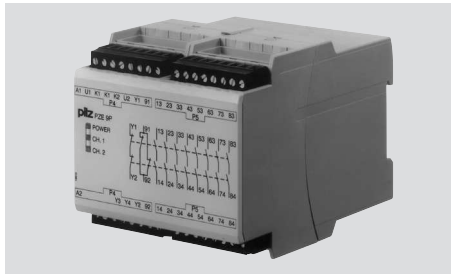
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

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



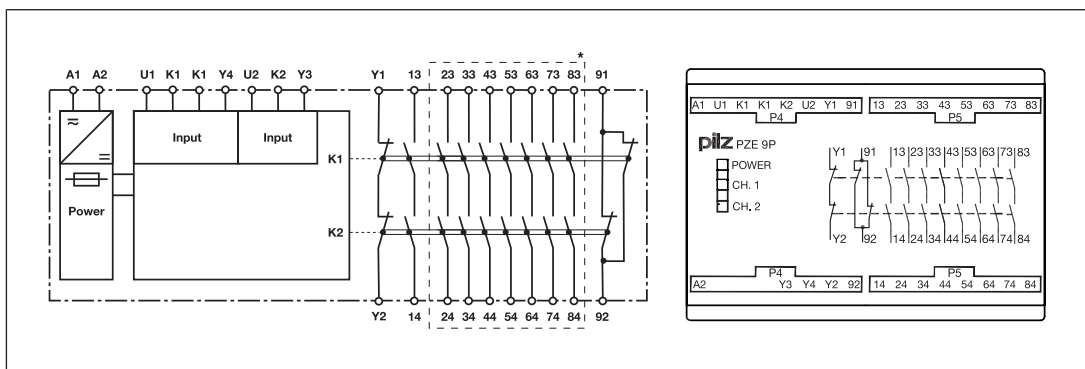
Unit features

- ▶ 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

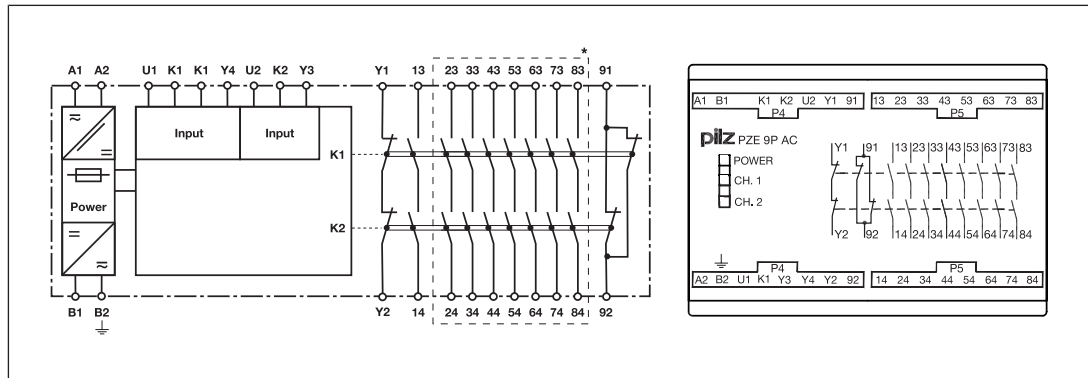


*Safe separation from non-marked area, except for safety contact 13-14, in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

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:

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

$R_{l_{\max}}$ = 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.

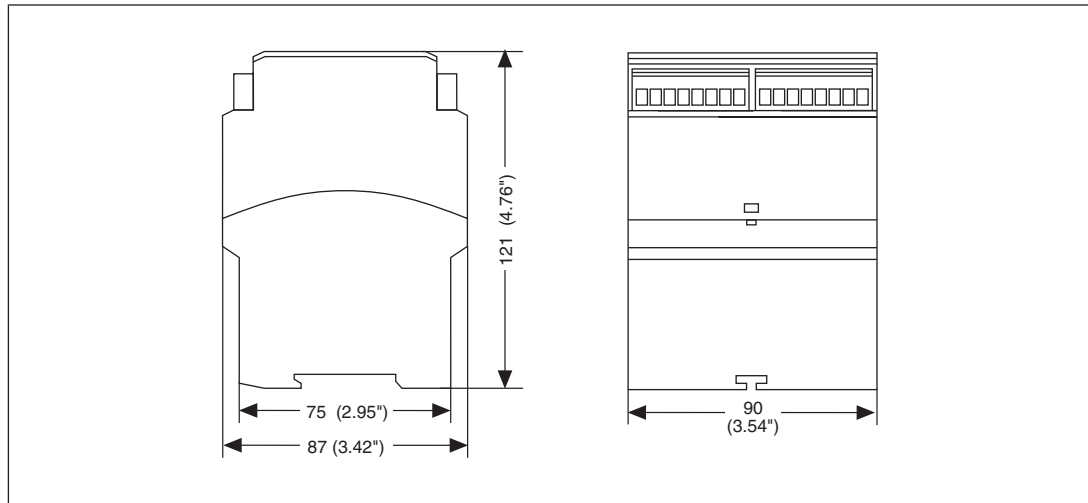
Safety relays PNOZ X PZE 9P

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 RI-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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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 RI-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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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.

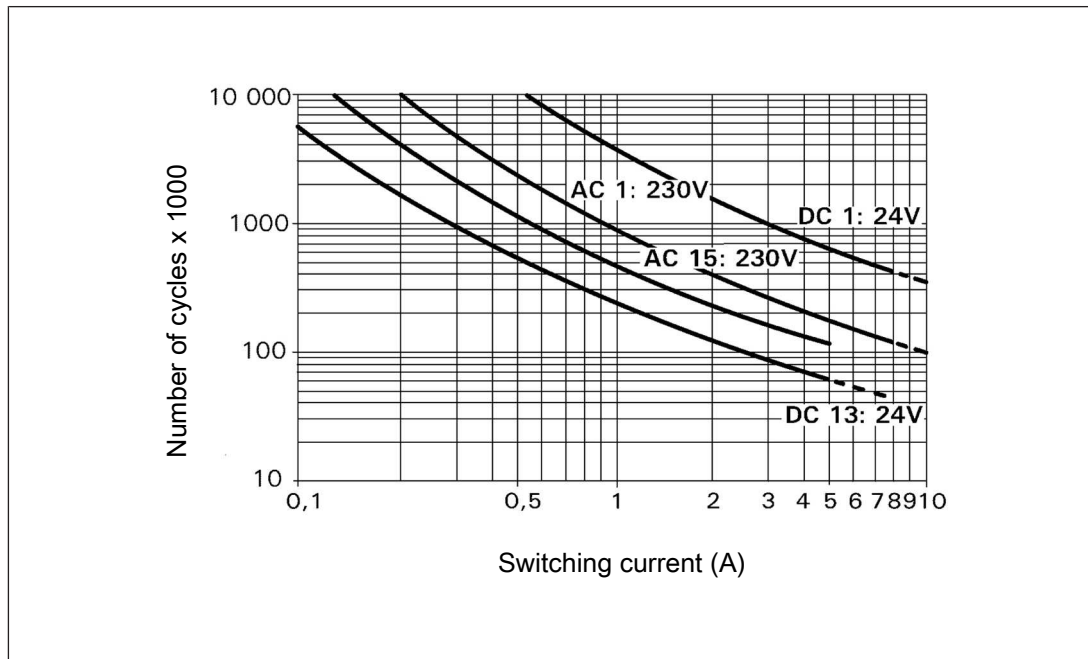
Supplementary data

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

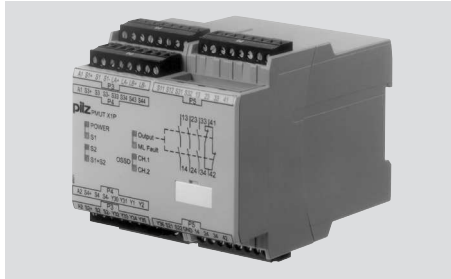
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 con-tactors, 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



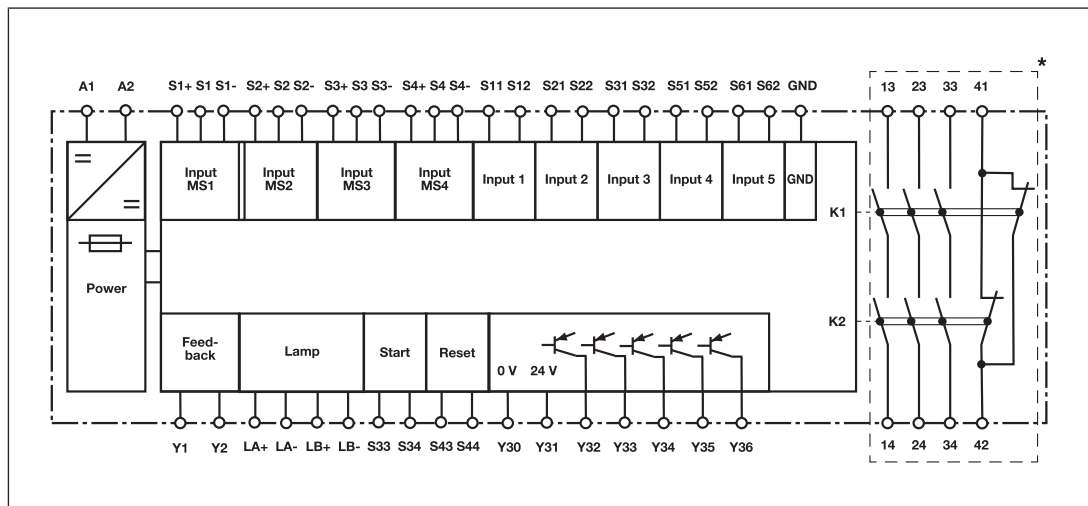
Unit features

- ▶ 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)

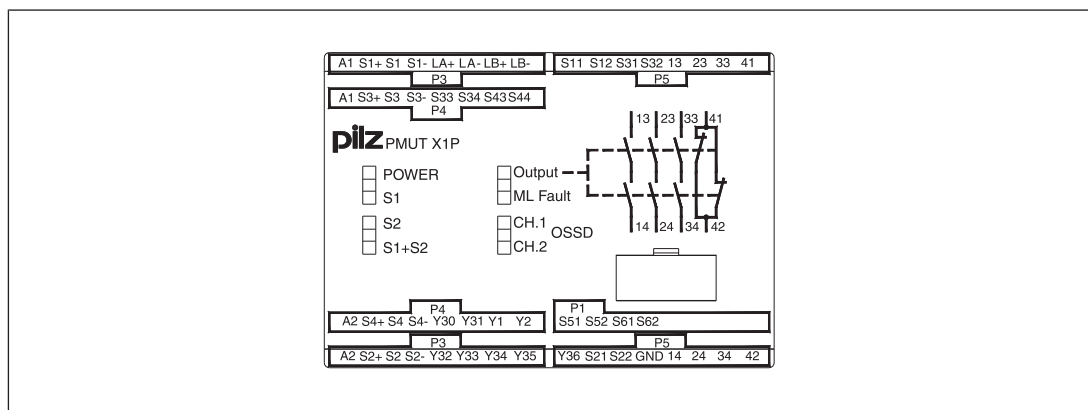
Safety relays PNOZ X PMUT X1P

- ▶ See order reference for unit types

Block diagram/terminal configuration



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



Safety relays PNOZ X PMUT X1P

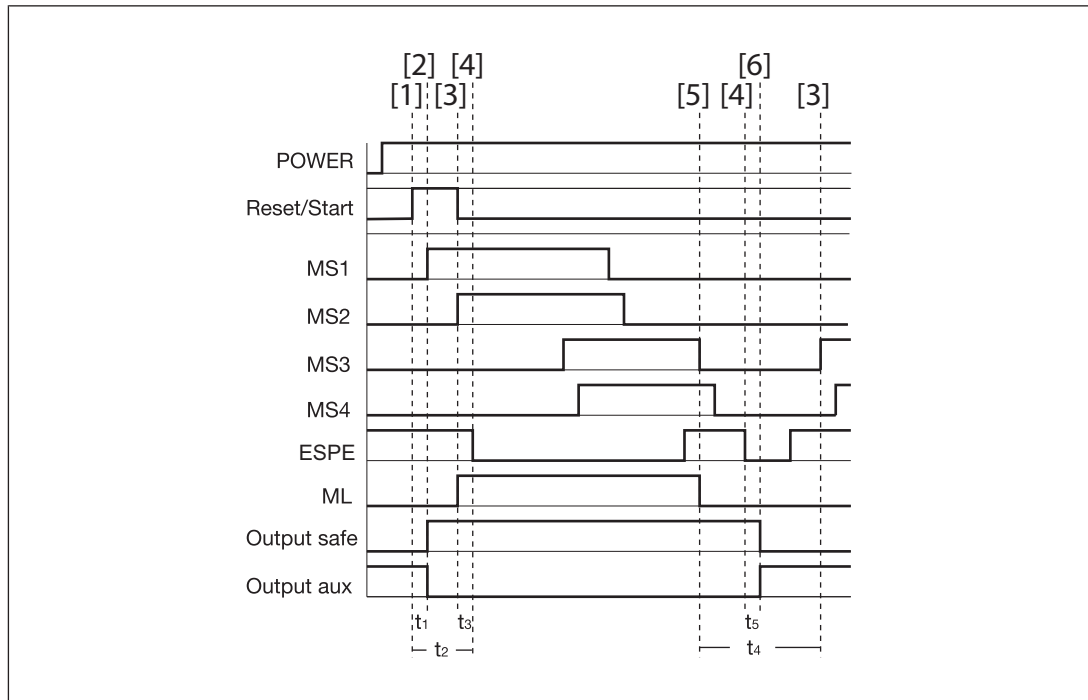
Function description

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

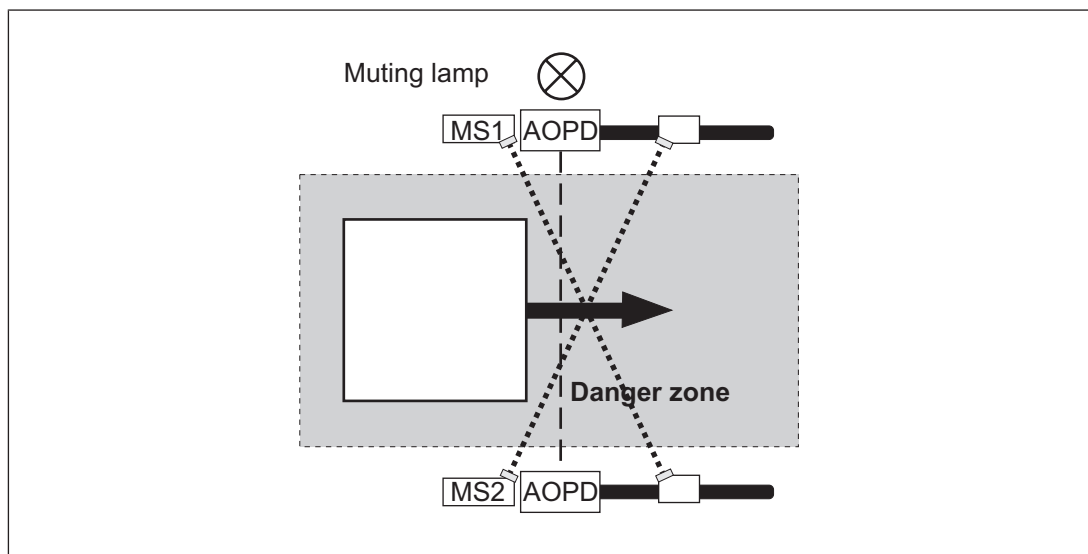
Operating modes

- ▶ 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

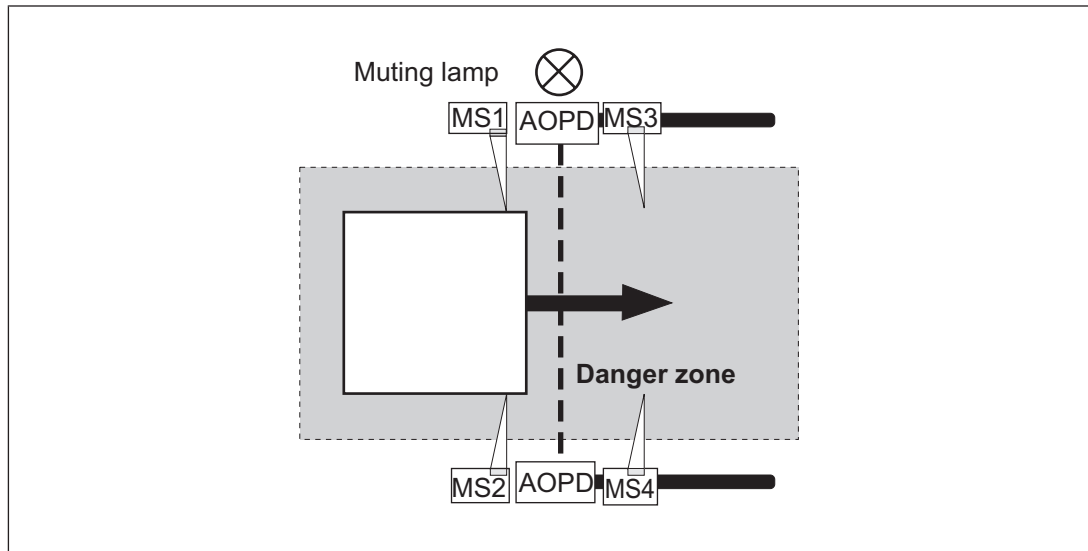
The muting controller can be used for parallel or sequential muting:

- ▶ Parallel muting with 2 muting sensors

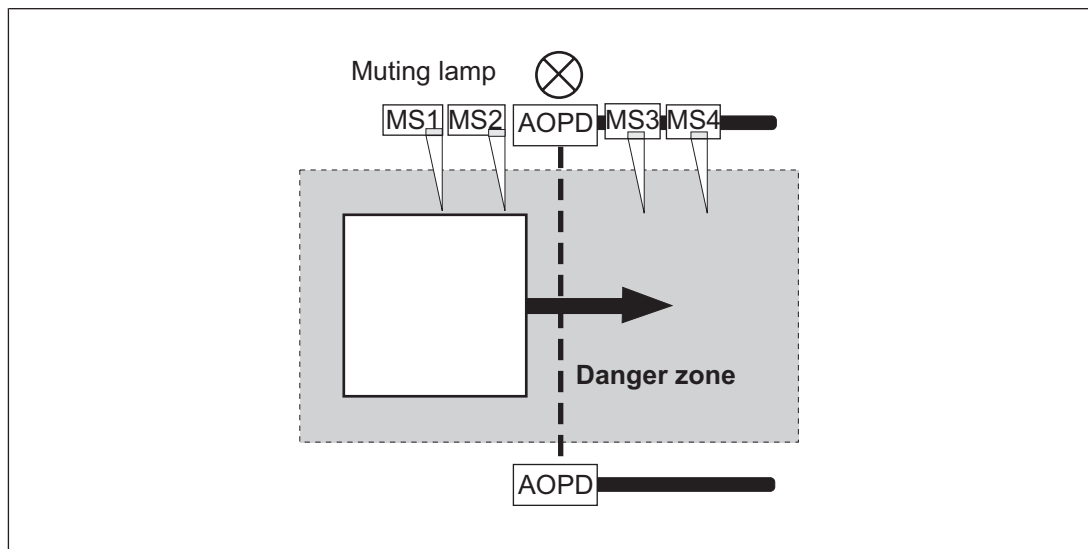


Safety relays PNOZ X PMUT X1P

- ▶ Parallel muting with 4 muting sensors



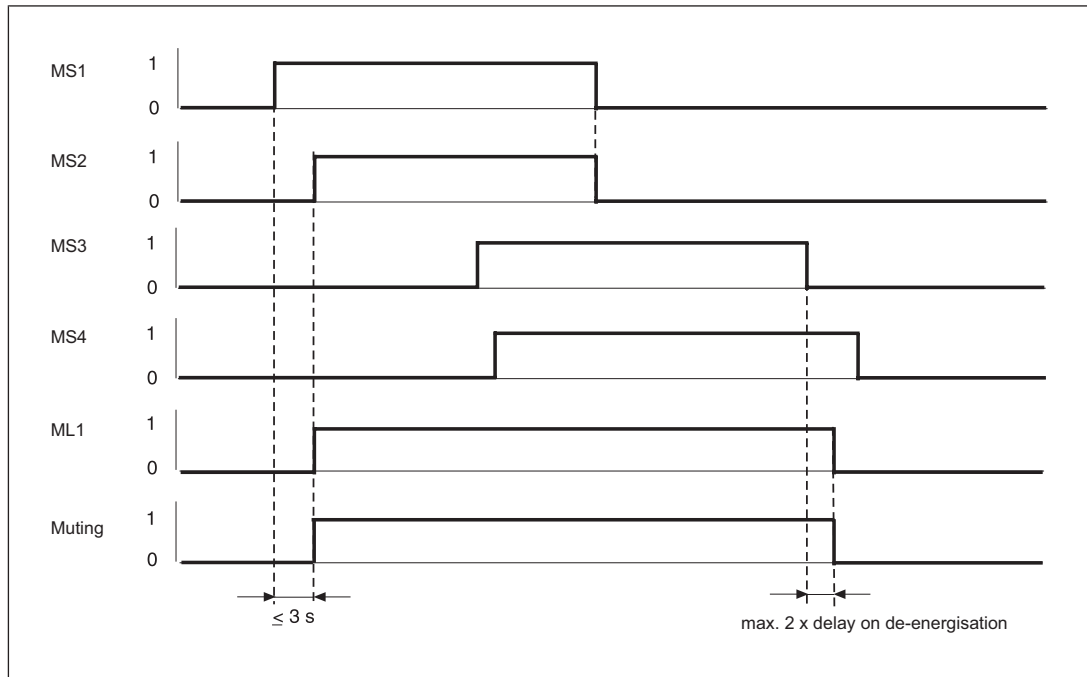
- ▶ Sequential muting with 4 muting sensors



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:

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

$R_{l_{\max}}$ = 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 1cm² and a luminosity of at least 200 cd/m², 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 con- tacts via light grid		
Light grid (ESPE) Semiconductor output PNP/NPN Detection of shorts across con- tacts; - 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	Semiconductor	Contacts

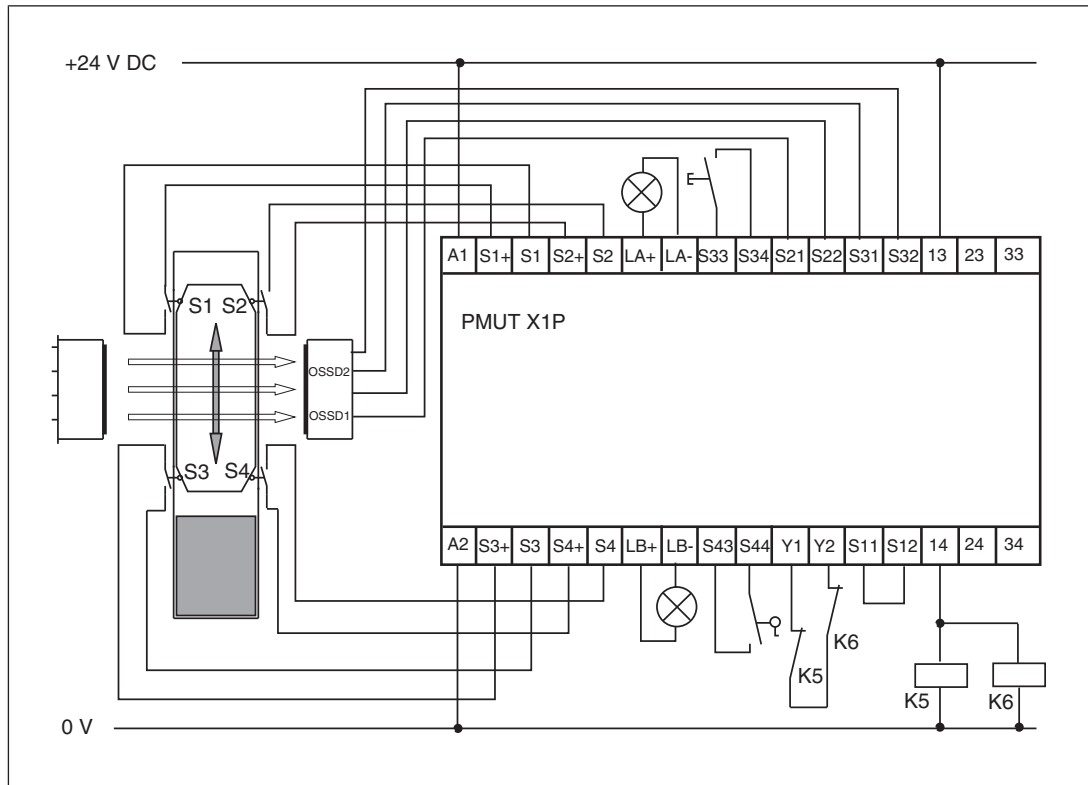
Start circuit	Semiconductor	Contacts
S1: Key switch S3: Start button		

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

Semiconductor output	Semiconductor	Contacts
Y32: Light grid active Y33: Muting active Y34: Muting lamp warning Y35: Both muting lamps defective Y36: Safety contacts closed		

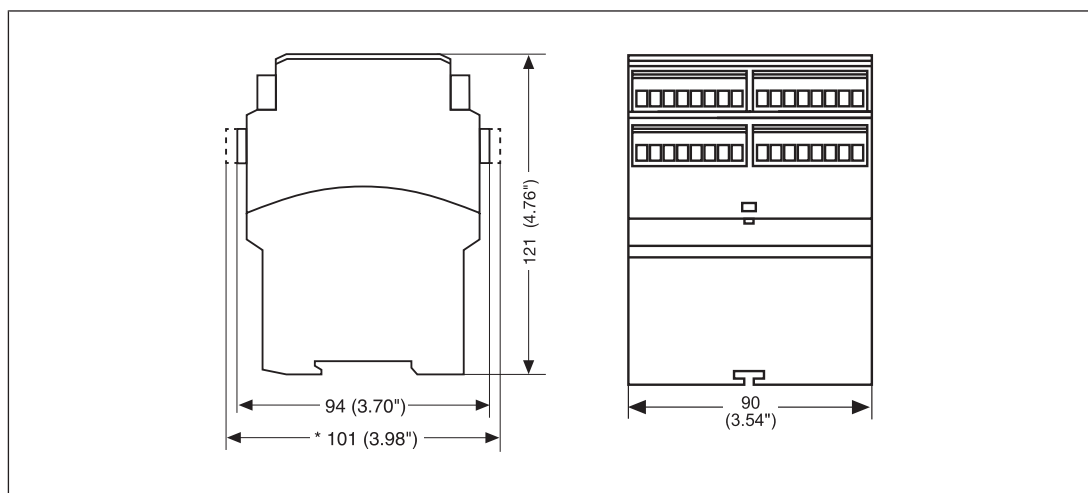
Safety relays PNOZ X PMUT X1P

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 RI-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
I _{th} 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 mm ² , 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.

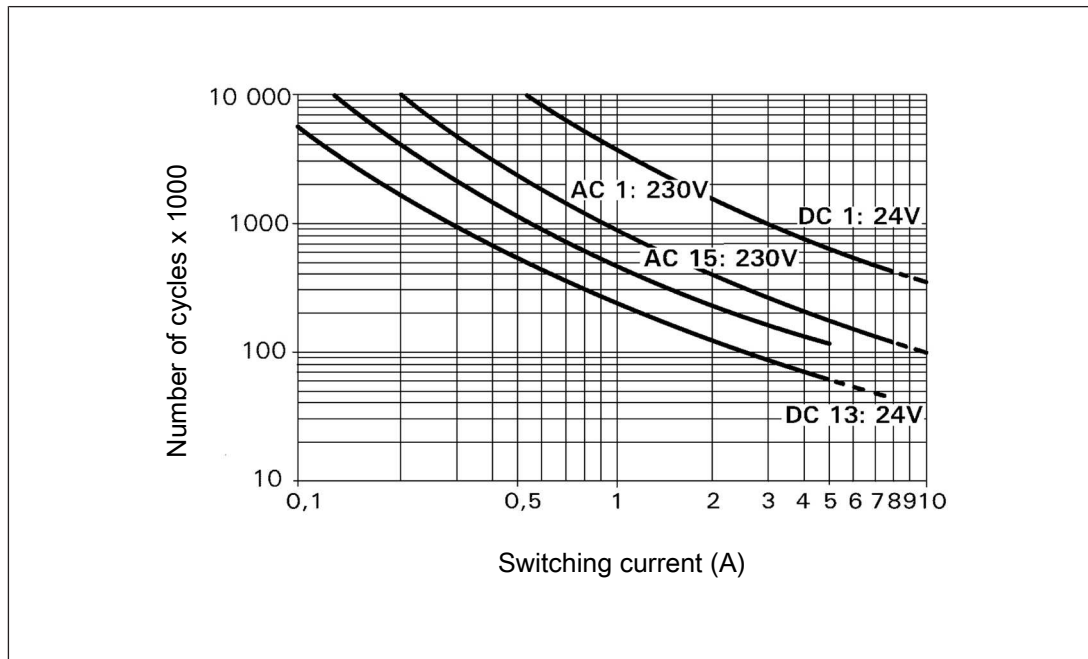
Supplementary data

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

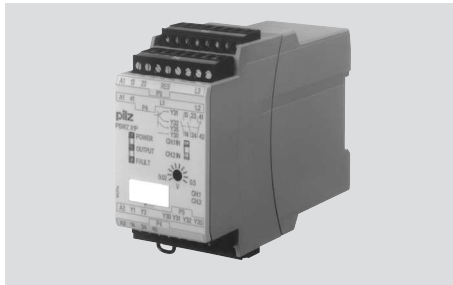
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

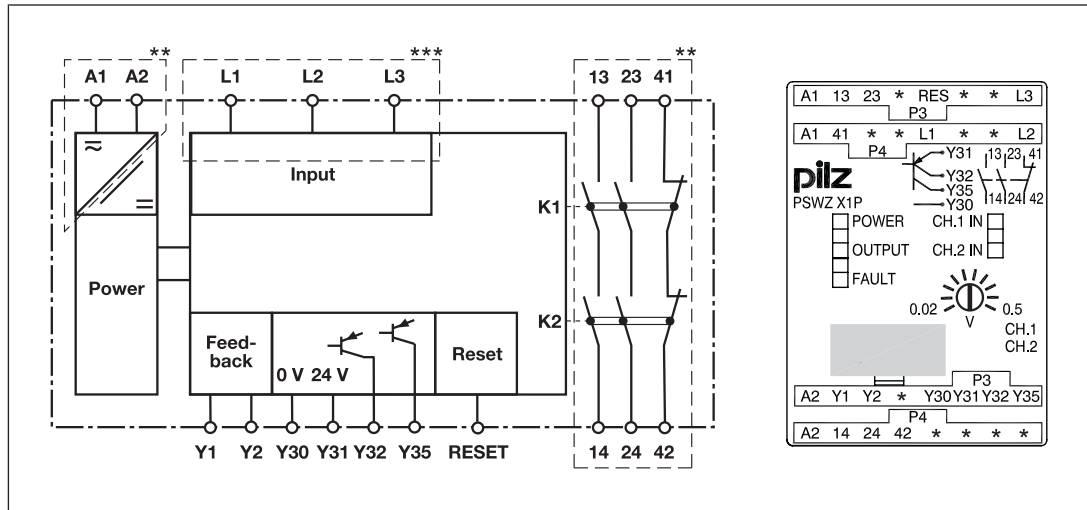


Unit features

- ▶ 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.

Safety relays PNOZ X PSWZ X1P

- ▶ 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

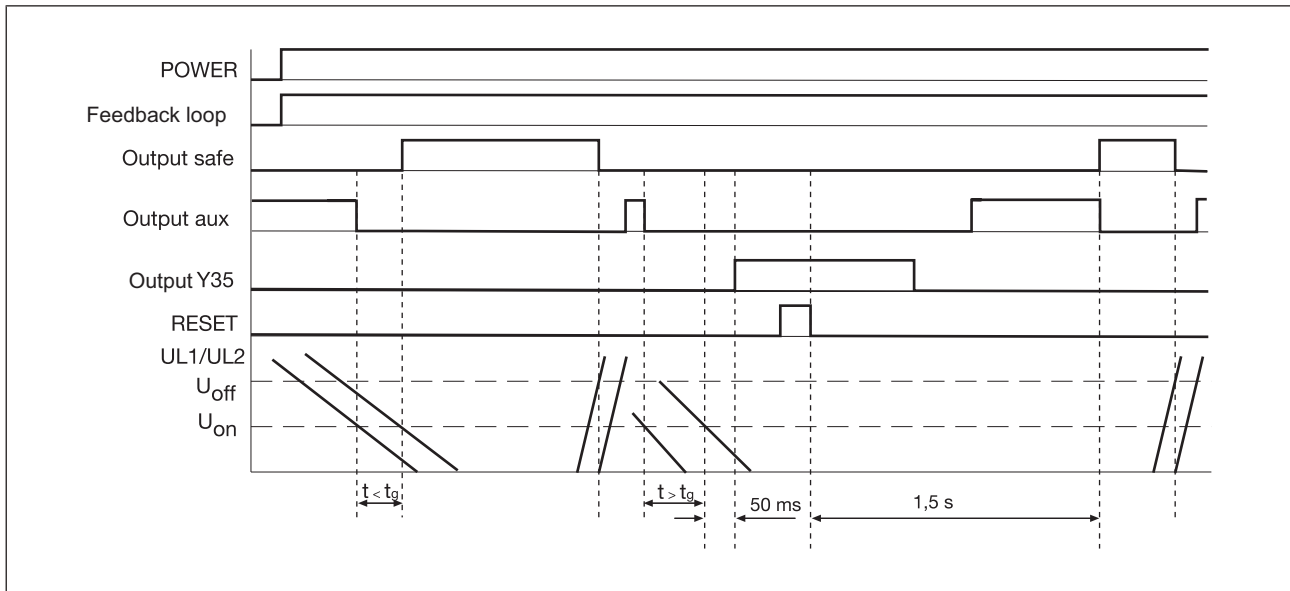
An internal self test is carried out during initial commissioning and each time the supply voltage is switched off and on. The process simulates switching all measuring voltages on and then off again. Provided no error occurs during the self test, the unit will then be ready for operation.

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:

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

$R_{l_{\max}}$ = 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

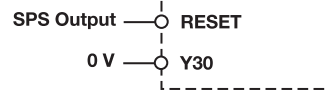
Preparing for operation

Connection

Supply voltage	AC	DC
Input circuit	Single-phase motor	Three-phase motor
<p>Single-phase motor = single-phase measurement signal evaluation</p> <p>Three-phase motor = two-phase measurement signal evaluation</p>		
Single-phase measurement signal evaluation	/	
Feedback loop	with feedback loop monitoring	without feedback loop monitoring
Contacts from external contactors or link		
Semiconductor output		
<p>Y32: Semiconductor output for switch status</p> <p>Y35: Semiconductor output for fault signal</p>		

Safety relays PNOZ X PSWZ X1P

Semiconductor input

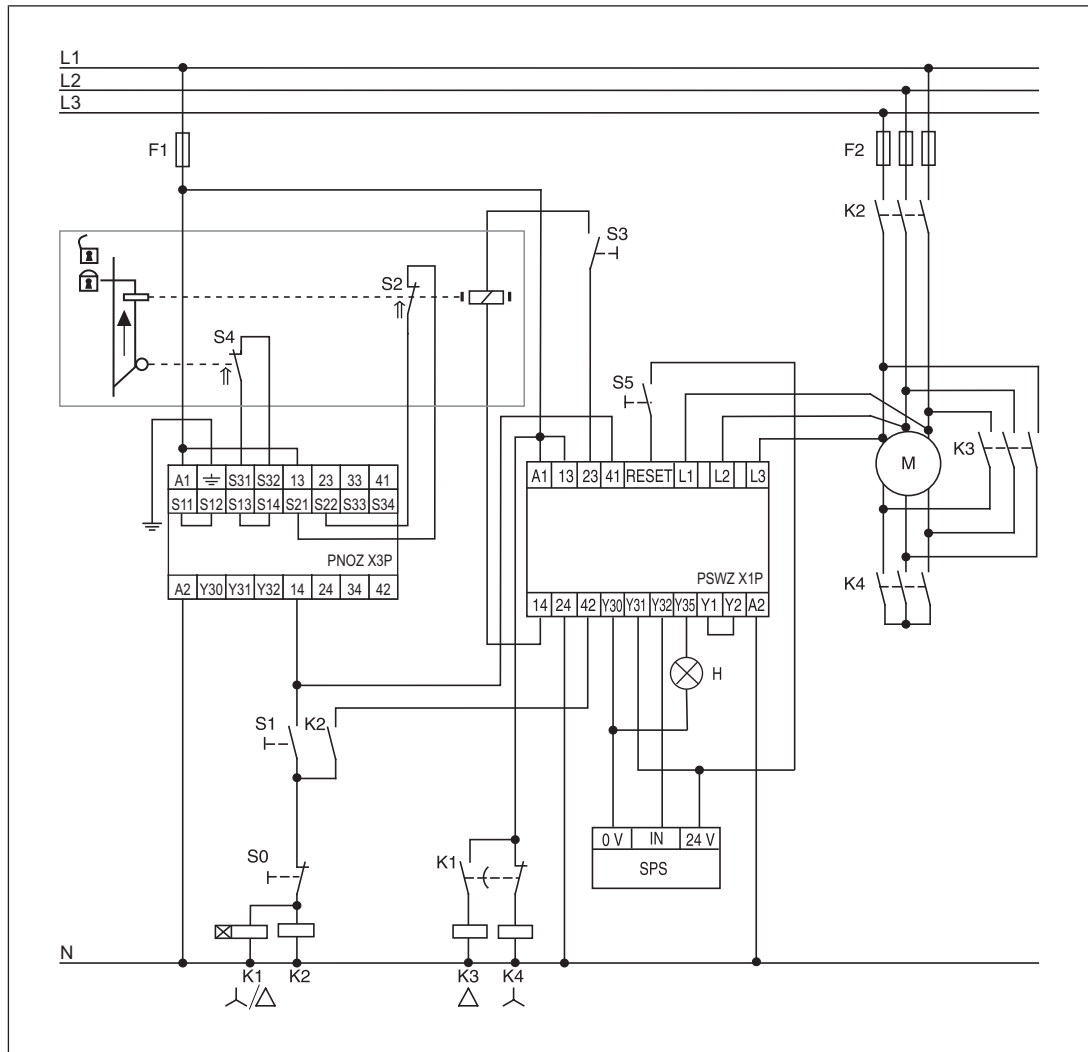


Set standstill detection

- ▶ 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

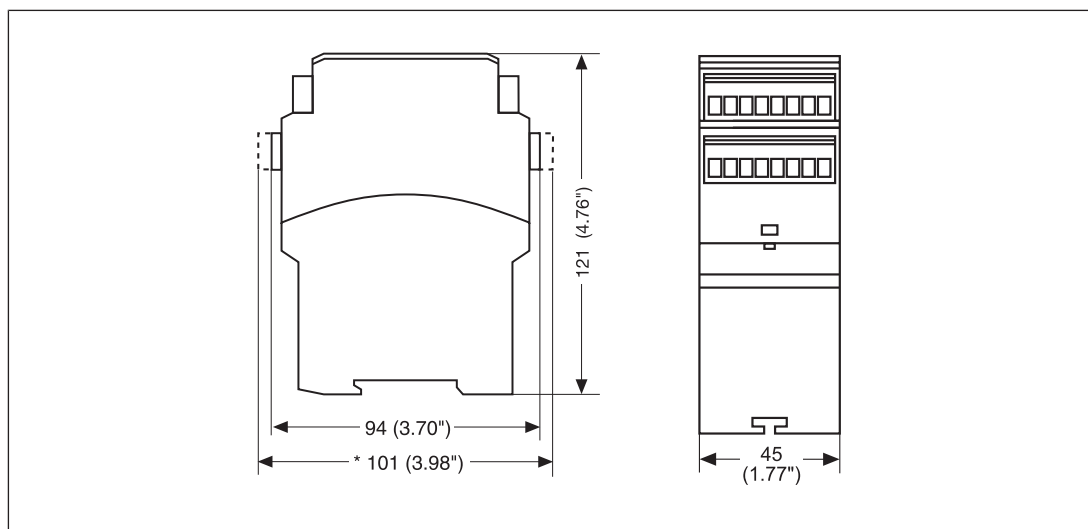
- ▶ S0: Off switch
- ▶ S1: On switch
- ▶ S2/S4: Safety gate switch
- ▶ S3: Release
- ▶ S5: Reset button
- ▶ K1: Star/delta control relay
- ▶ K2: Motor contactor
- ▶ K3: Delta contactor
- ▶ K4: Star contactor
- ▶ H: Fault indicator

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
I _{th} 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 mm ² , 24 - 14 AWG	0,25 - 2,5 mm ² , 24 - 14 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,5 - 1,5 mm ² , 24 - 16 AWG	0,5 - 1,5 mm ² , 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 U _{on} (adjustable)	7,5 - 500 mV	20 - 500 mV
Release value U _{off}	2 x U _{on}	2 x U _{on}
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 I _K	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 con- tacts		
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 con- tacts		
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 con- tacts		
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 con- tacts		
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
I _{th} 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 mm ² , 24 - 14 AWG	0,25 - 2,5 mm ² , 24 - 14 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,5 - 1,5 mm ² , 24 - 16 AWG	0,5 - 1,5 mm ² , 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 U _{on} (adjustable)	20 - 500 mV	120 - 3000 mV	7,5 - 500 mV
Release value U _{off}	2 x U _{on}	2 x U _{on}	2 x U _{on}
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 I _K	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 A ² s	66 A ² s	66 A ² s
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 A ² s	66 A ² s	66 A ² s
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
I _{th} 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 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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	EN ISO 13849-1: 2015	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.

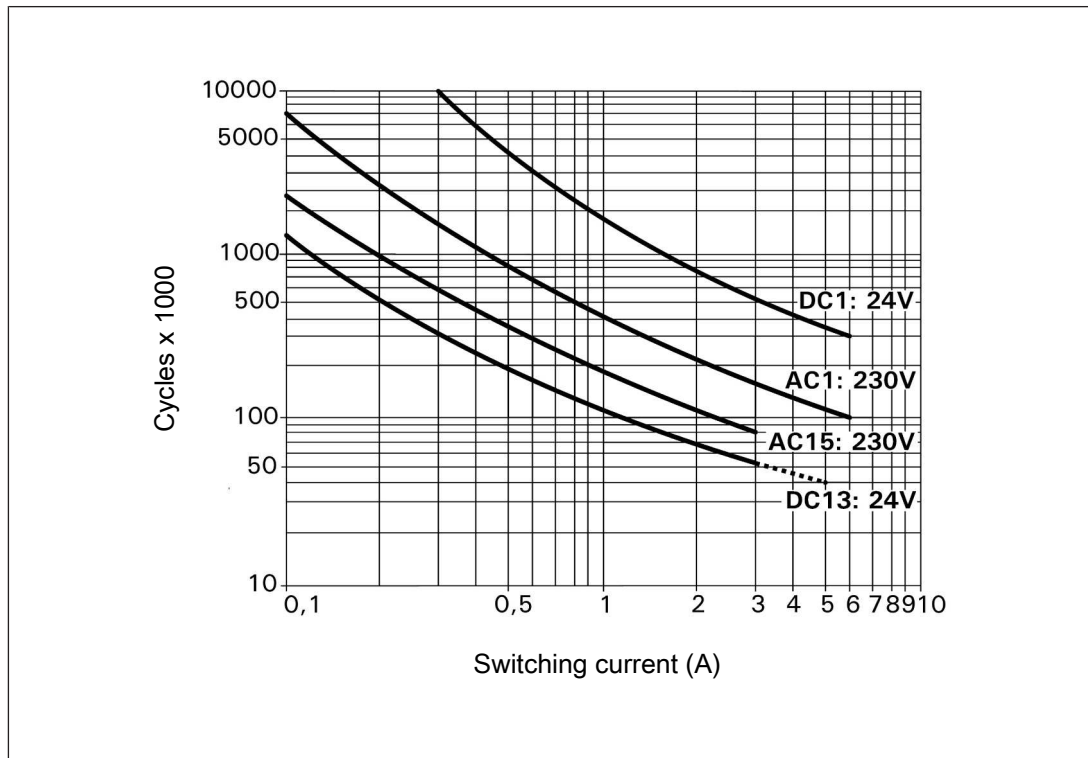


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X PSWZ X1P

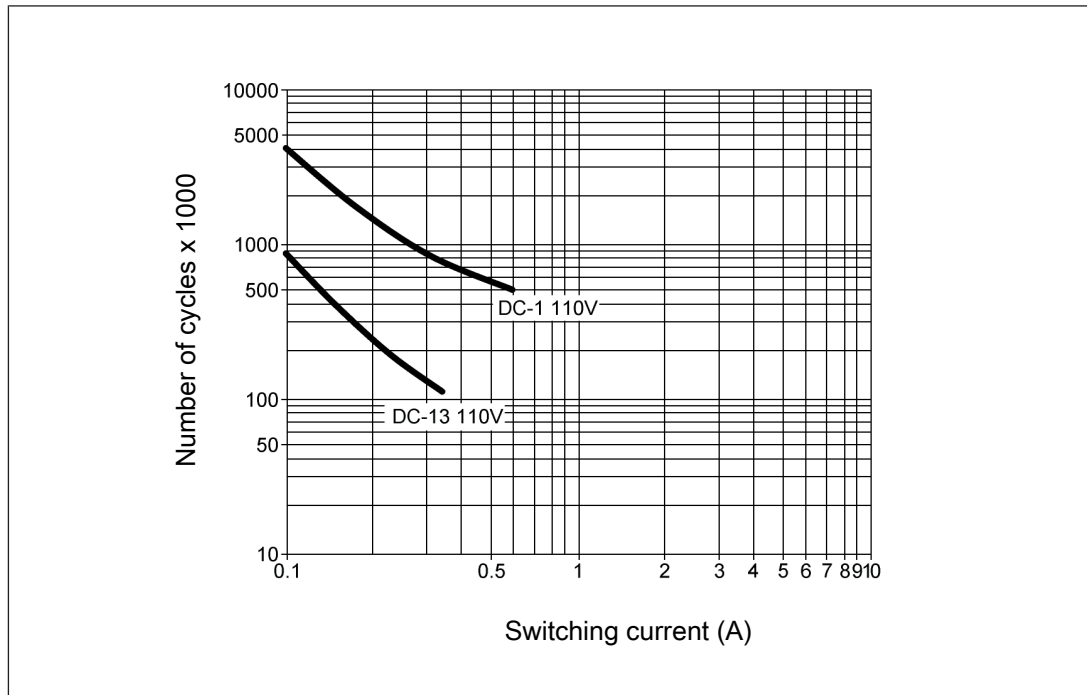


Fig.: Service life graphs at 110 VDC

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

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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

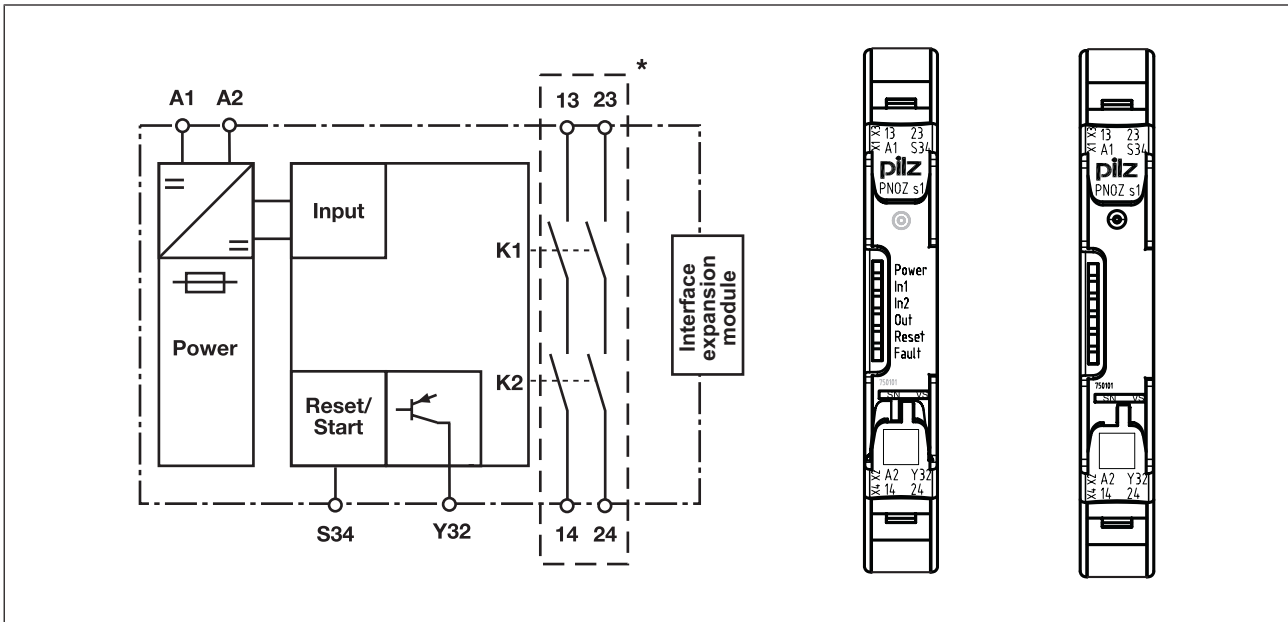


Fig.: Centre: Front view with cover, right: Front view without cover

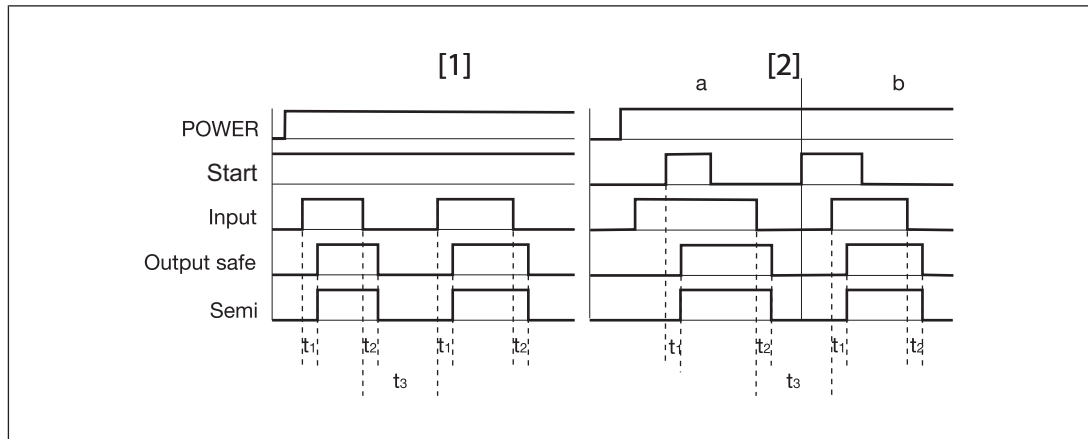
*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (over-voltage category II)

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).

Safety relays PNOZsigma PNOZ s1

- ▶ 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:

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

$R_{l_{\max}}$ = 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.

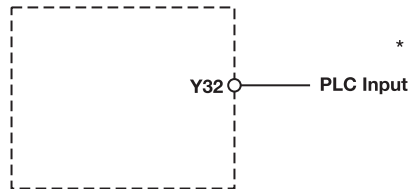
Safety relays PNOZsigma PNOZ s1

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



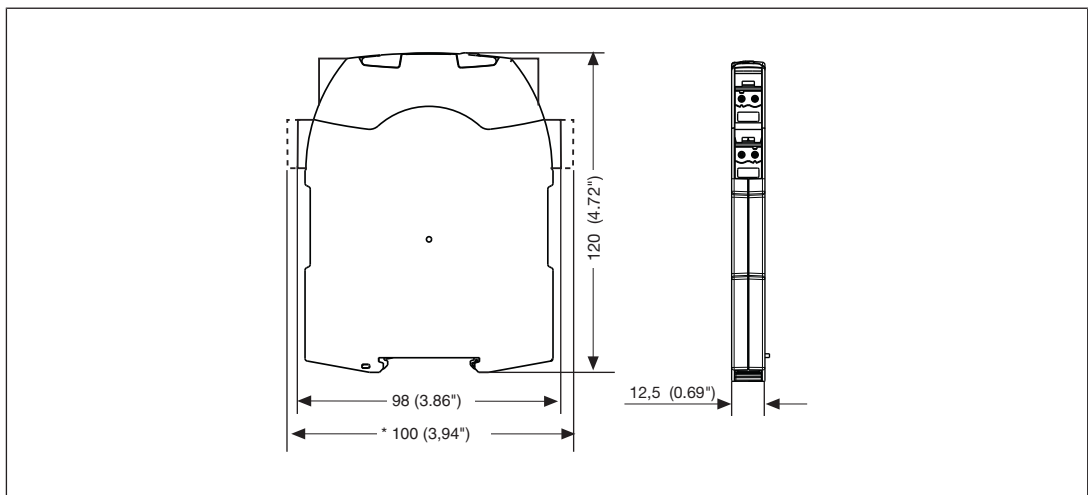
*Connect together the 0V connections on all the external power supplies

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 RI-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), instantaneous	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	EN ISO 13849-1: 2015	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015
	PL	Category					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

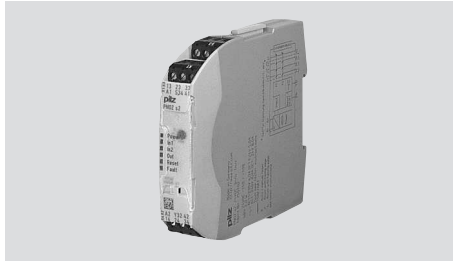
The service life table indicates the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.

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

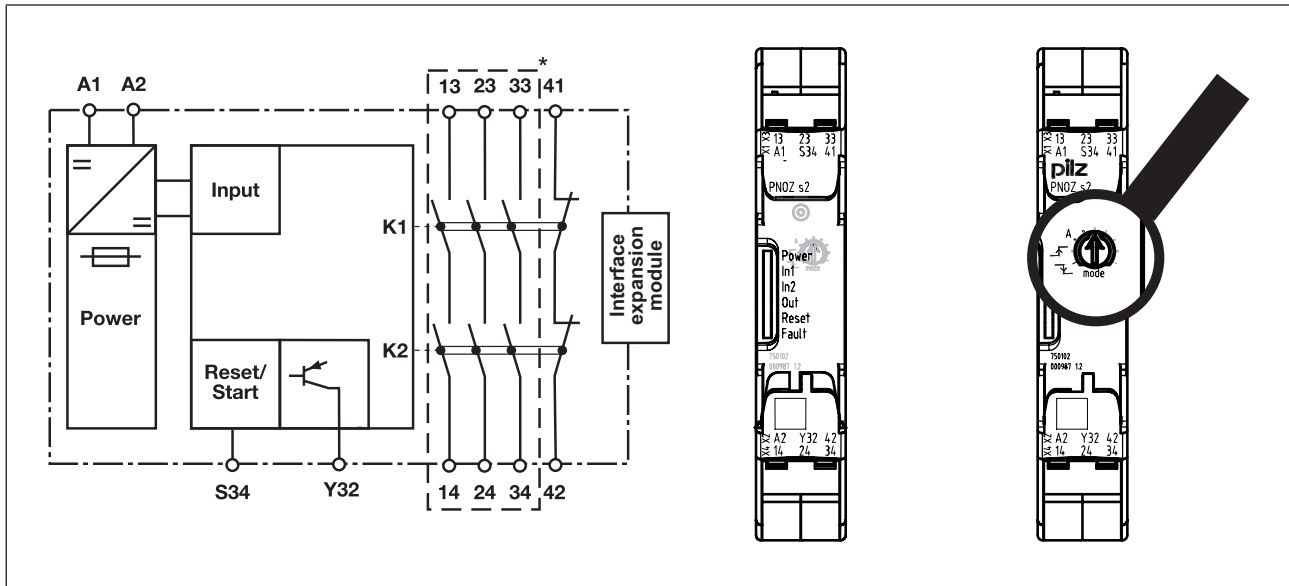




Fig.: Centre: Front view with cover, right: Front view without cover

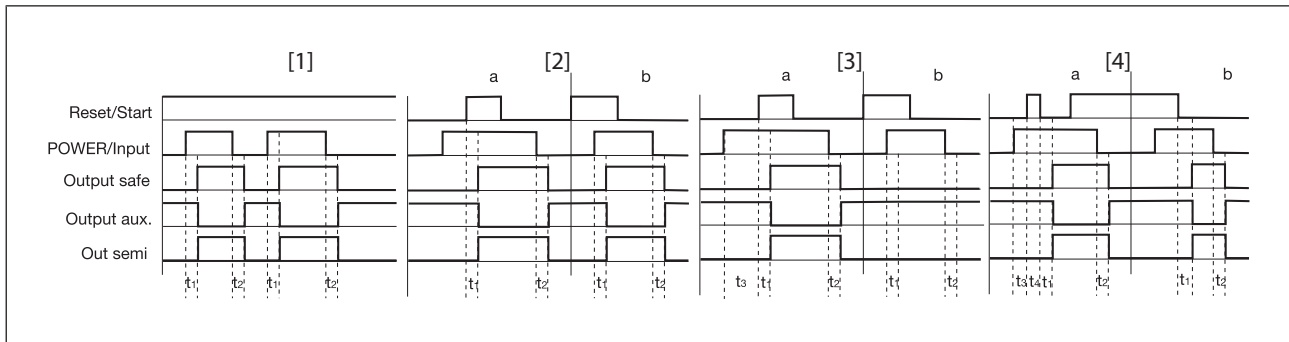
*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

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:

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

$R_{l_{\max}}$ = 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

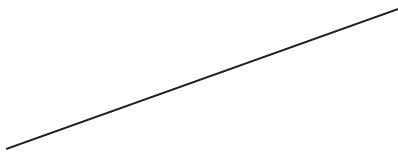
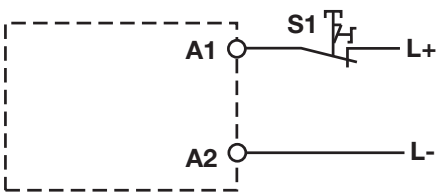
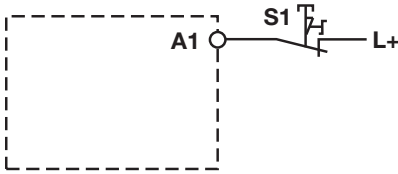
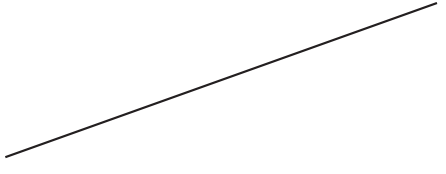
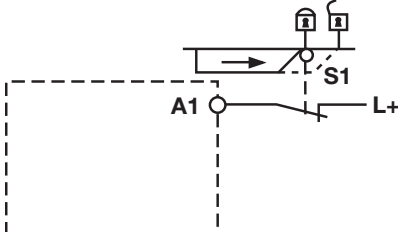
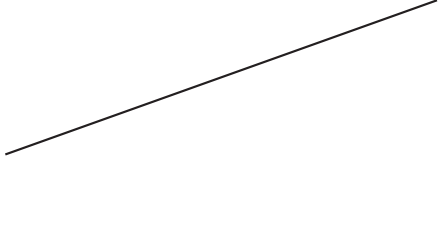
The operating mode is set via the rotary switch on the unit. You can do this by opening the cover on the front of the unit.

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		

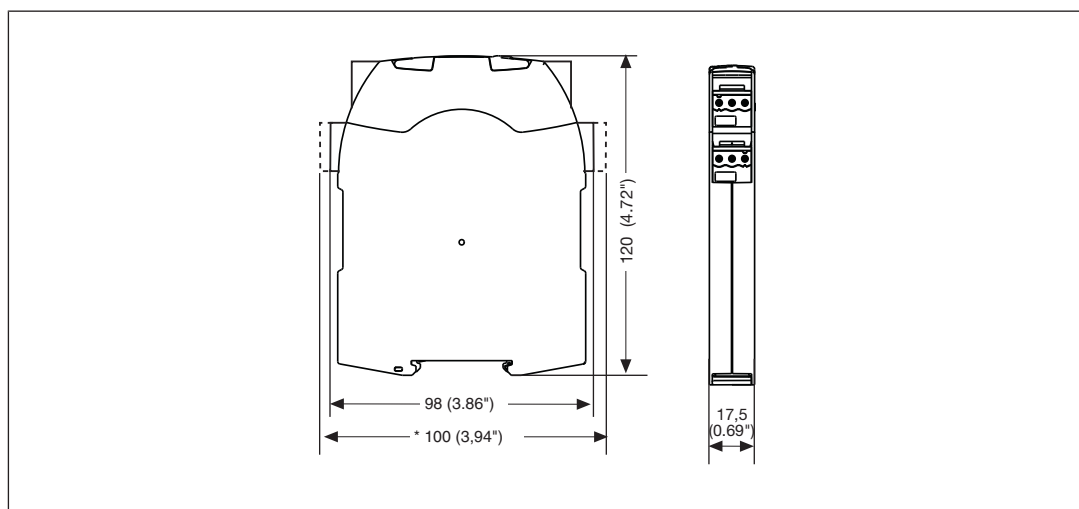
Safety relays PNOZsigma PNOZ s2

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/restart		
Semiconductor output		
<p style="text-align: right;">*</p>		

*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 RI- 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 A ² s	260 A ² s
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 A ² s	160 A ² s
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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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.

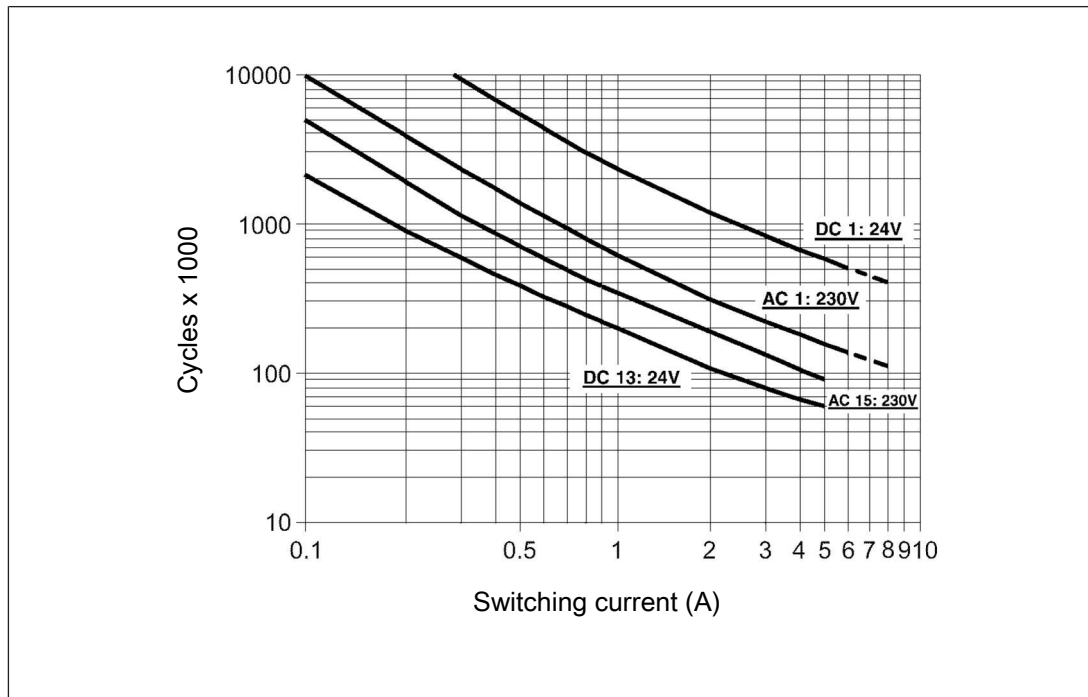


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s2

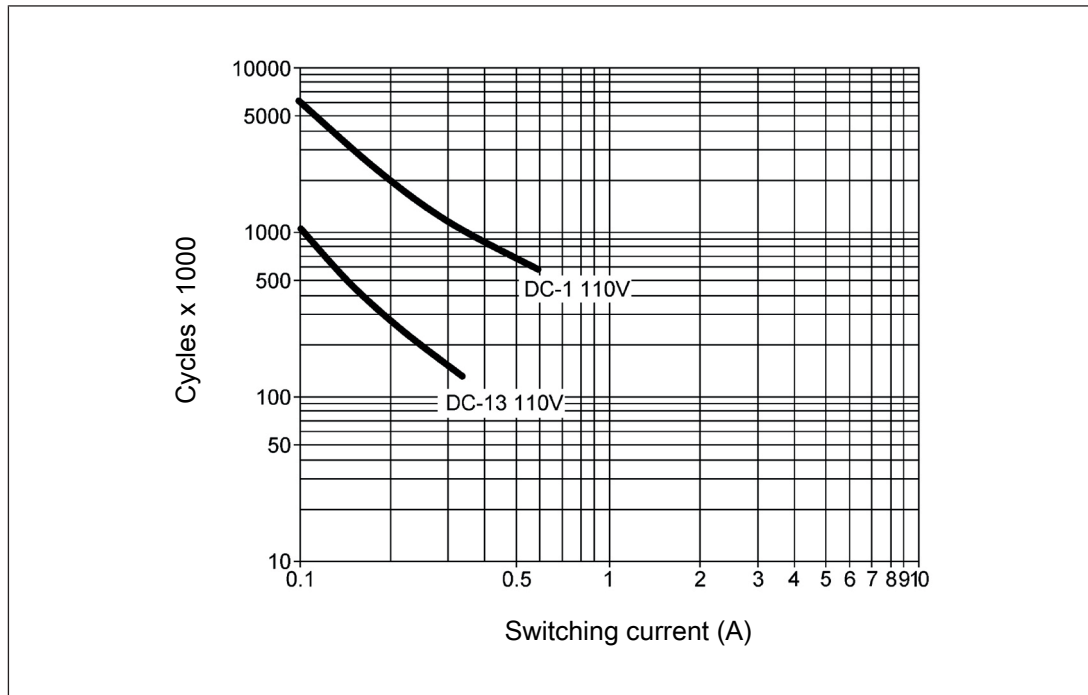


Fig.: Service life graphs at 110 V DC

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

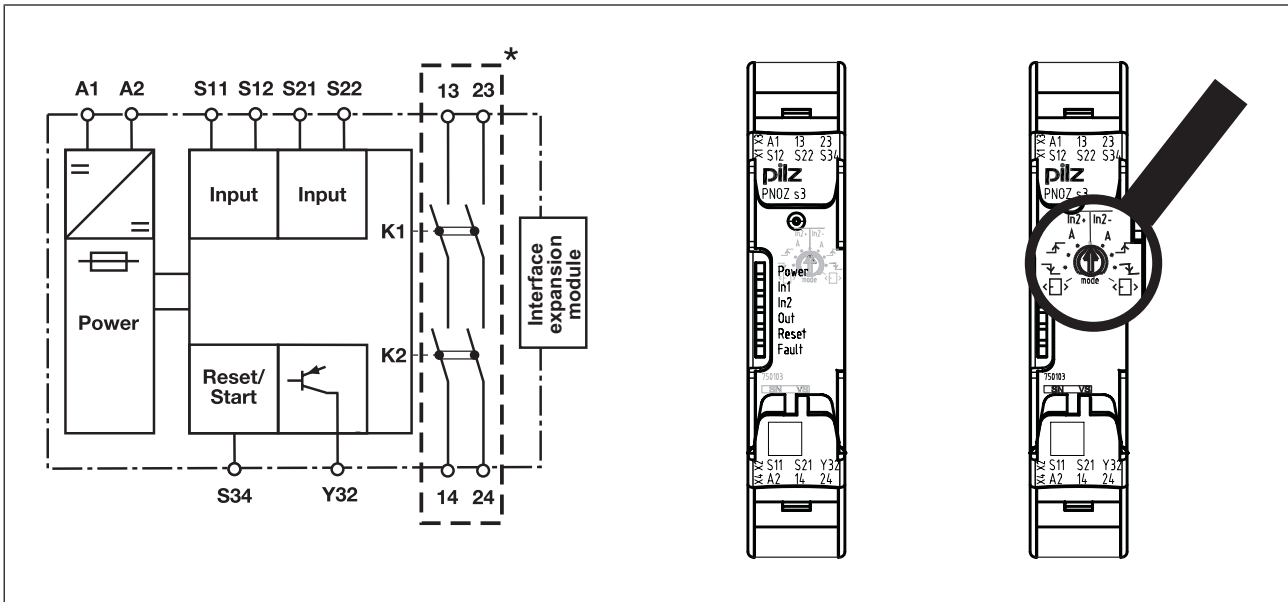




Fig.: Centre: Front view with cover, right: Front view without cover

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

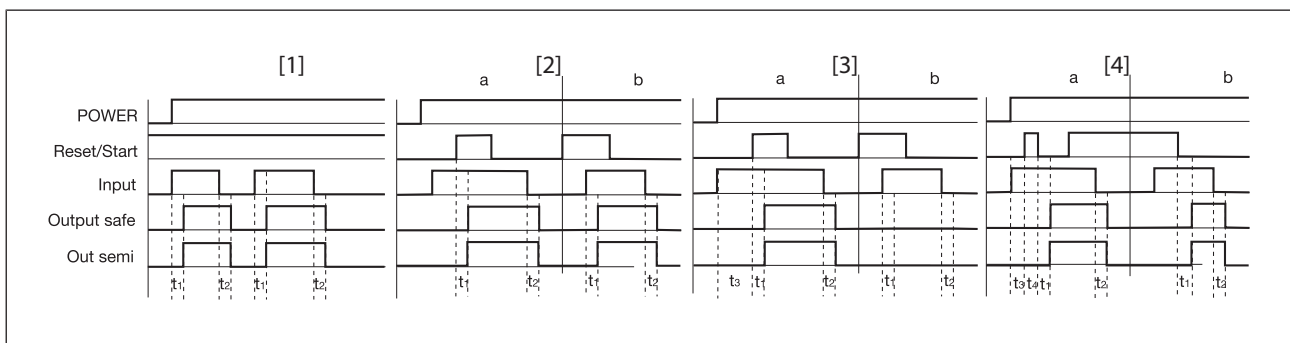
Function description

- ▶ $\overline{\text{In}2+}$ 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.
- ▶ $\overline{\text{In}2-}$ 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:

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

$R_{l_{\max}}$ = 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.

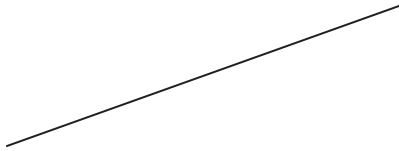
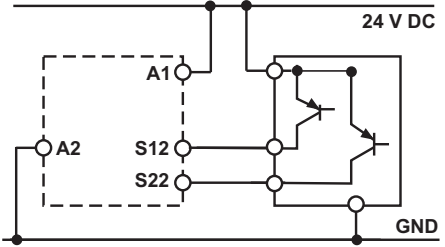

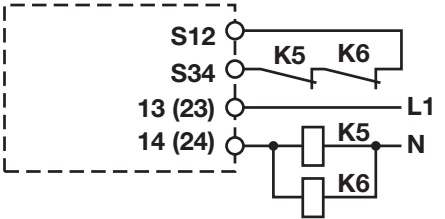
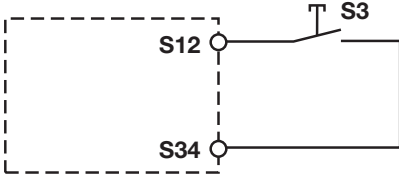
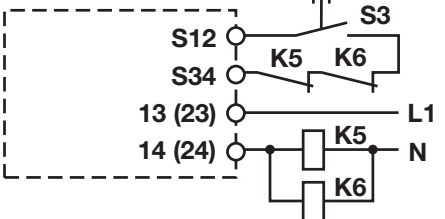
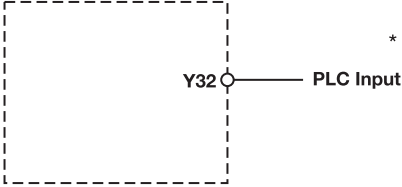
Operating mode selector switch "mode"	Automatic or manual start	Monitored start rising edge	Monitored start falling edge	Automatic start with start-up test
Without detection of shorts across contacts				
With detection of shorts across contacts				

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		

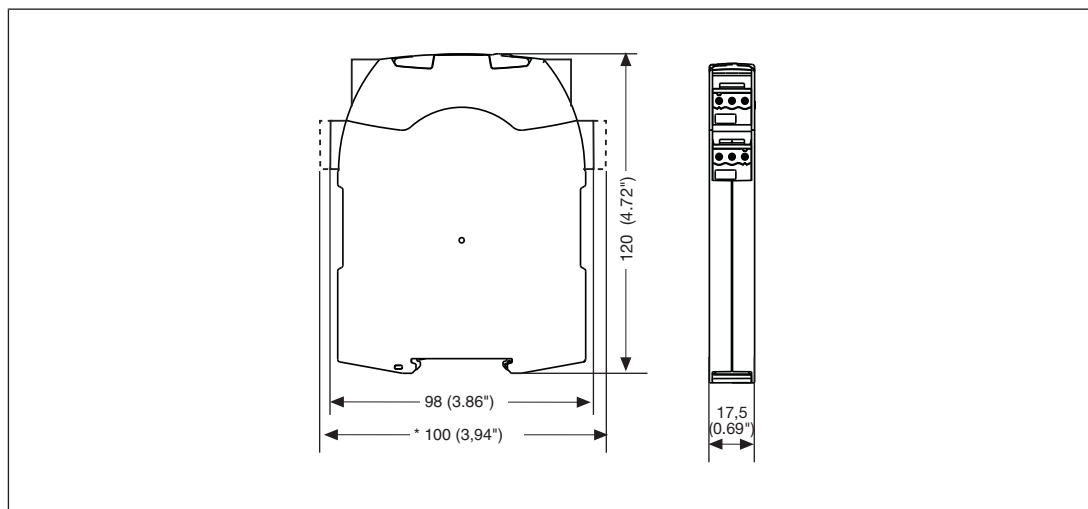
Safety relays PNOZsigma PNOZ s3

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		
 <p style="text-align: center;">*</p> <p style="text-align: center;">Y32 — PLC Input</p> <p>*Connect together the 0V connections on all the external power supplies</p>		

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 RI-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.

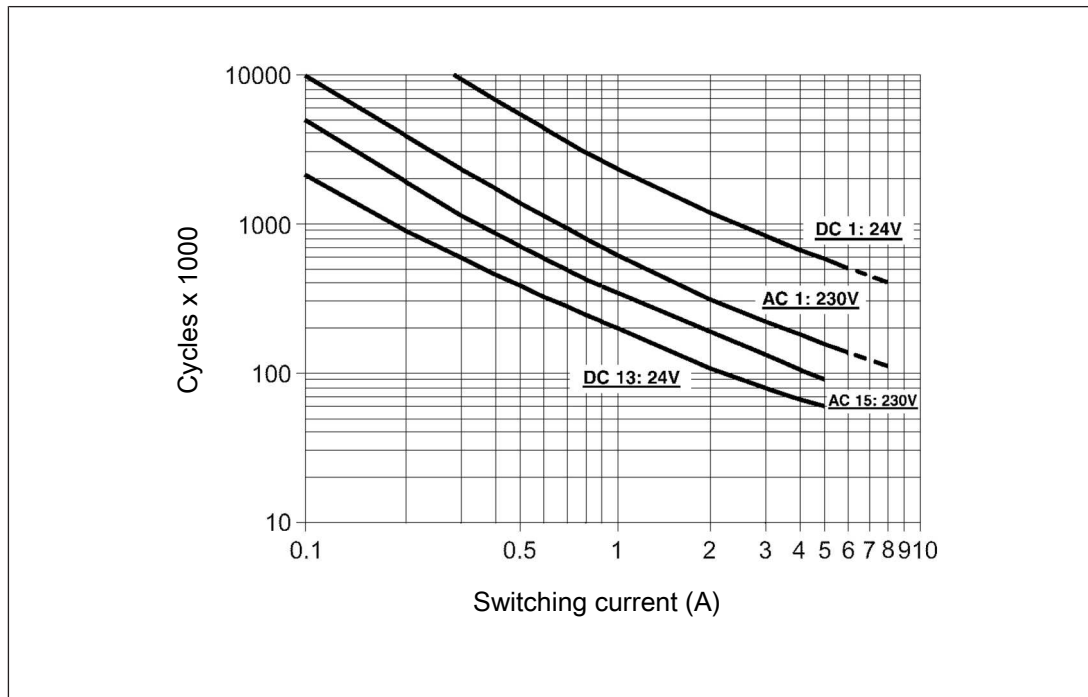


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s3

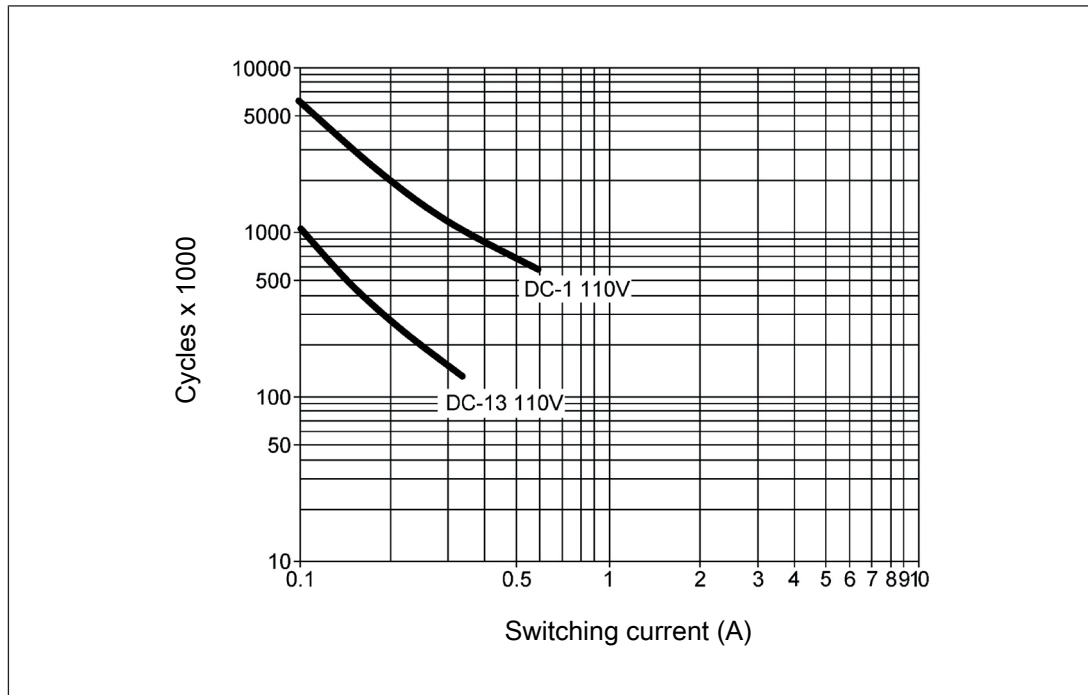


Fig.: Service life graphs at 110 V DC

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

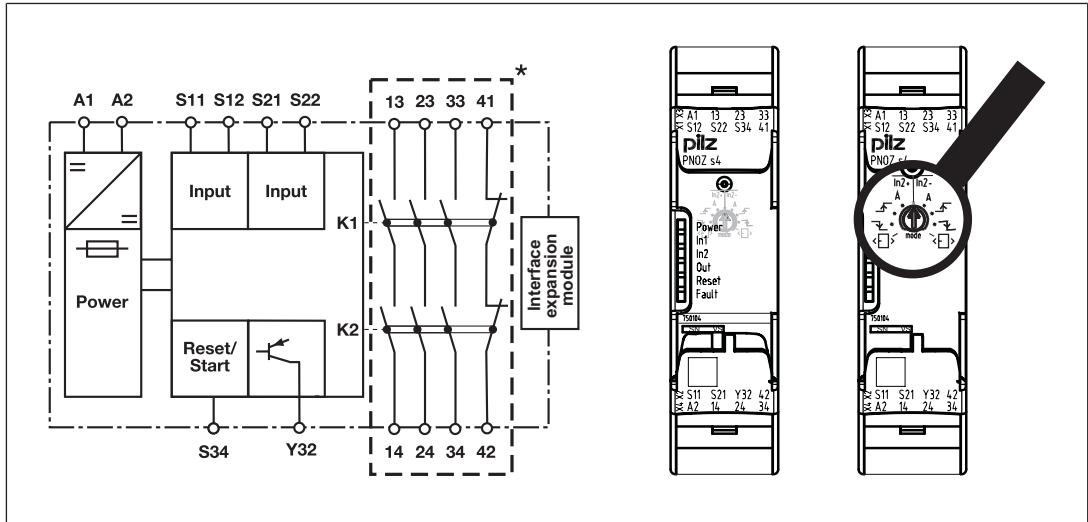


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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

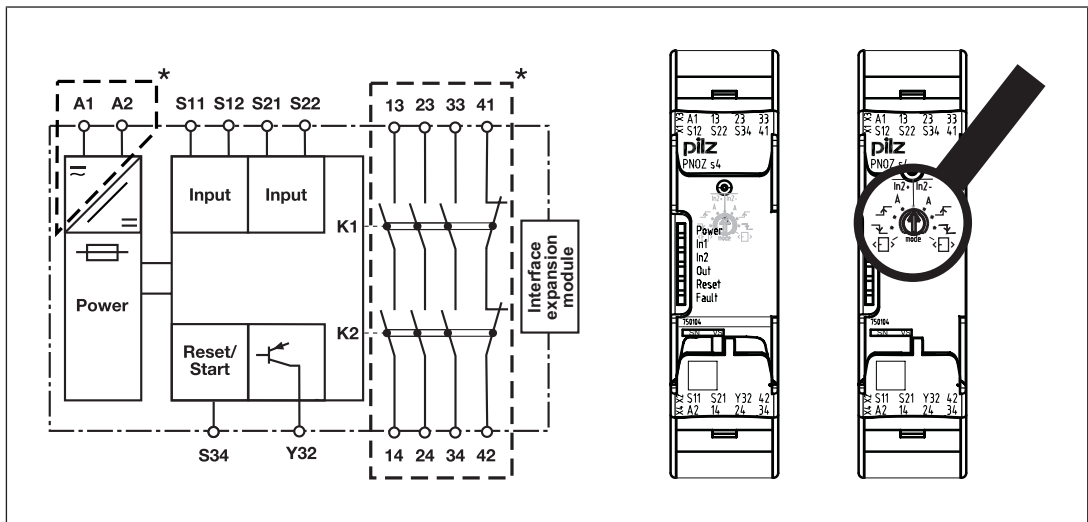


Fig.: Centre: Front view with cover, right: Front view without cover

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

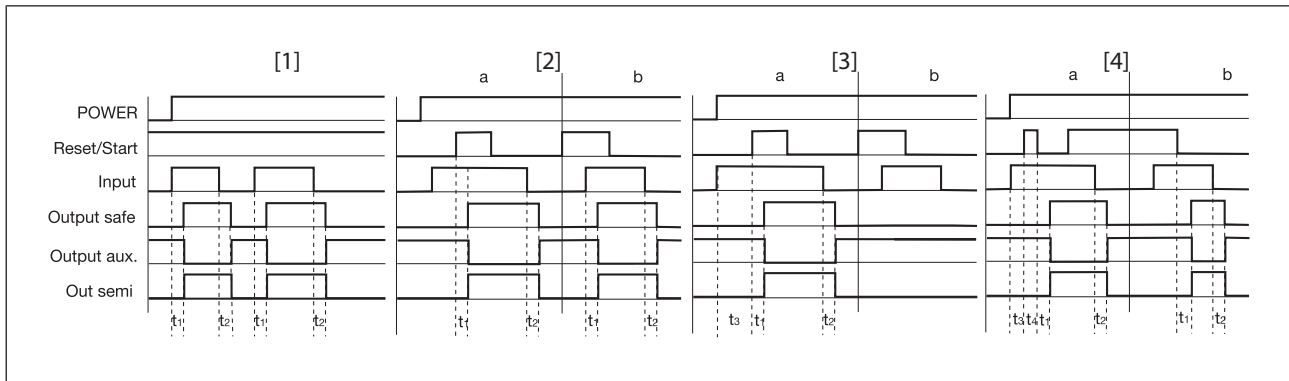
Safety relays PNOZsigma PNOZ s4

Function description

- ▶ $\overline{\text{In}2\text{+}}$ 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.
- ▶ $\overline{\text{In}2\text{-}}$ 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.
- ▶ $\overline{\downarrow}$ 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.
- ▶ \uparrow 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).
- ▶ \square 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:

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

$R_{l_{\max}}$ = 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.

Safety relays PNOZsigma PNOZ s4

- ▶ 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/re-start		
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		

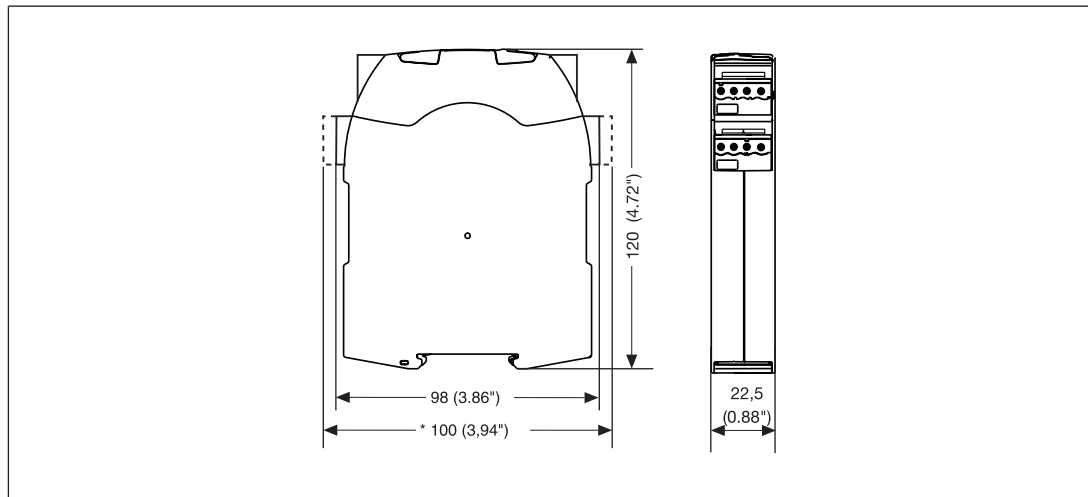
Legend

- ▶ 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 R _{lmax}			
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 I _K	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 A ² s	66 A ² s	260 A ² s
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
I _{th} 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	–
I _{th} 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 RI-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 A ² s	260 A ² s
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
I _{th} 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	–
I _{th} 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	EN ISO 13849-1: 2015	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 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

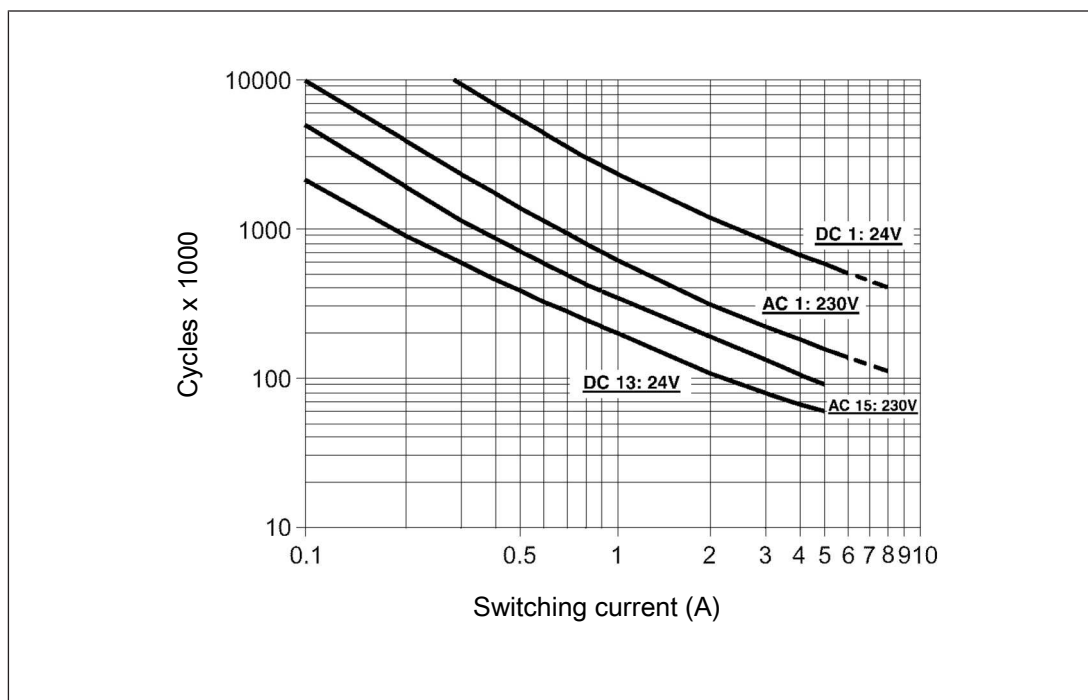


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma PNOZ s4

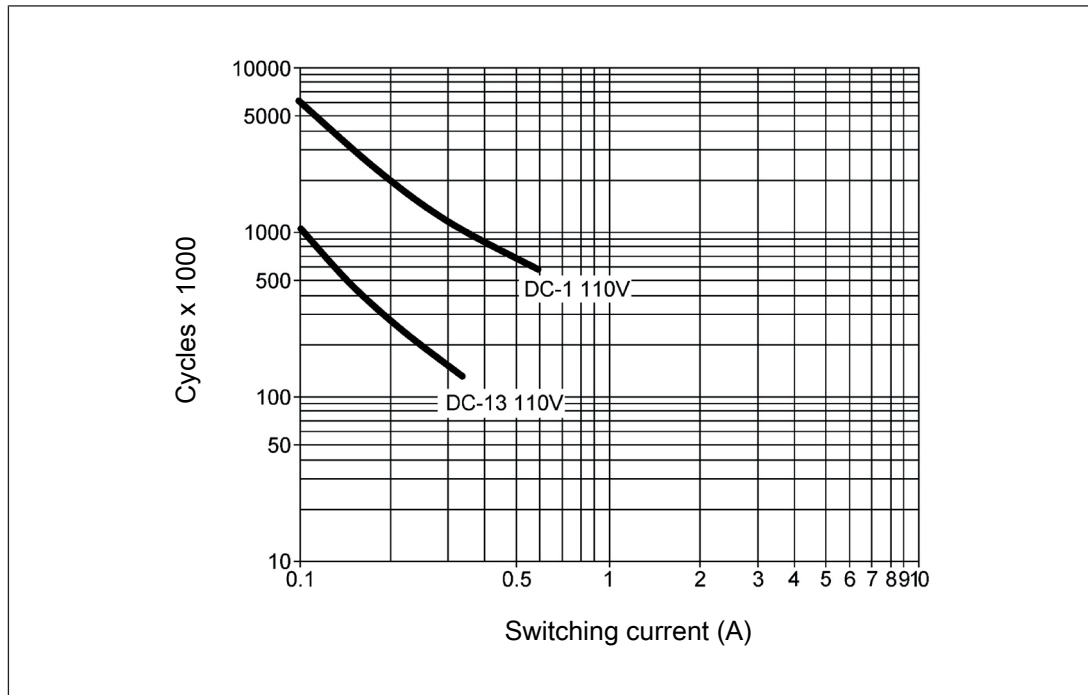


Fig.: Service life graphs at 110 VDC

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

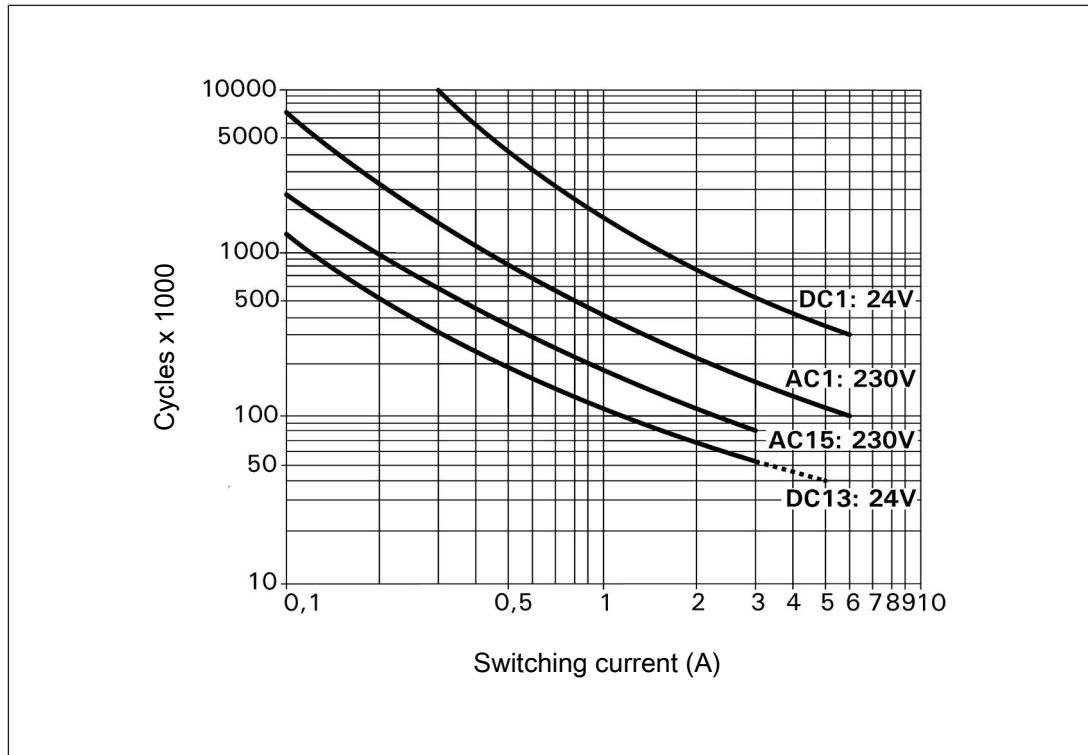


Fig.: Service life graphs at 24 VDC and 230 VAC

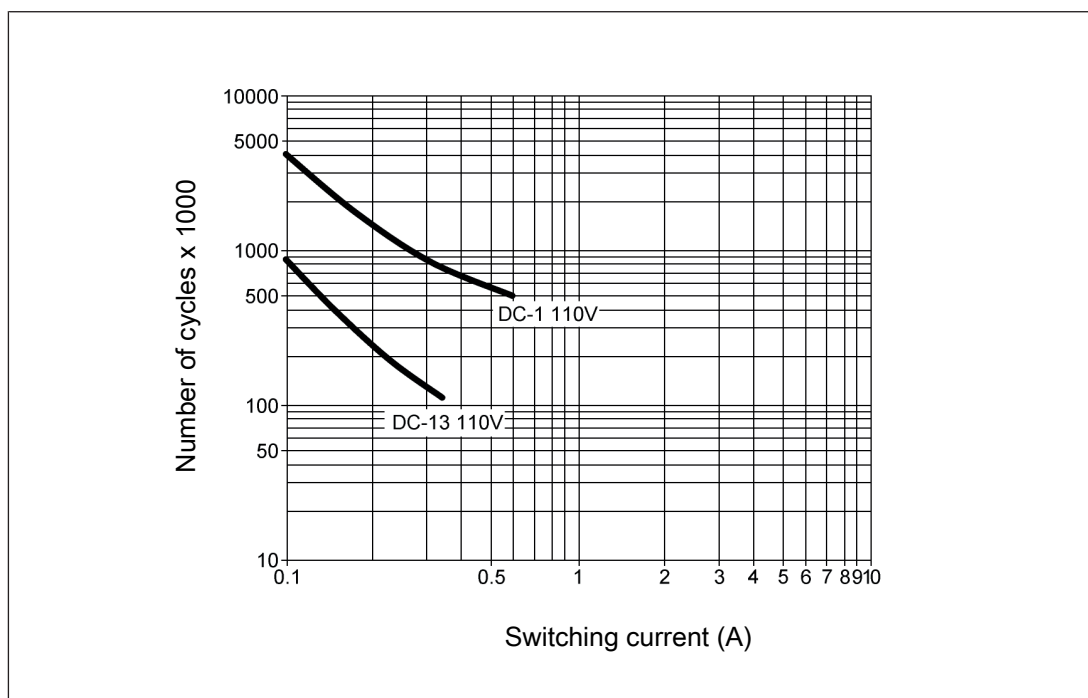


Fig.: Service life graphs at 110 VDC

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

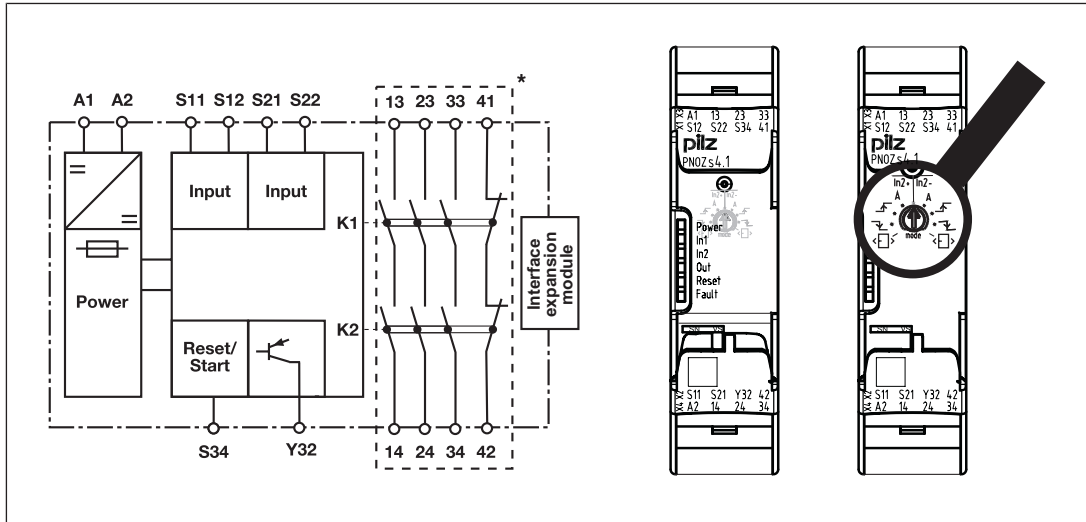


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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

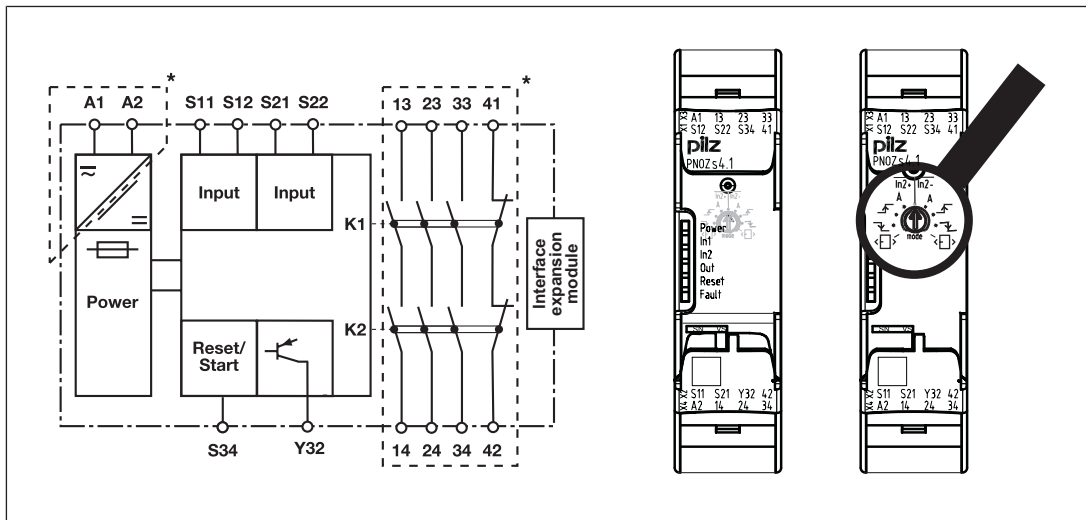


Fig.: Centre: Front view with cover, right: Front view without cover

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

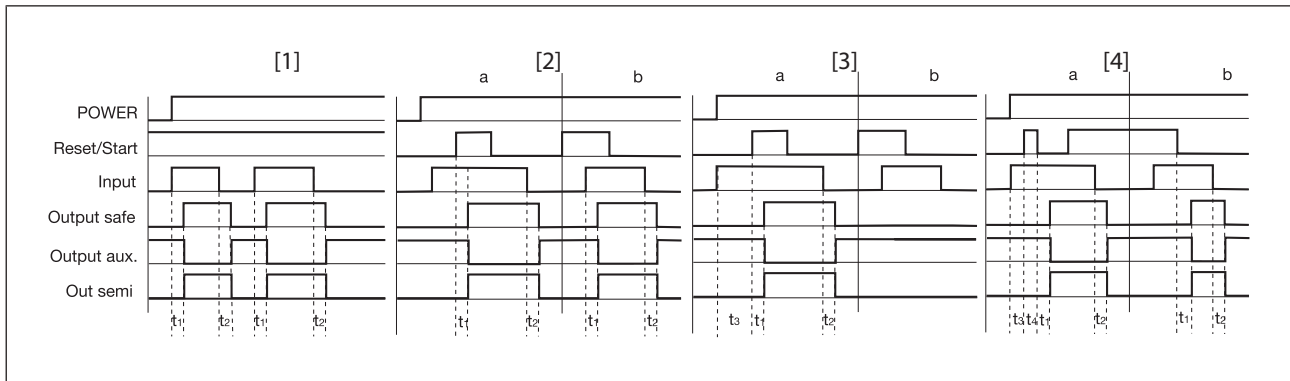
Safety relays PNOZsigma PNOZ s4.1

Function description

- ▶ $\overline{\text{In}2\text{+}}$ 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.
- ▶ $\overline{\text{In}2\text{-}}$ 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.
- ▶ $\overline{\text{In}2\text{-}}$ 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.
- ▶ $\overline{\text{In}2\text{+}}$ 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).
- ▶ $\overline{\text{In}2\text{-}}$ 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:

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

$R_{l\max}$ = 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				

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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 $U_B = 24$ VDC)		

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▶ Start circuit/feedback loop

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/re-start		

▶ 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	

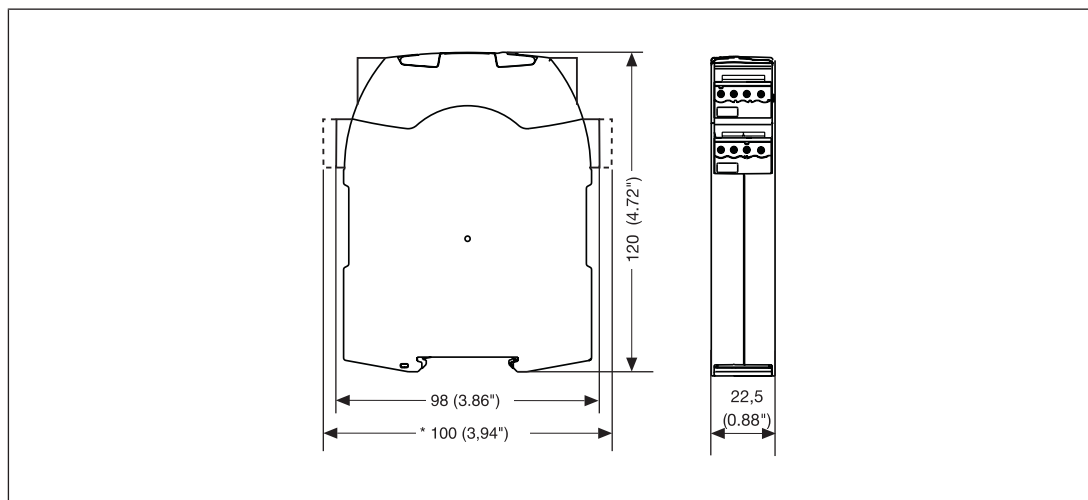
Legend

- ▶ 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 R _{lmax}				
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 I _K	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: 2 4 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: 2 4 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 mm ² , 24 - 12 AWG	0,2 - 2,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
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.

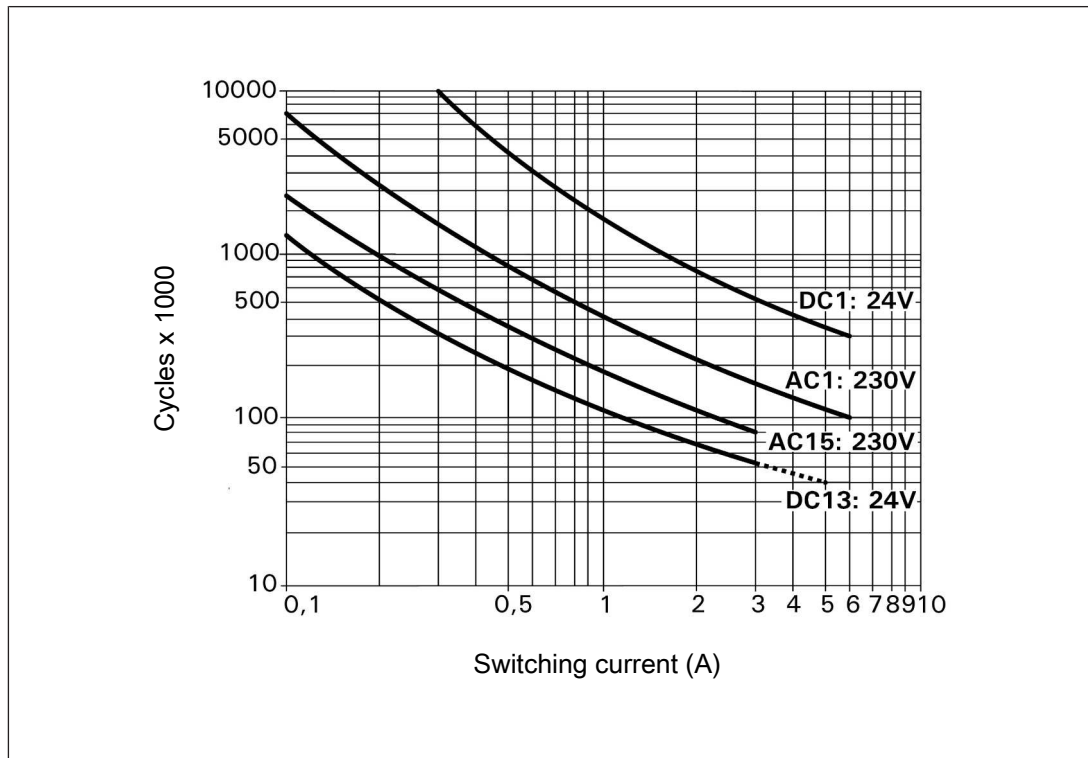


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s4.1

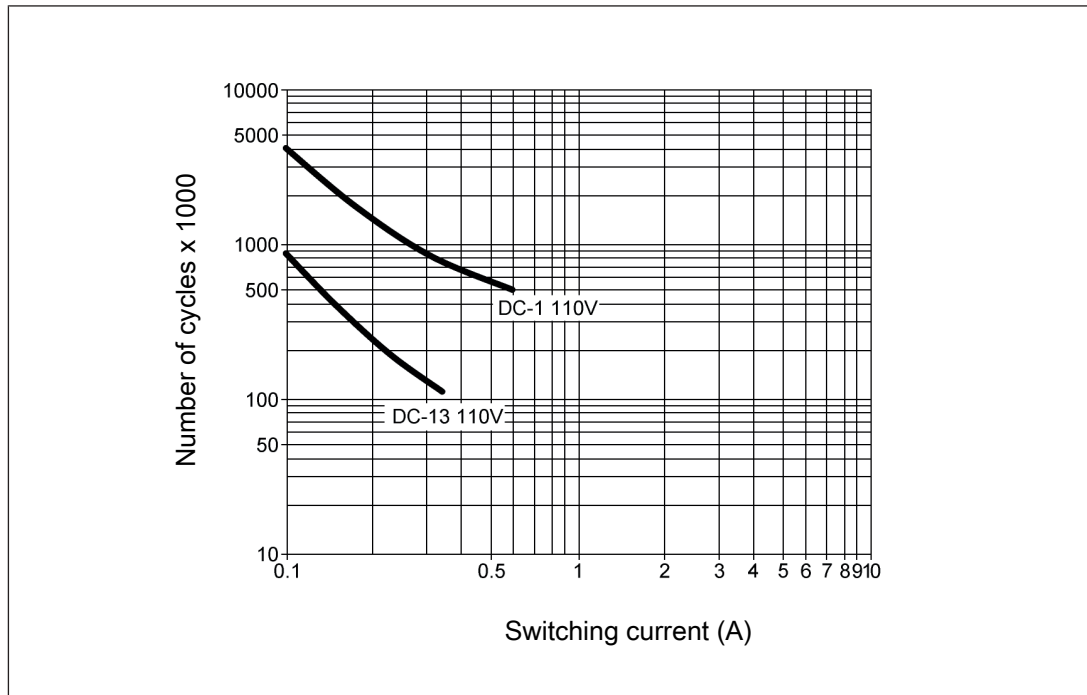


Fig.: Service life graphs at 110 V DC

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

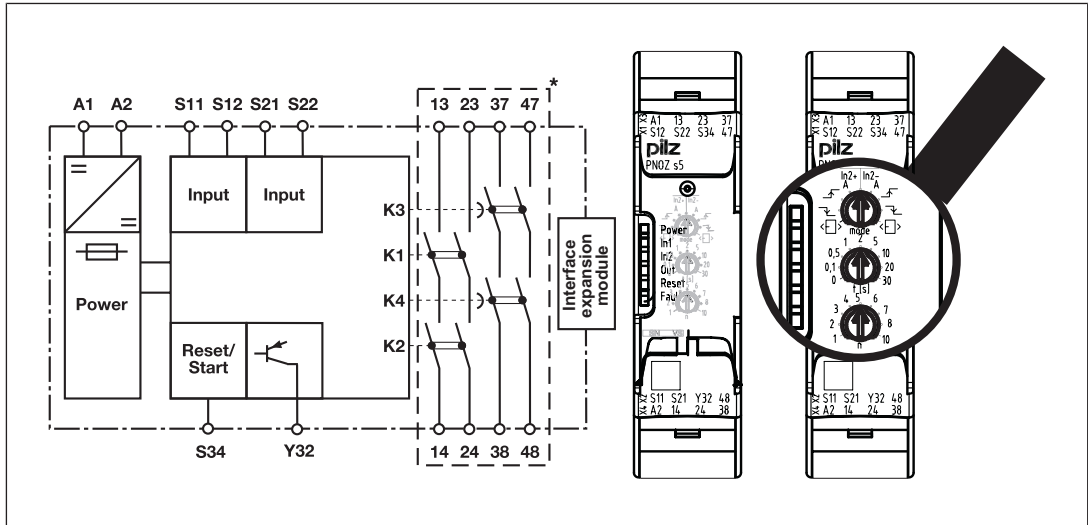


Fig.: Centre: Front view with cover, right: Front view without cover

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

Type: 48 - 240 VAC/DC

- ▶ U_B : 48 – 240 VAC/DC; Order No. 750135, 751135

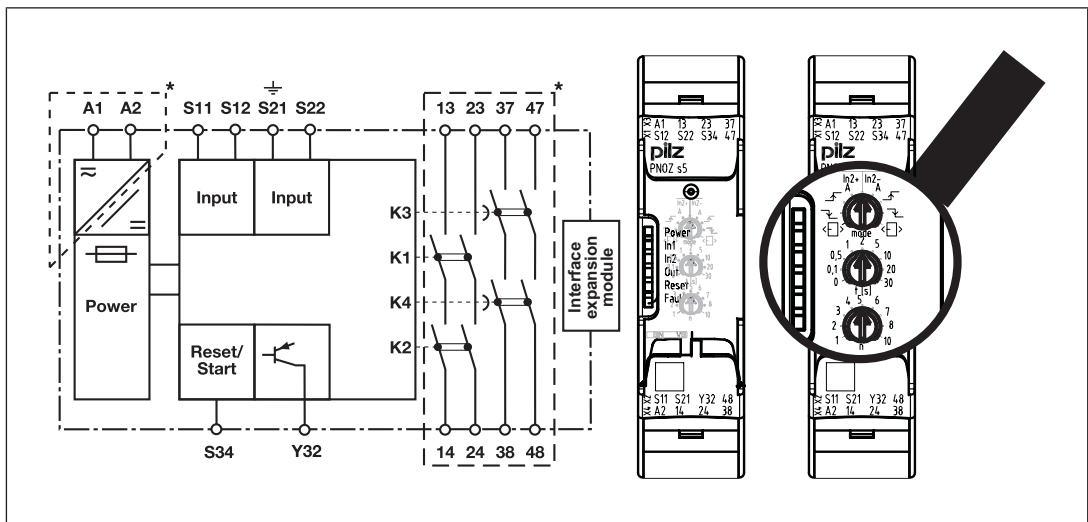


Fig.: Centre: Front view with cover, right: Front view without cover

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

Safety relays PNOZsigma PNOZ s5

Function description

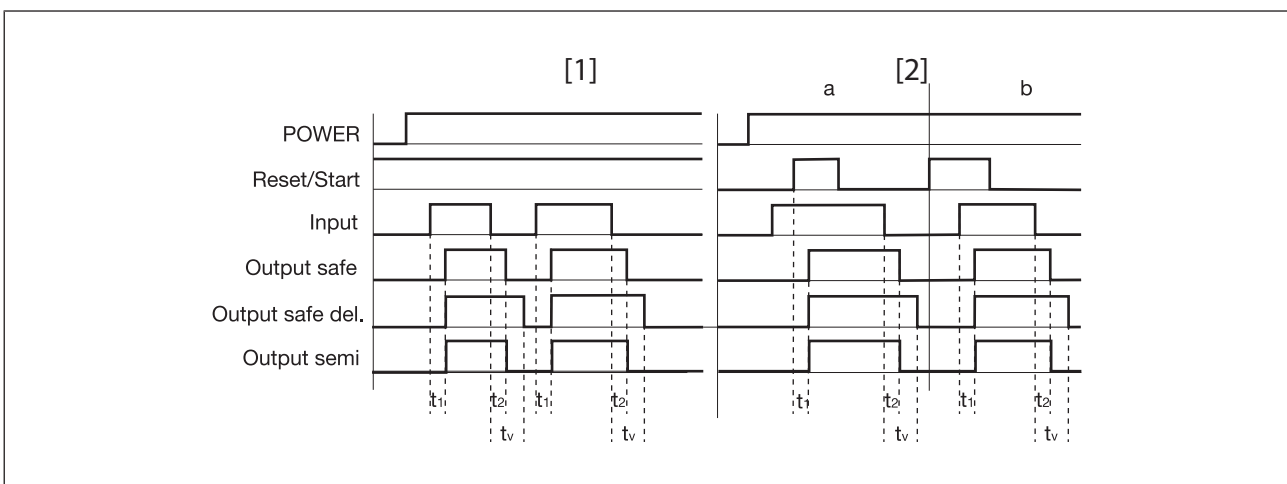
- ▶ $\overline{\text{In}2\text{+}}$ Single-channel operation: no redundancy in the input circuit, earth faults in the start circuit and input circuit are detected.
- ▶ Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ s5
 - earth faults in the start and input circuit,
 - short circuits in the input circuit and, with a monitored start, in the start circuit too.
- ▶ $\overline{\text{In}2\text{-}}$ 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.
- ▶ $\overline{\text{In}2\text{-}}$ 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.
- ▶ $\overline{\text{In}2\text{-}}$ 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).
- ▶ $\overline{\text{In}2\text{-}}$ 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



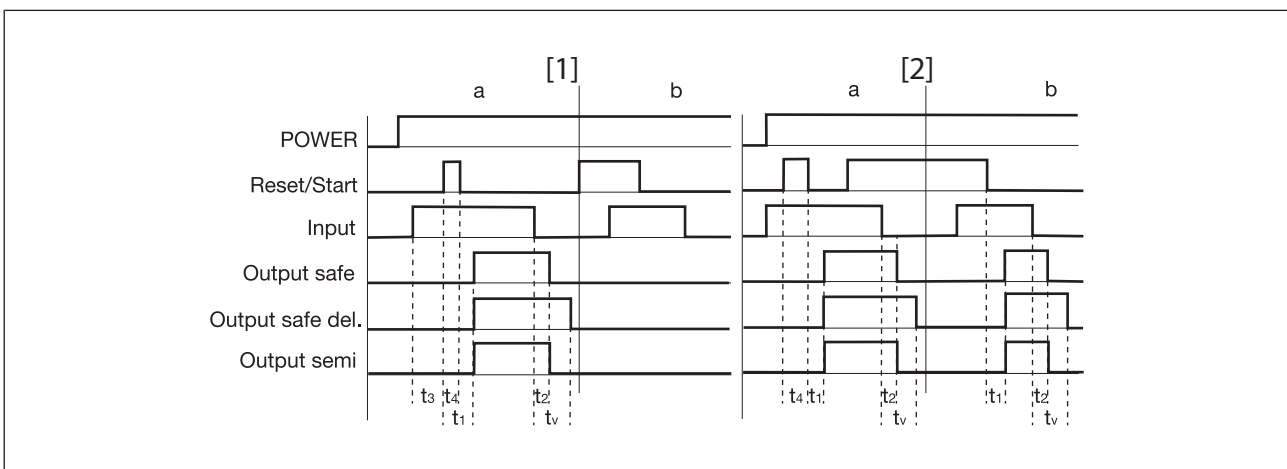
Legend

- ▶ 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

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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

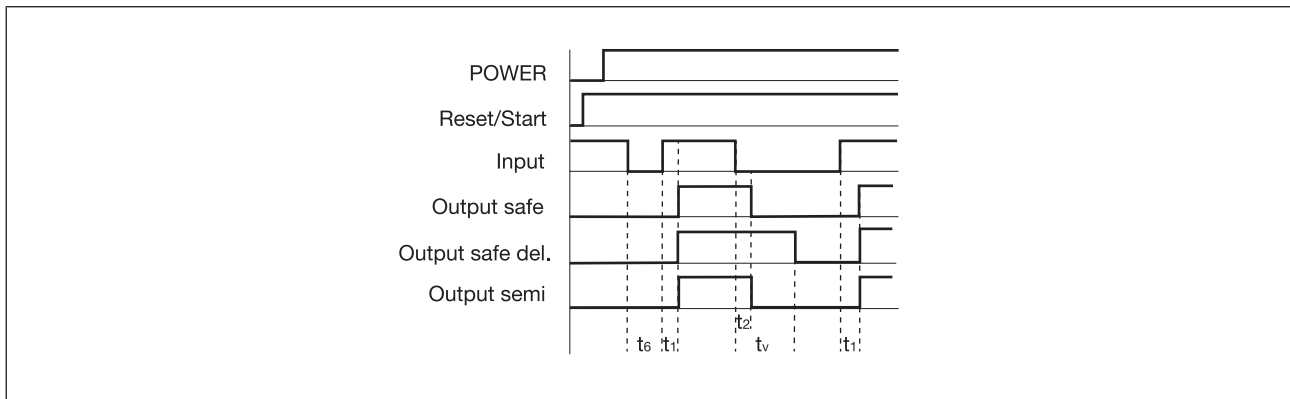


Legend

- ▶ 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:

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

$R_{l_{\max}}$ = 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"

$n \times t[s] = \text{Delay time}$

Example:

$t = 4 \text{ s}, n = 5$

Delay time = $5 \times 4 = 20 \text{ s}$

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		

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Input circuit	Single-channel	Dual-channel
Light beam device or safety switch, detection of shorts across contacts via ESPE (only on unit types with $U_B = 24$ 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

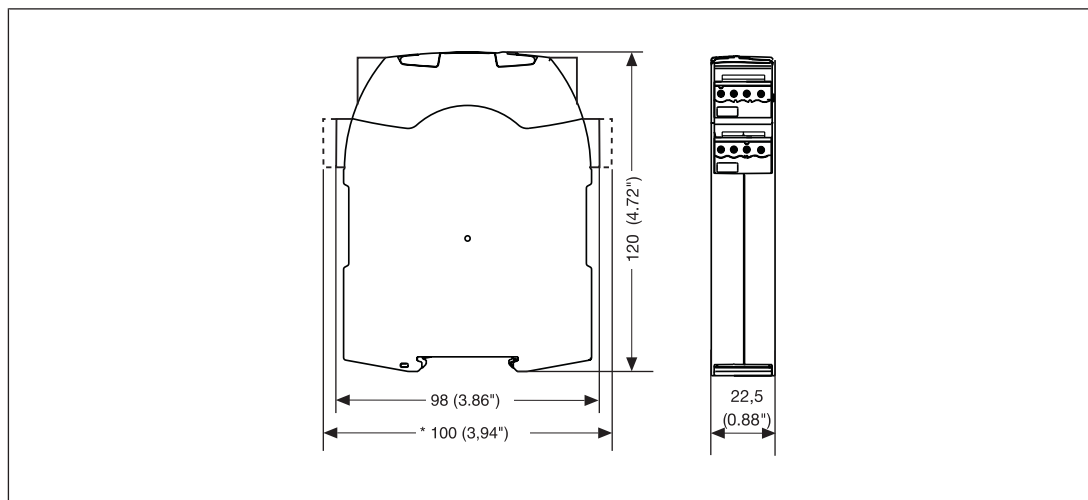
- ▶ S1/S2: E-STOP/safety gate switch
- ▶ S3: Reset button
- ▶ ↑↑: Switch operated
- ▶ : Gate open

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▶  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 R _{lmax}			
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
I _{th} 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 t_v	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	$t_v + 15 \% + 20 \text{ ms}$	$t_v + 15 \% + 20 \text{ ms}$	$t_v + 15 \% + 20 \text{ ms}$
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 mm ² , 24 - 12 AWG	0,2 - 2,5 mm ² , 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 RI-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		
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA
Relay outputs		
Number of output contacts		
Safety contacts (N/O), instantaneous	2	2
Safety contacts (N/O), delayed	2	2
Max. short circuit current I _K	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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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.

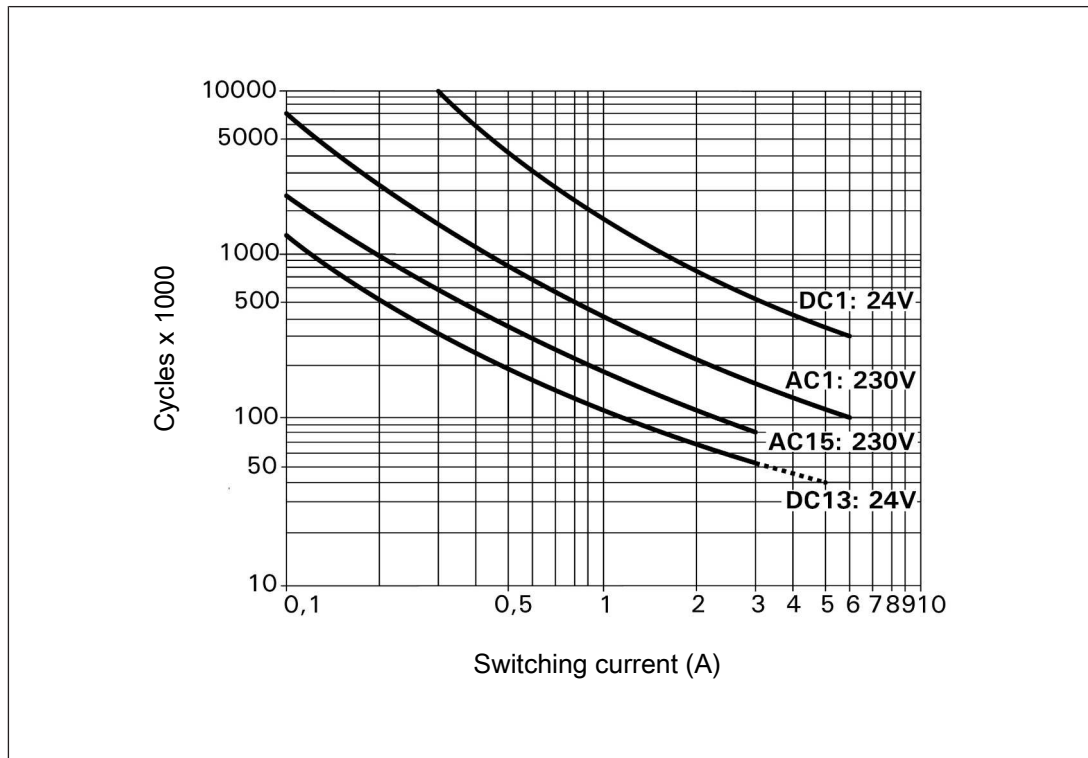


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s5

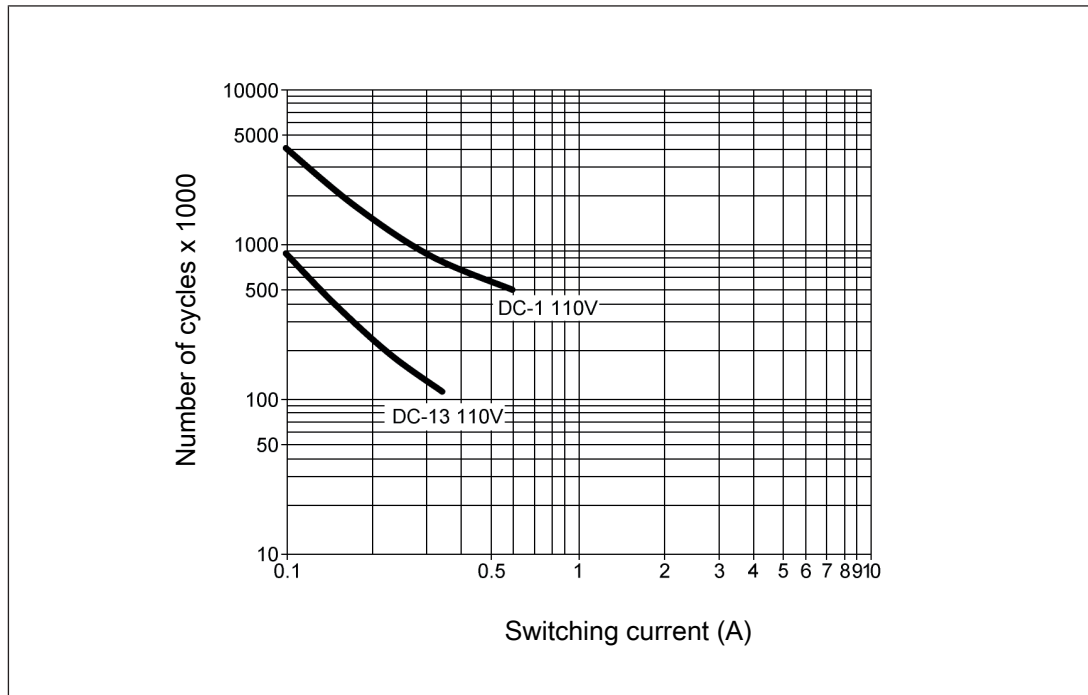


Fig.: Service life graphs at 110 V DC

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

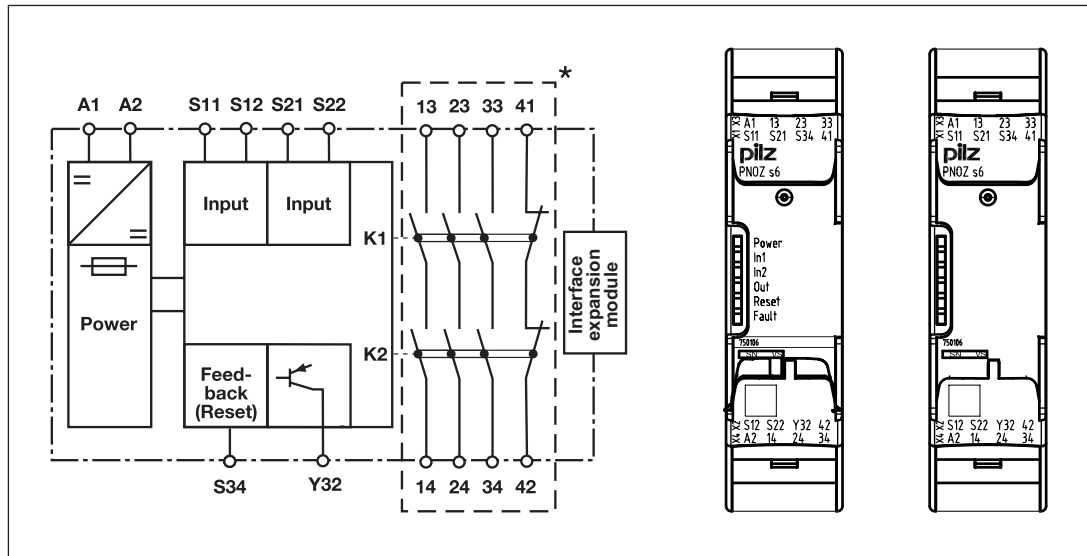


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage 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

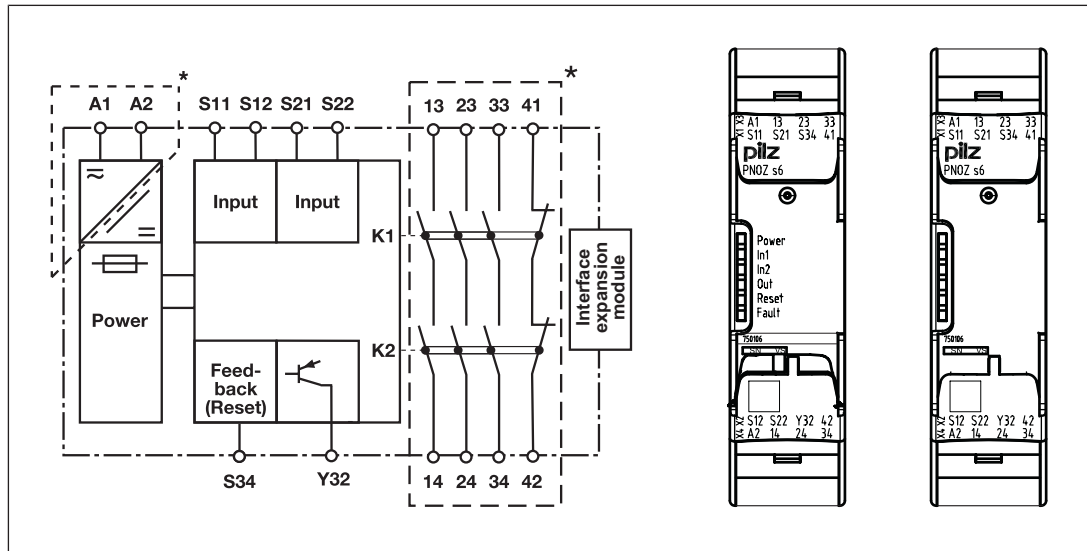


Fig.: Centre: Front view with cover, right: Front view without cover

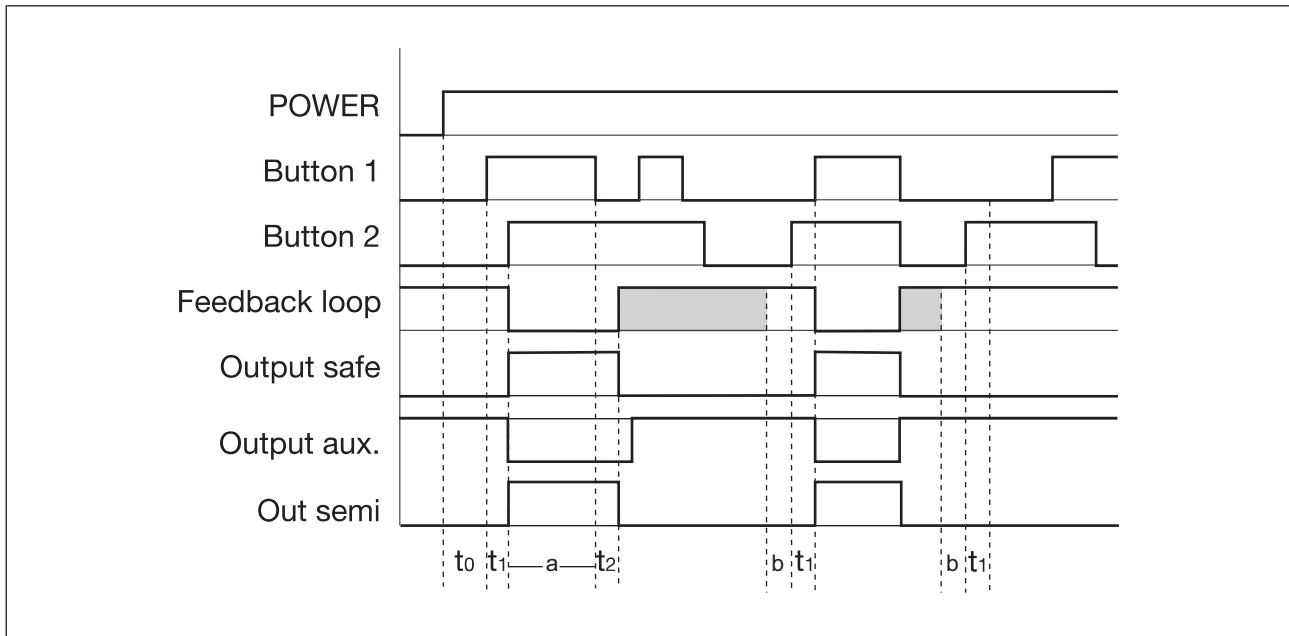
*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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.

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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 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:

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

$R_{l_{\max}}$ = 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		

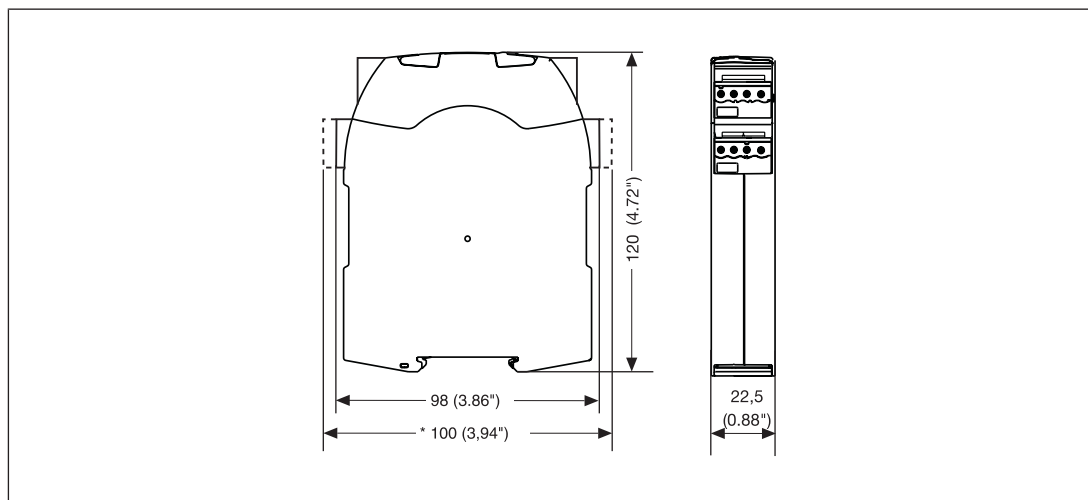
Legend

- ▶ 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 RI-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 I _K	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 A ² s	66 A ² s
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 A ² s	66 A ² s
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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI- 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 I _K	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 A ² s	66 A ² s
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 A ² s	66 A ² s
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

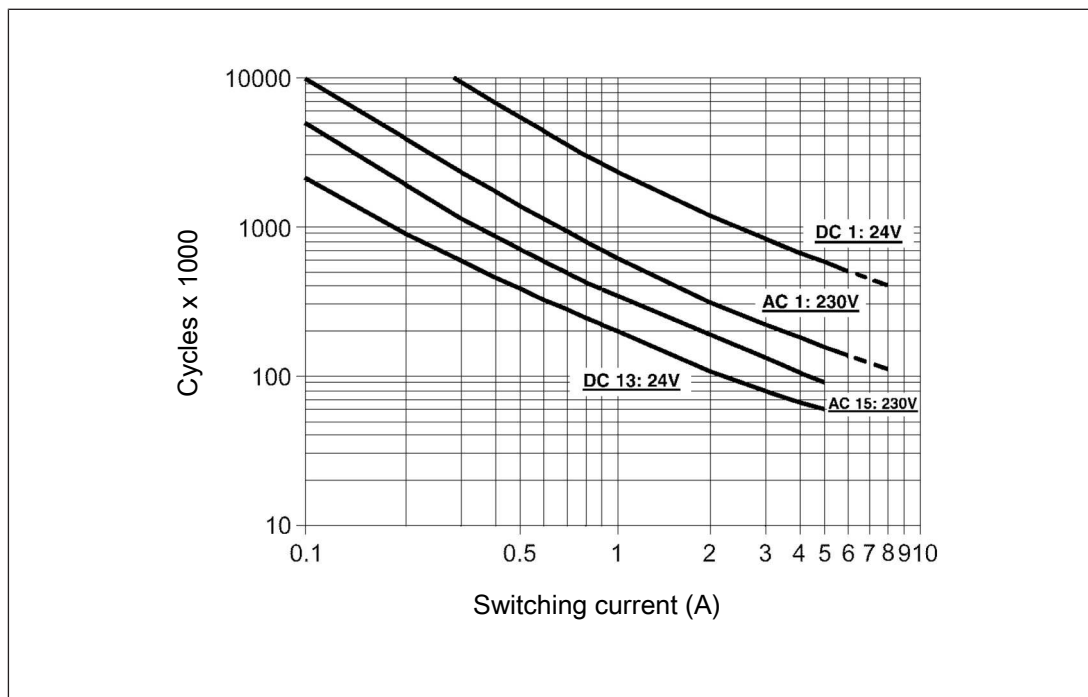


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma PNOZ s6

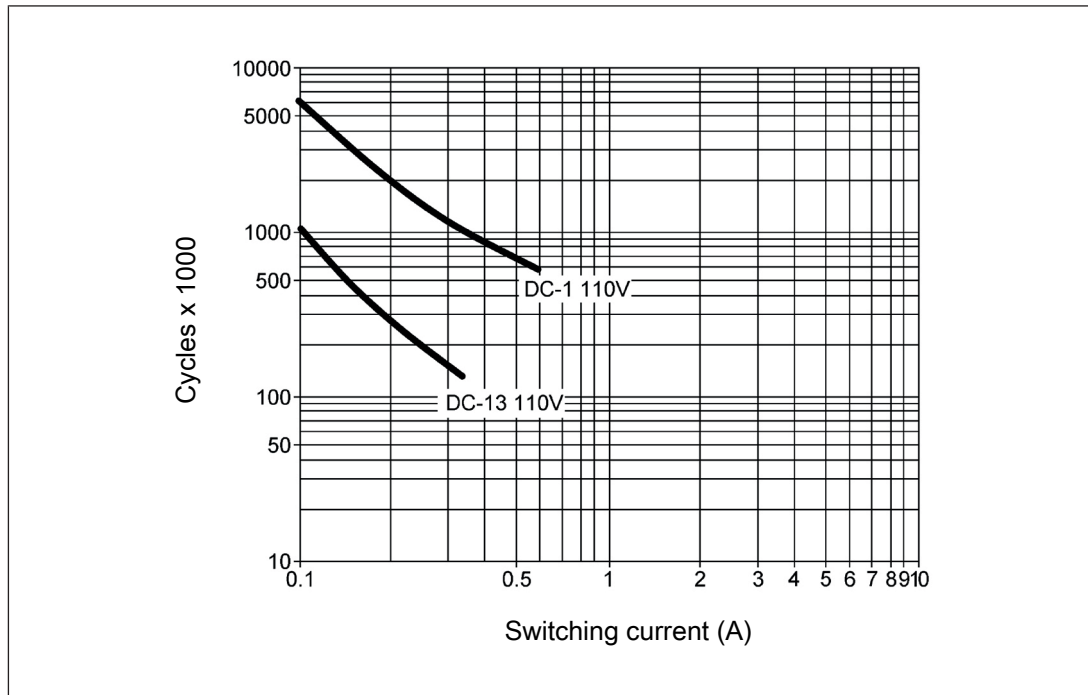


Fig.: Service life graphs at 110 VDC

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

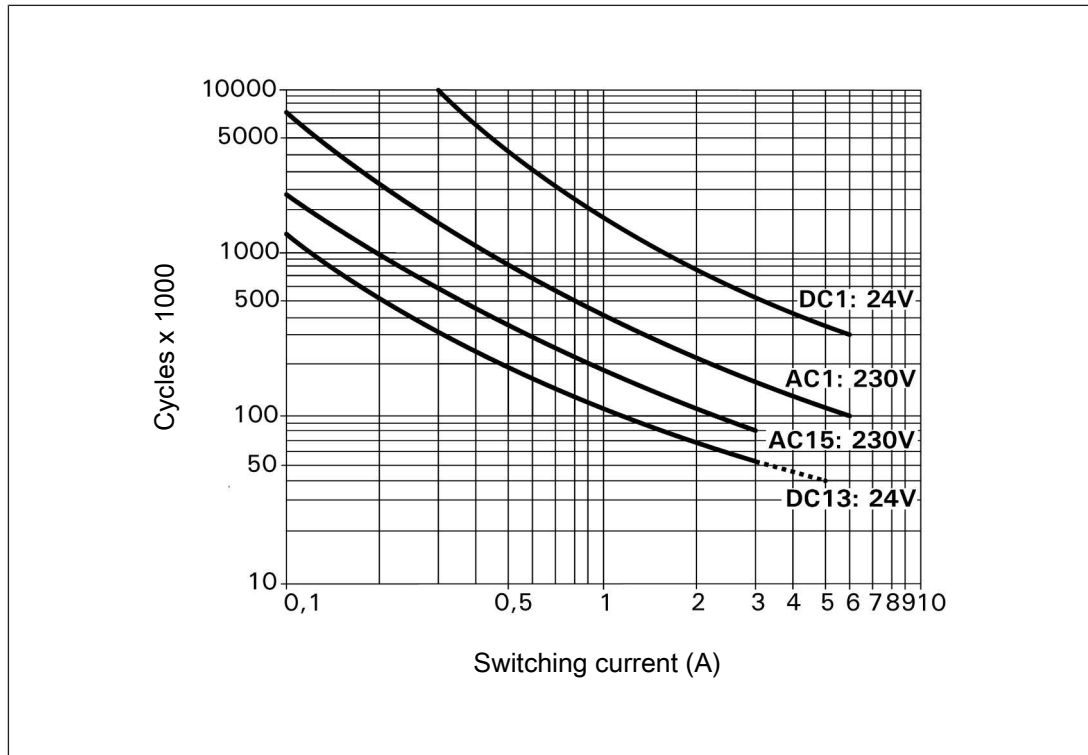


Fig.: Service life graphs at 24 VDC and 230 VAC

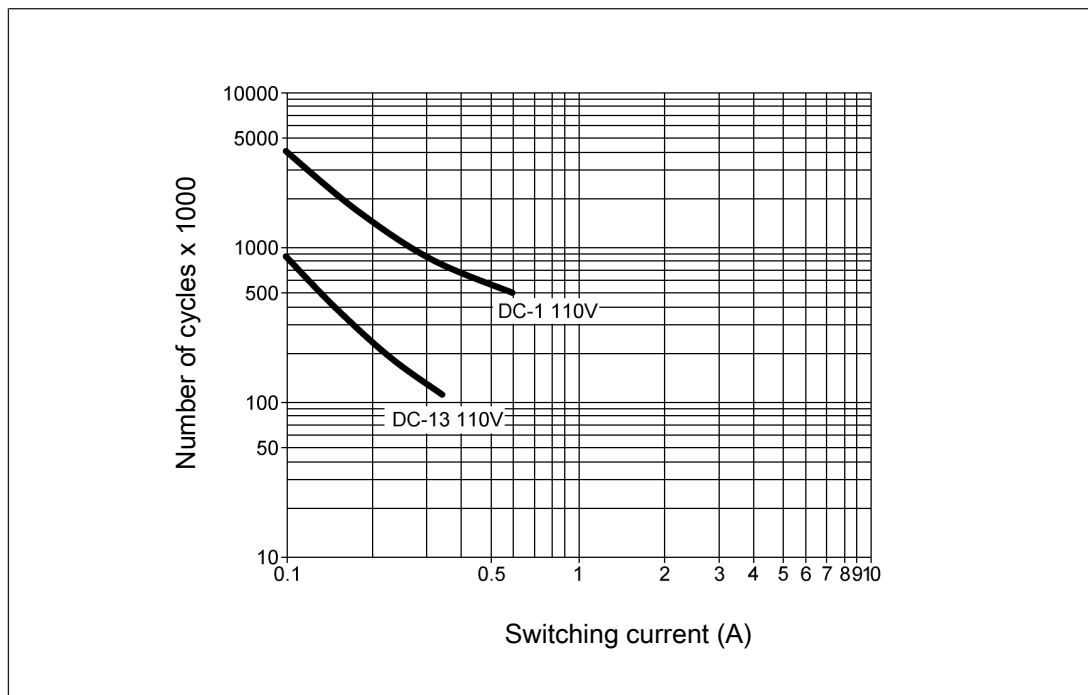


Fig.: Service life graphs at 110 VDC

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

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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

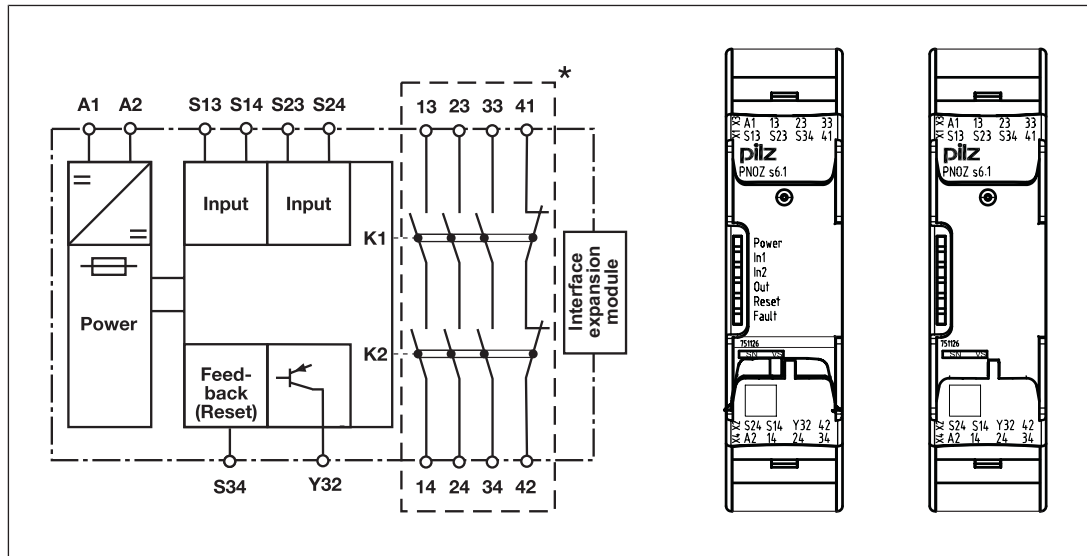


Fig.: Centre: Front view with cover, right: Front view without cover

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

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Unit types with UB 48 - 240 VAC/DC

- ▶ U_B : 48 - 240 VAC/DC; Order no. 750156, 751156

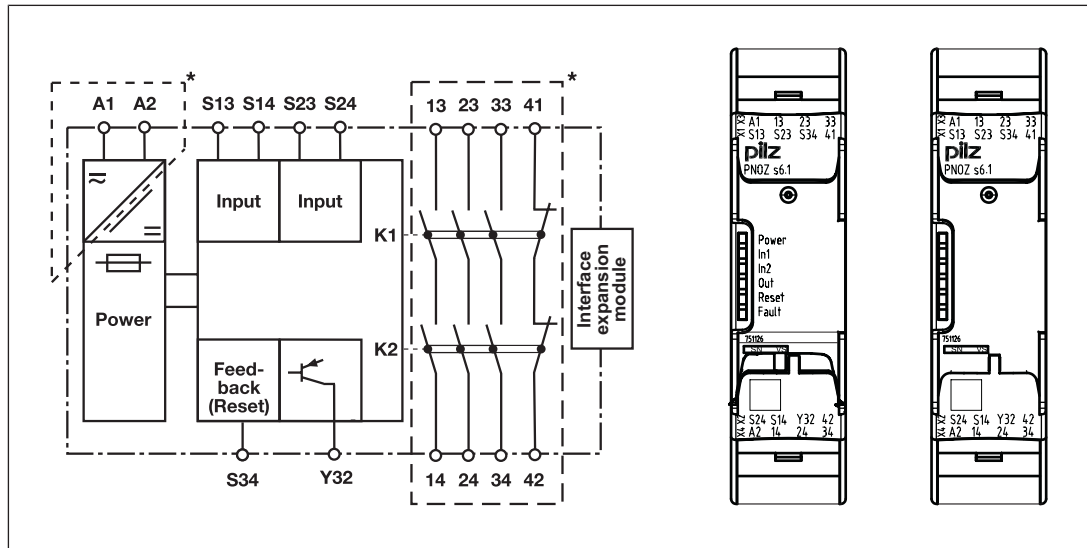


Fig.: Centre: Front view with cover, right: Front view without cover

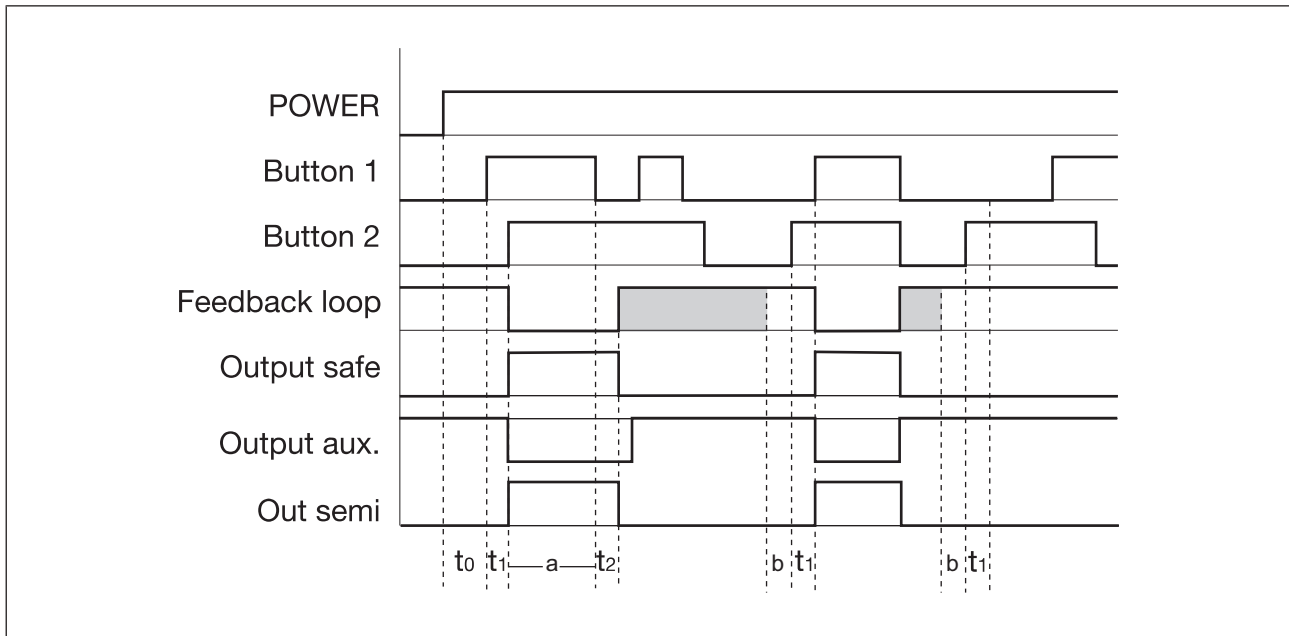
*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

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.

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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 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:

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

$R_{l_{\max}}$ = 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		

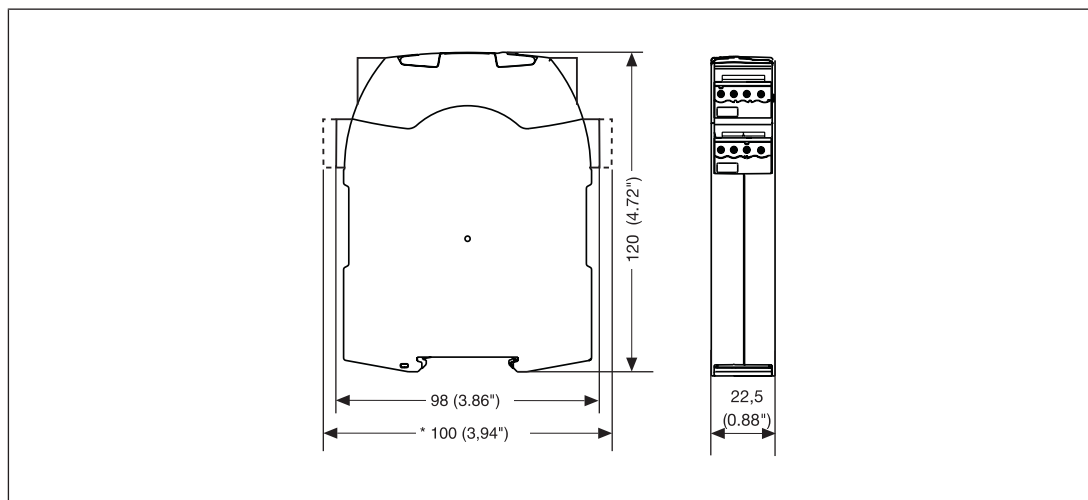
Legend

- ▶ 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 RI-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 I _K	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 A ² s	66 A ² s
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 A ² s	66 A ² s
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
I _{th} 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
I _{th} 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 mm ² , 24 - 12 AWG	0,25 - 2,5 mm ² , 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	0,25 - 1 mm ² , 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 24 - 16 AWG	0,2 - 1,5 mm ² , 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 RI- 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

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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 I _K	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 A ² s	66 A ² s
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 A ² s	66 A ² s
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
I _{th} 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

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Conventional thermal current while loading several contacts	751126	751156
I _{th} 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

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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.

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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.

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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

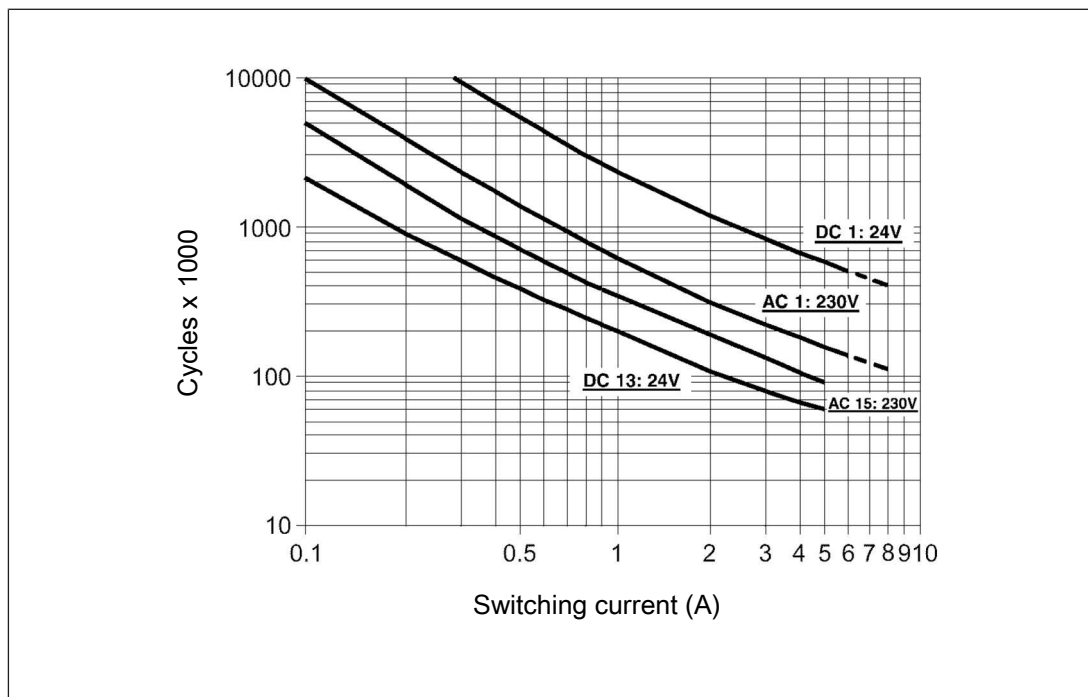


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma PNOZ s6.1

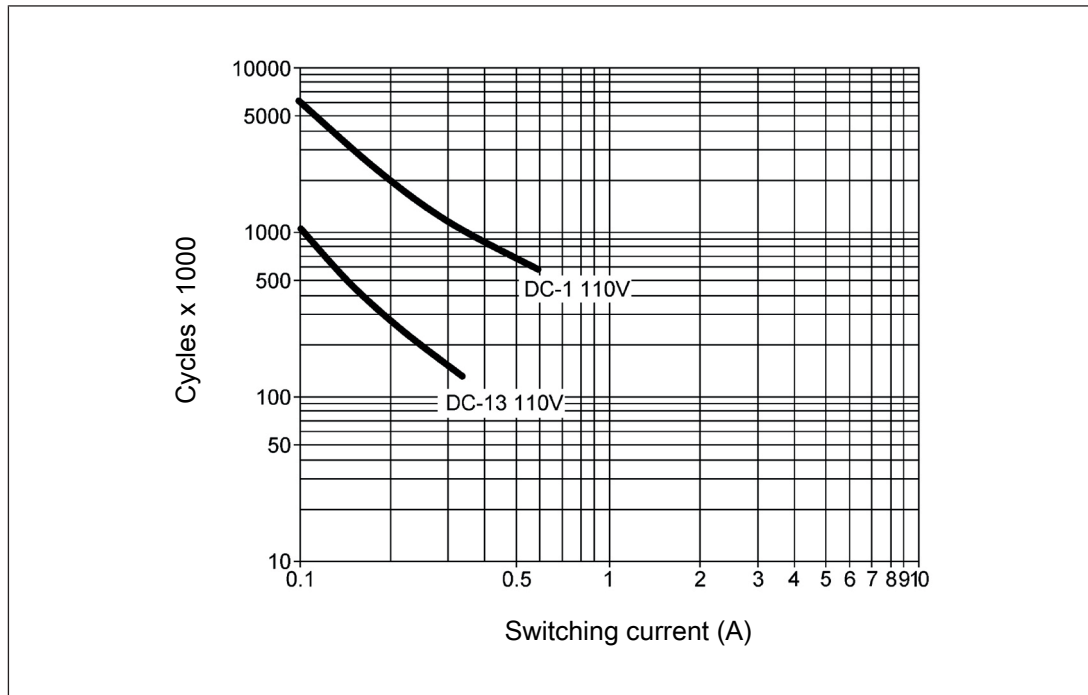


Fig.: Service life graphs at 110 VDC

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

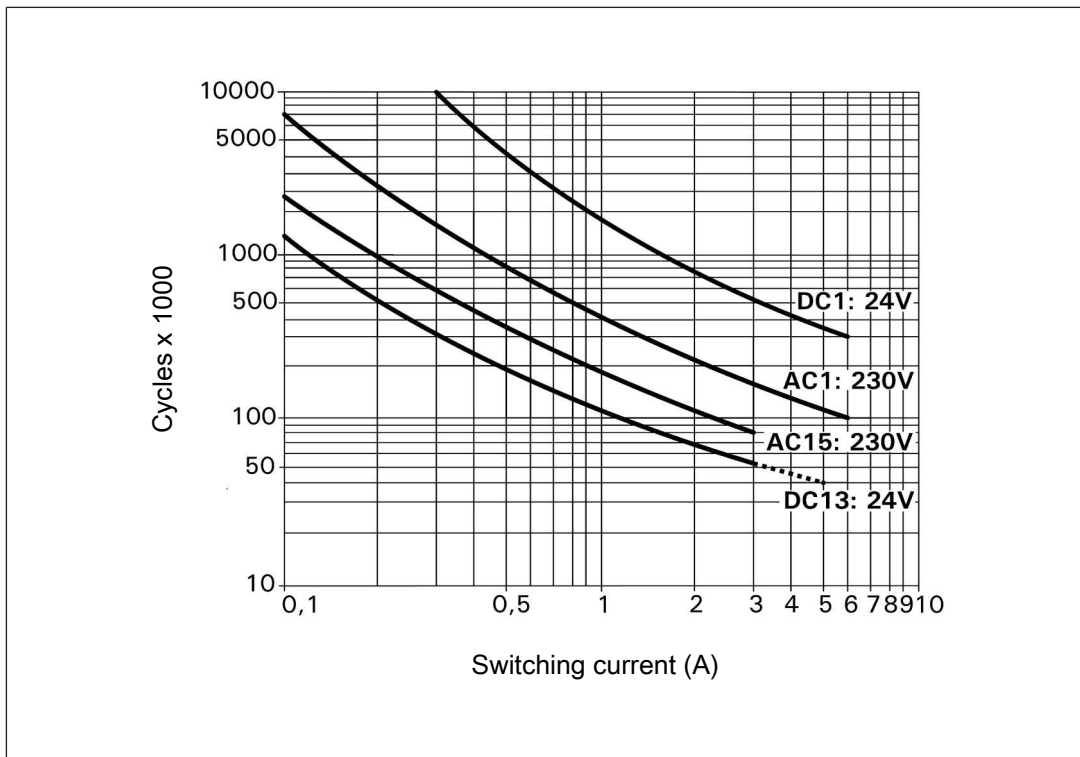


Fig.: Service life graphs at 24 VDC and 230 VAC

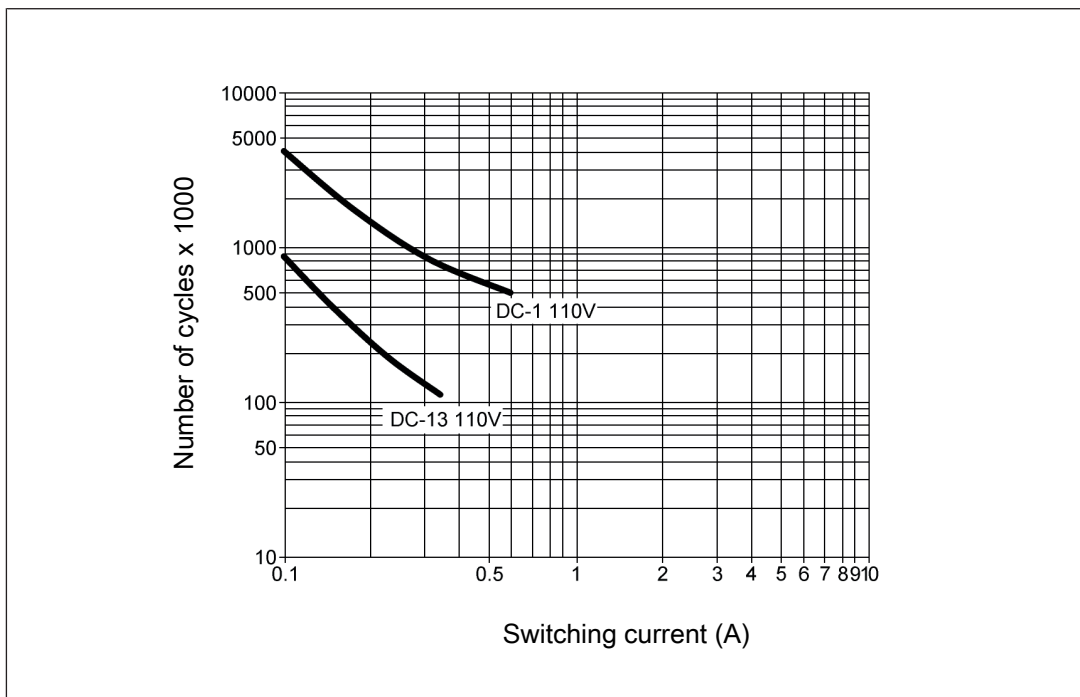


Fig.: Service life graphs at 110 VDC

Safety relays PNOZsigma PNOZ s6.1

Example

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

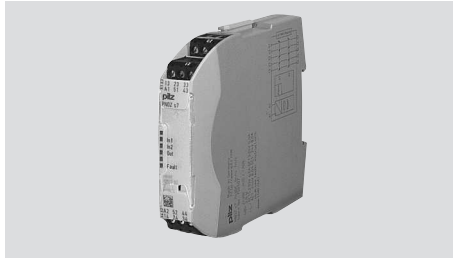
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see [Technical details \[688\]](#)) can be used in the calculation.

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

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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

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Block diagram/terminal configuration

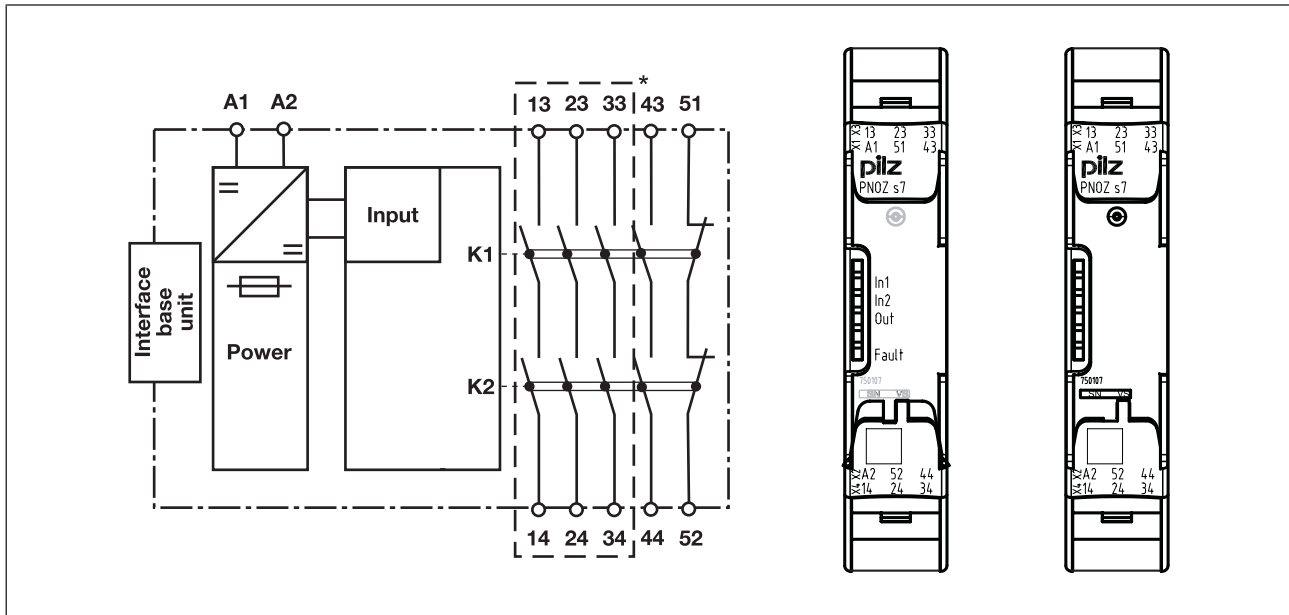


Fig.: Centre: Front view with cover, right: Front view without cover

*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:

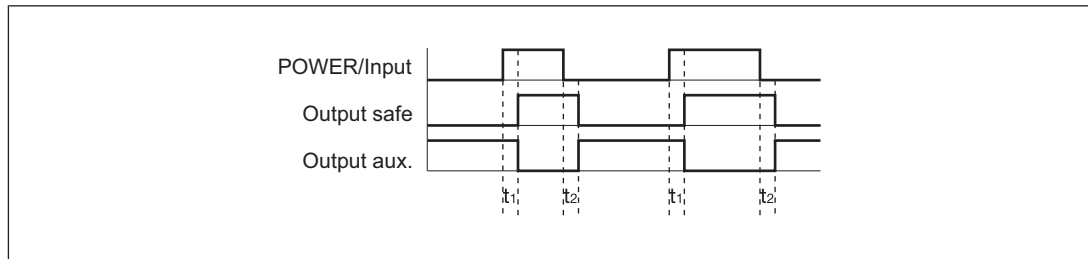
- ▶ Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- ▶ Single-channel operation: one input circuit affects the output relays

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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.

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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

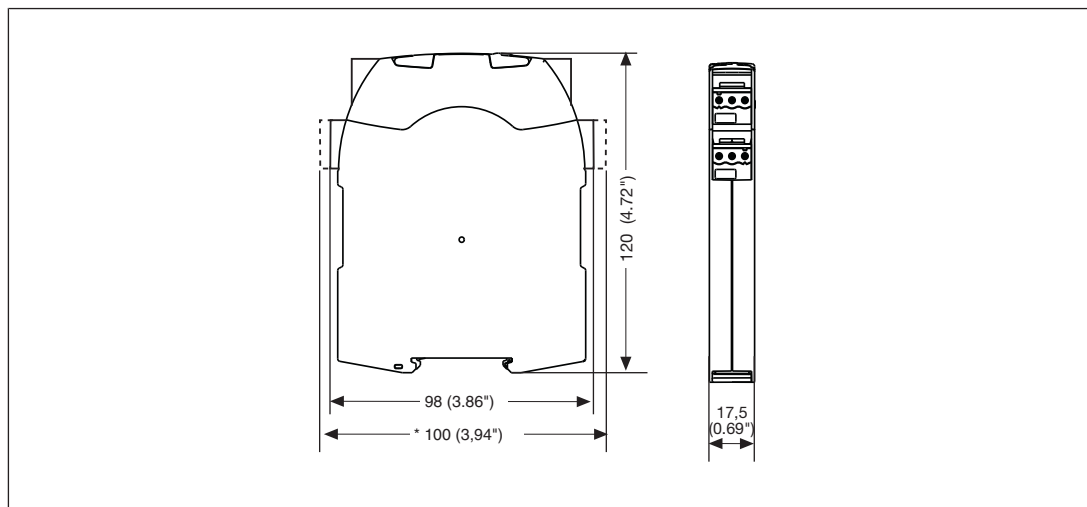
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

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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 R _{lmax}			
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 I _K	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
I _{th} 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

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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

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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 mm ² , 24 - 12 AWG	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 24 - 12 AWG	0,2 - 2,5 mm ² , 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.

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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.

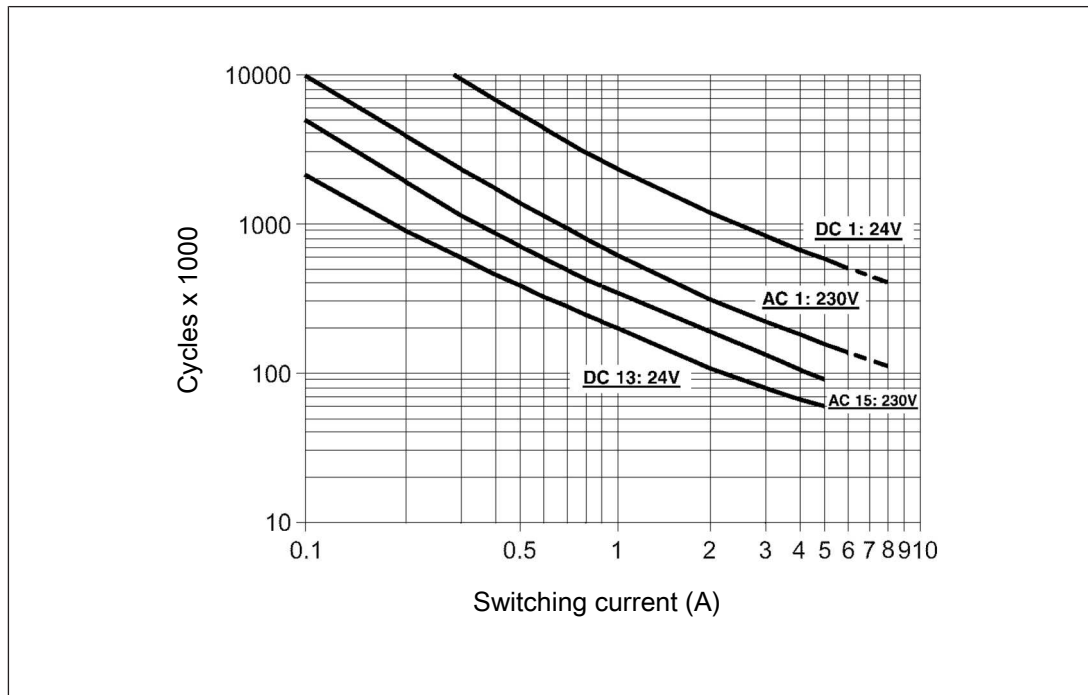


Fig.: Service life graphs at 24 V DC and 230 V AC

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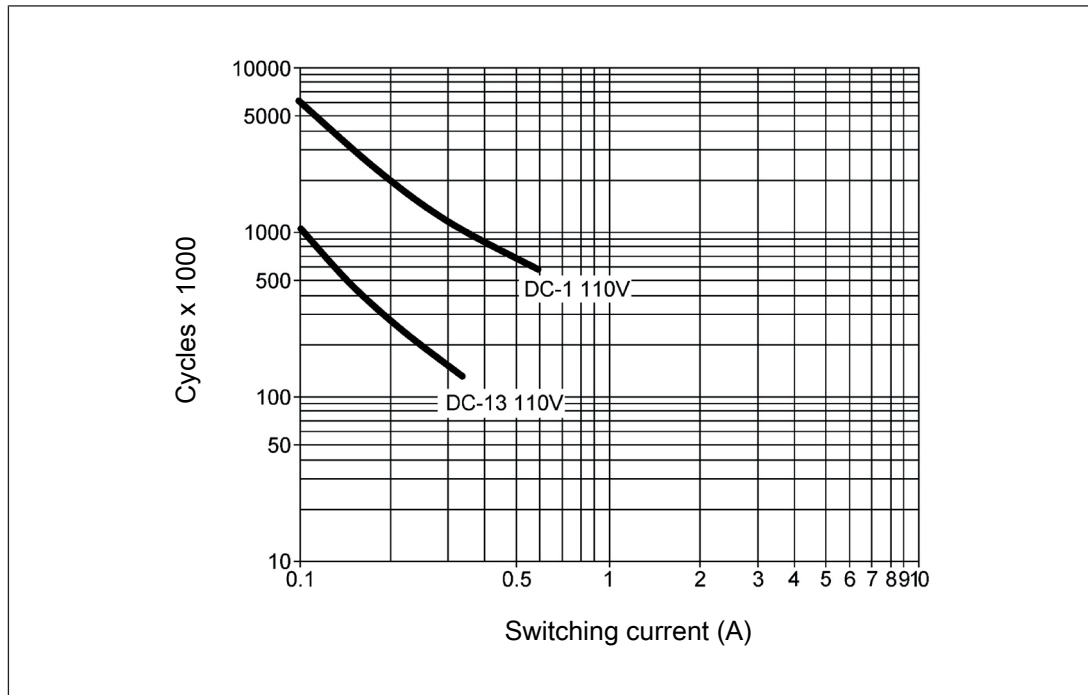


Fig.: Service life graphs at 110 V DC

Example

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

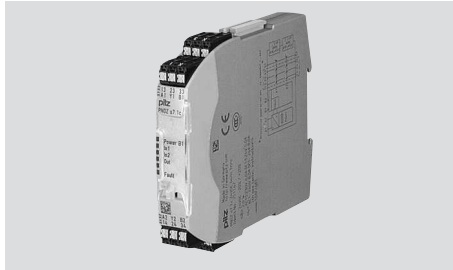
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see [Technical details \[708\]](#)) can be used in the calculation.

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

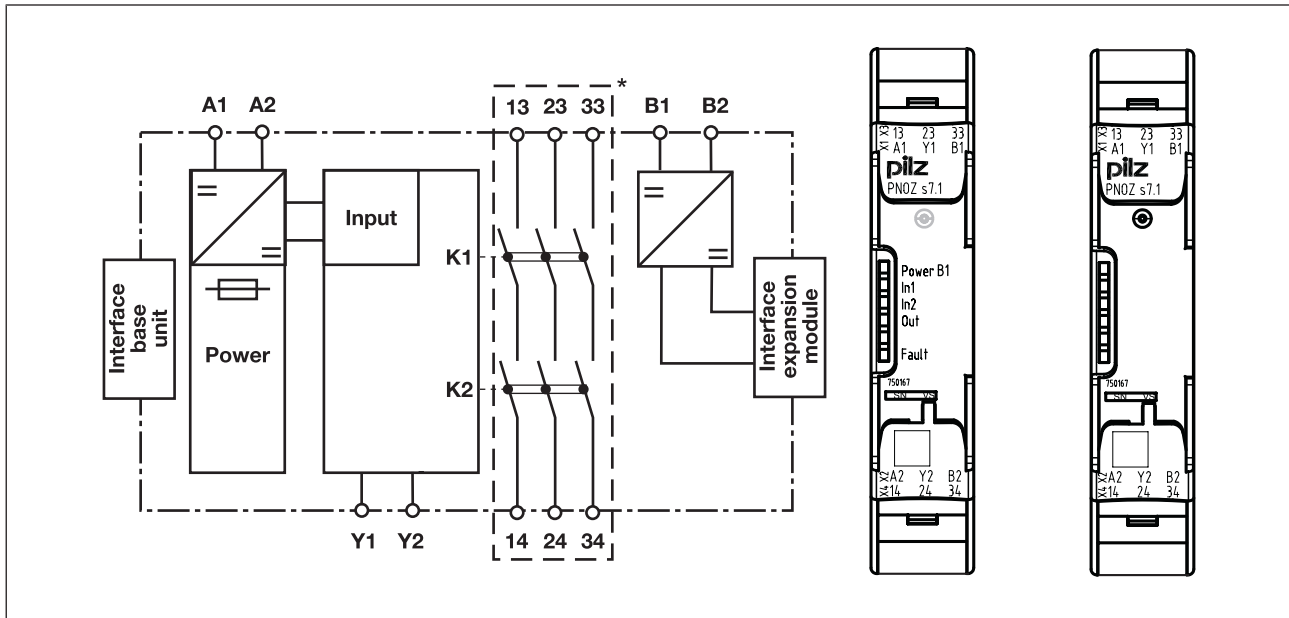


Fig.: Centre: Front view with cover, right: Front view without cover

*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:

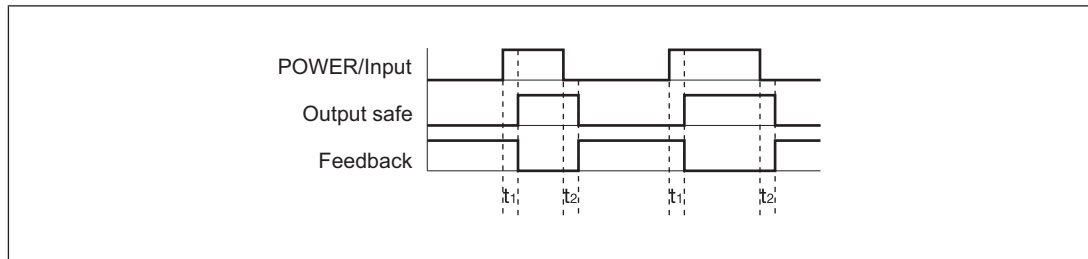
- ▶ Single-channel operation: one input circuit affects the output relays
- ▶ Connection for base unit

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

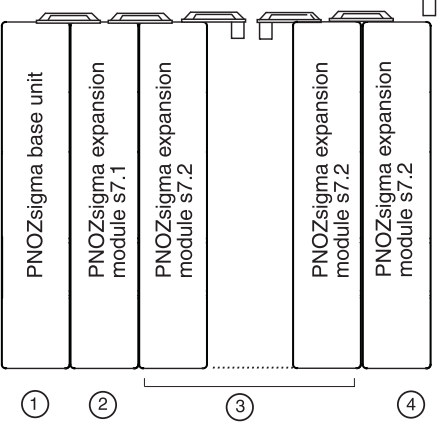
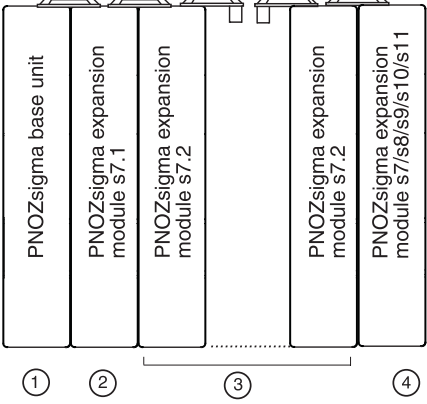
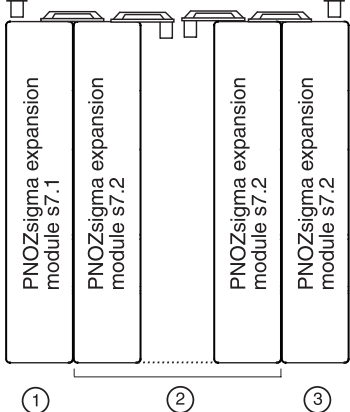
- ▶ Connect the contact expansion modules using the connector supplied.

Control cabinet installation

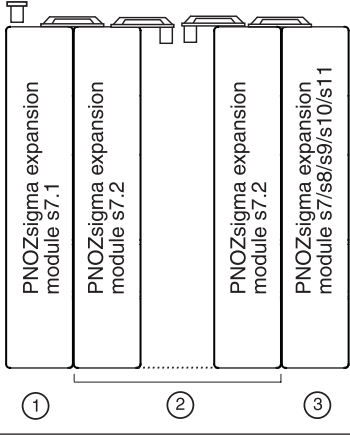
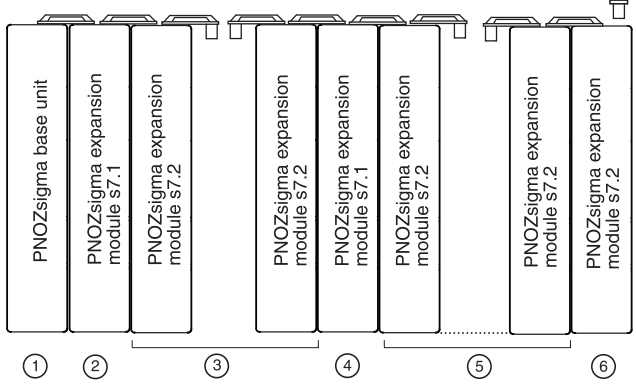
- ▶ The safety relay should be installed in a control cabinet with a protection type of at least IP54.
- ▶ Use the notch on the rear of the unit to attach it to a DIN rail (35 mm).
- ▶ When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).

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).
<p>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</p>	 <p>The diagram shows a vertical stack of four modules. Module 1 is the 'PNOZsigma base unit'. Module 2 is 'PNOZsigma expansion module s7.1'. Module 3 is 'PNOZsigma expansion module s7.2'. Module 4 is 'PNOZsigma expansion module s7.2'. A bracket groups modules 2, 3, and 4 under the label ③. A terminator symbol is shown on the right side of module 4.</p>
<p>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</p>	 <p>The diagram shows a vertical stack of five modules. Module 1 is the 'PNOZsigma base unit'. Module 2 is 'PNOZsigma expansion module s7.1'. Module 3 is 'PNOZsigma expansion module s7.2'. Module 4 is 'PNOZsigma expansion module s7.2'. Module 5 is 'PNOZsigma expansion module s7/s8/s9/s10/s11'. A bracket groups modules 2, 3, and 4 under the label ③. A terminator symbol is shown on the right side of module 5.</p>
<p>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</p>	 <p>The diagram shows a vertical stack of four modules. Module 1 is 'PNOZsigma expansion module s7.1'. Module 2 is 'PNOZsigma expansion module s7.2'. Module 3 is 'PNOZsigma expansion module s7.2'. Module 4 is 'PNOZsigma expansion module s7.2'. A bracket groups modules 1, 2, and 3 under the label ②. Terminator symbols are shown on the right side of modules 1 and 3.</p>

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).
<p>①: Contact expansion module PNOZ s7.1 with terminator</p> <p>②: Contact expansion module PNOZ s7.2</p> <p>③: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator</p>	
<p>①: Base unit</p> <p>②: Contact expansion module PNOZ s7.1</p> <p>③: Contact expansion module PNOZ s7.2</p> <p>④: Contact expansion module PNOZ s7.1</p> <p>⑤: Contact expansion module PNOZ s7.2</p> <p>⑥: Contact expansion module PNOZ s7.2 with terminator</p>	

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 I_{max} in the input circuit:

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

$R_{I_{max}}$ = 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

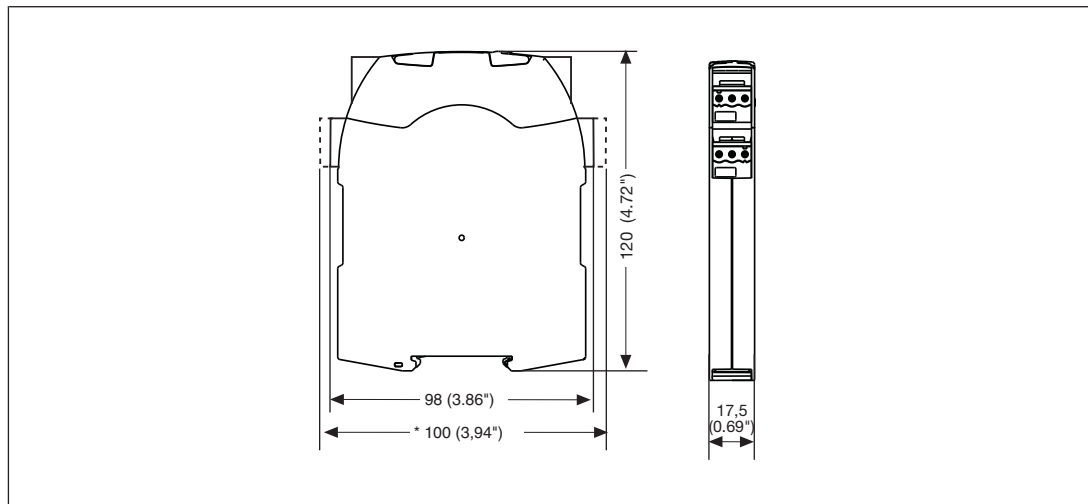
Supply voltage	AC	DC
Base unit: Safety relay PNOZsigma		
Base unit: Safety relay PNOZ X		
Supply voltage for expansion modules PNOZsigma		
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZsigma		
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog driven via semiconductor 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 RI-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 I _K	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 A ² s	260 A ² s
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]
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Safety contacts, instantaneous

PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20
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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.

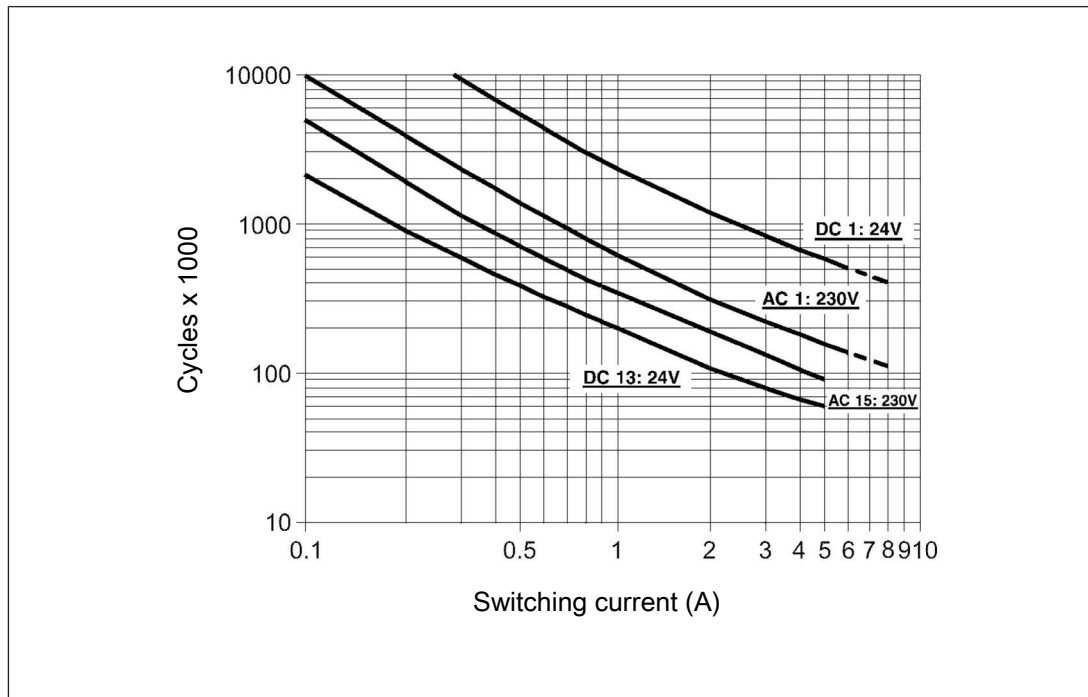


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s7.1

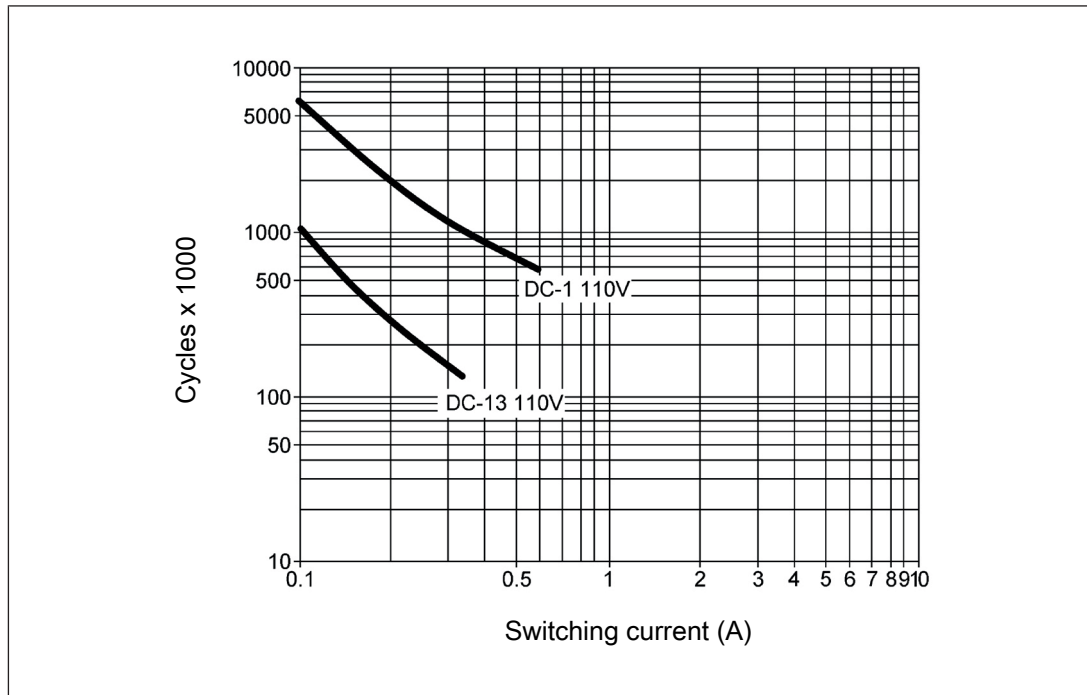


Fig.: Service life graphs at 110 V DC

Example

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

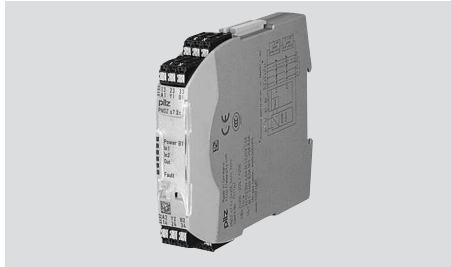
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see [Technical details \[723\]](#)) can be used in the calculation.

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

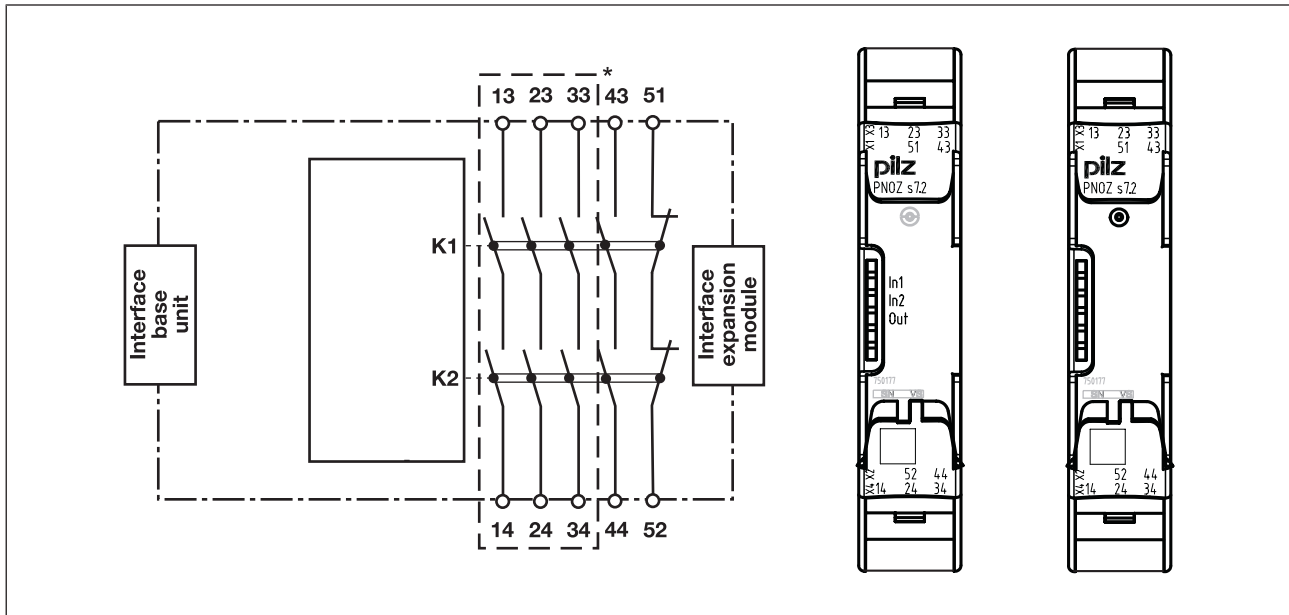


Fig.: Centre: Front view with cover, right: Front view without cover

*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

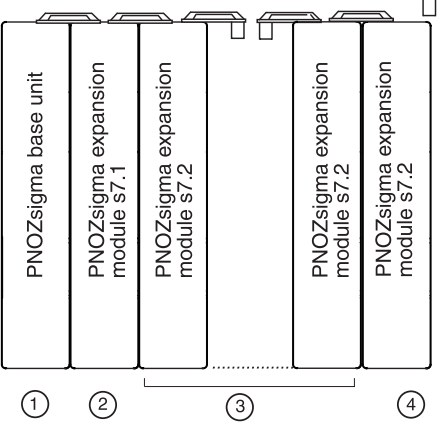
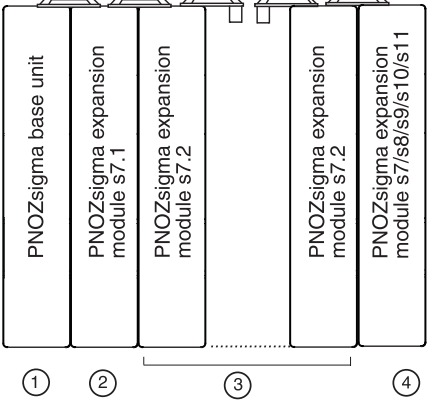
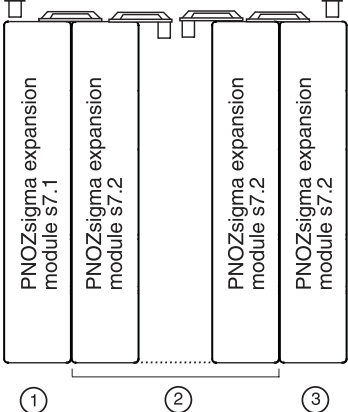
- ▶ Connect the contact expansion modules using the connector supplied.

Control cabinet installation

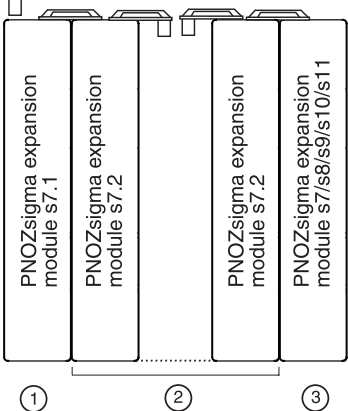
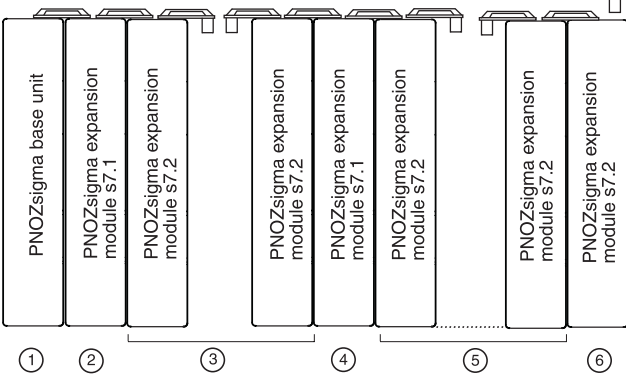
- ▶ The safety relay should be installed in a control cabinet with a protection type of at least IP54.
- ▶ Use the notch on the rear of the unit to attach it to a DIN rail.
- ▶ Ensure the unit is mounted securely on a vertical DIN rail (35 mm) by using a fixing element (e.g. retaining bracket or an end 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).
<p>①: Base unit</p> <p>②: Contact expansion module PNOZ s7.1</p> <p>③: Contact expansion module PNOZ s7.2</p> <p>④: Contact expansion module PNOZ s7.2 with terminator</p>	 <p>The diagram shows a vertical stack of modules. From left to right: 1. PNOZsigma base unit (labeled ①), 2. PNOZsigma expansion module s7.1 (labeled ②), 3. PNOZsigma expansion module s7.2 (labeled ③), 4. PNOZsigma expansion module s7.2 (labeled ③), 5. PNOZsigma expansion module s7.2 with terminator (labeled ④). A bracket groups modules 2, 3, and 4.</p>
<p>①: Base unit</p> <p>②: Contact expansion module PNOZ s7.1</p> <p>③: Contact expansion module PNOZ s7.2</p> <p>④: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator</p>	 <p>The diagram shows a vertical stack of modules. From left to right: 1. PNOZsigma base unit (labeled ①), 2. PNOZsigma expansion module s7.1 (labeled ②), 3. PNOZsigma expansion module s7.2 (labeled ③), 4. PNOZsigma expansion module s7.2 (labeled ③), 5. PNOZsigma expansion module s7/s8/s9/s10/s11 (labeled ④). A bracket groups modules 2, 3, and 4.</p>
<p>①: Contact expansion module PNOZ s7.1 with terminator</p> <p>②: Contact expansion module PNOZ s7.2</p> <p>③: Contact expansion module PNOZ s7.2 with terminator</p>	 <p>The diagram shows a vertical stack of modules. From left to right: 1. PNOZsigma expansion module s7.1 with terminator (labeled ①), 2. PNOZsigma expansion module s7.2 (labeled ②), 3. PNOZsigma expansion module s7.2 (labeled ②), 4. PNOZsigma expansion module s7.2 with terminator (labeled ③). A bracket groups modules 1, 2, and 3.</p>

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).
<p>①: Contact expansion module PNOZ s7.1 with terminator</p> <p>②: Contact expansion module PNOZ s7.2</p> <p>③: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator</p>	
<p>①: Base unit</p> <p>②: Contact expansion module PNOZ s7.1</p> <p>③: Contact expansion module PNOZ s7.2</p> <p>④: Contact expansion module PNOZ s7.1</p> <p>⑤: Contact expansion module PNOZ s7.2</p> <p>⑥: Contact expansion module PNOZ s7.2 with terminator</p>	

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.

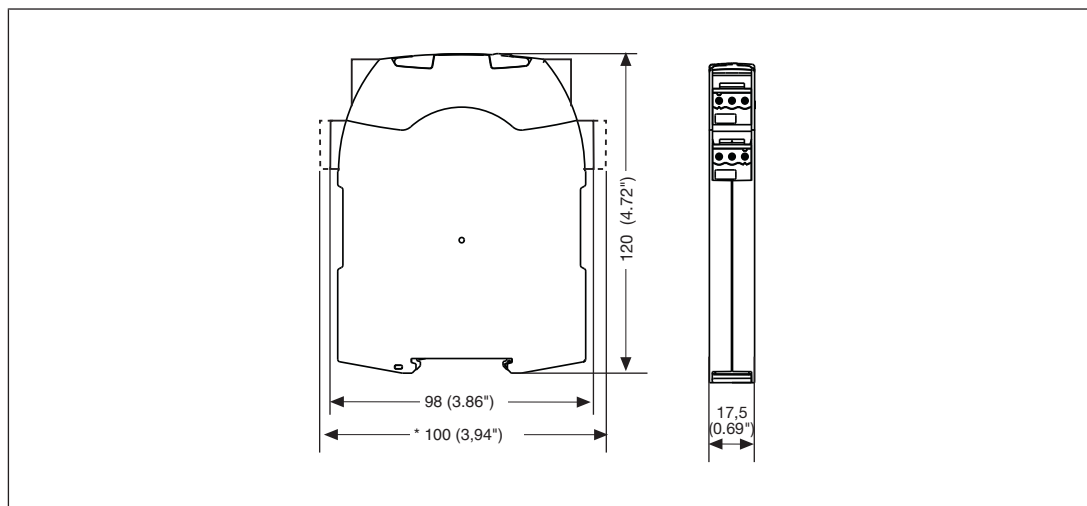
Safety relays PNOZsigma PNOZ s7.2

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 RI-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 A ² s	260 A ² s
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 A ² s	160 A ² s
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
I _{th} 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	EN ISO 13849-1: 2015	EN 62061 SIL CL	EN 62061 PFH _D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015
	PL	Category					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.

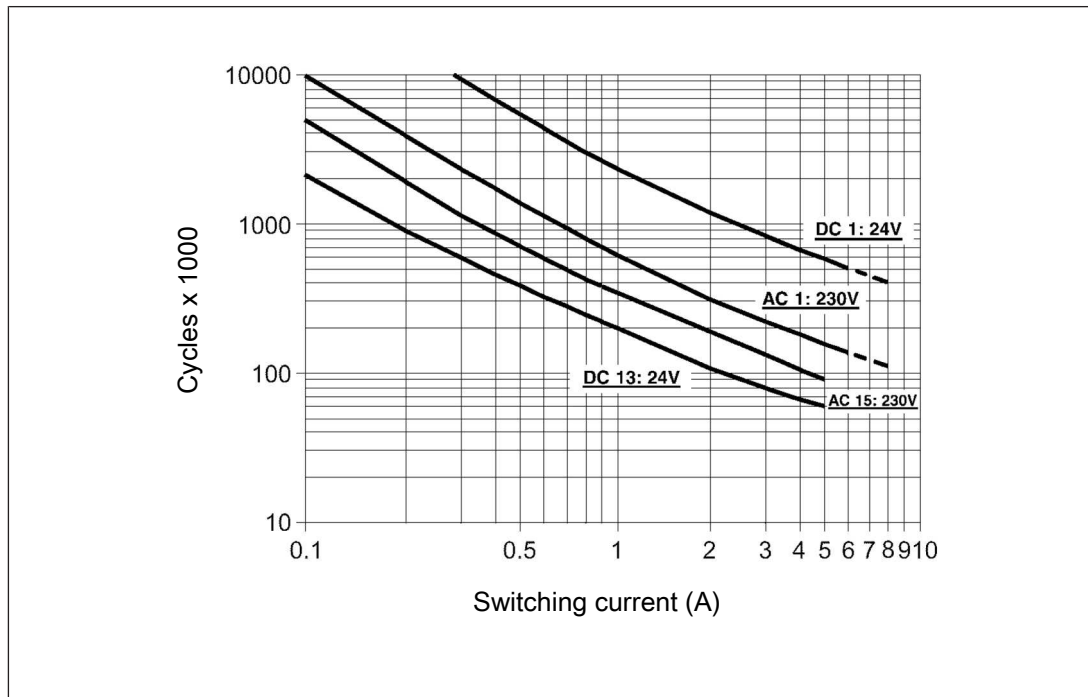


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s7.2

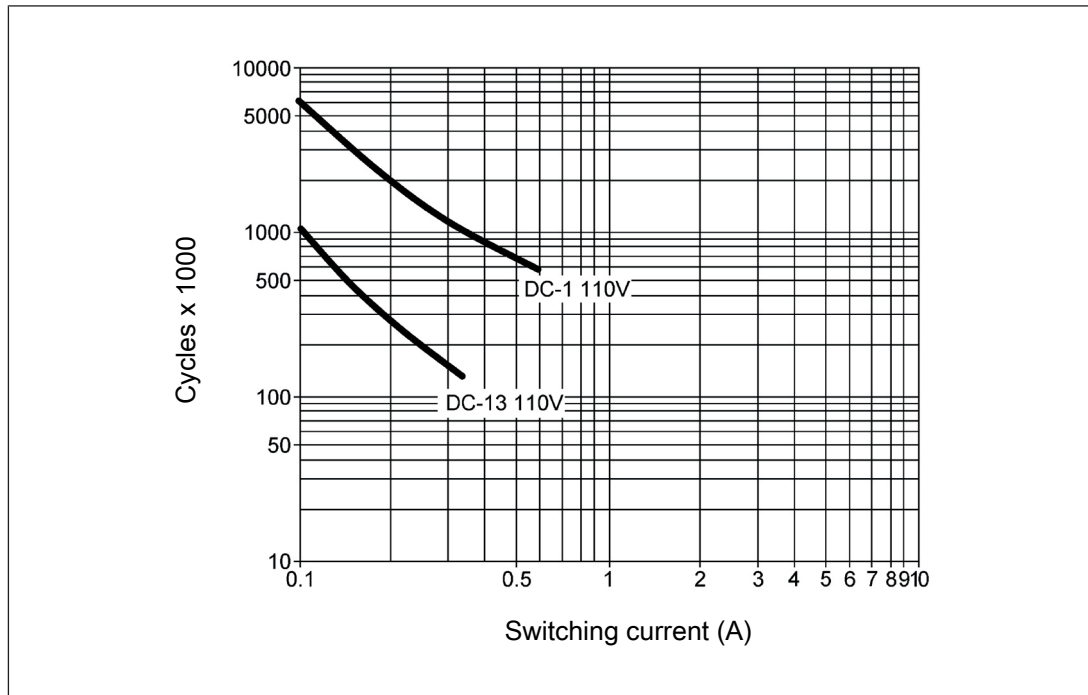


Fig.: Service life graphs at 110 V DC

Example

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

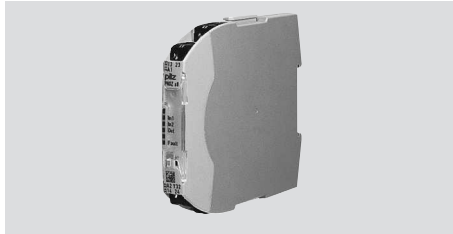
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see [Technical details \[735\]](#)) can be used in the calculation.

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

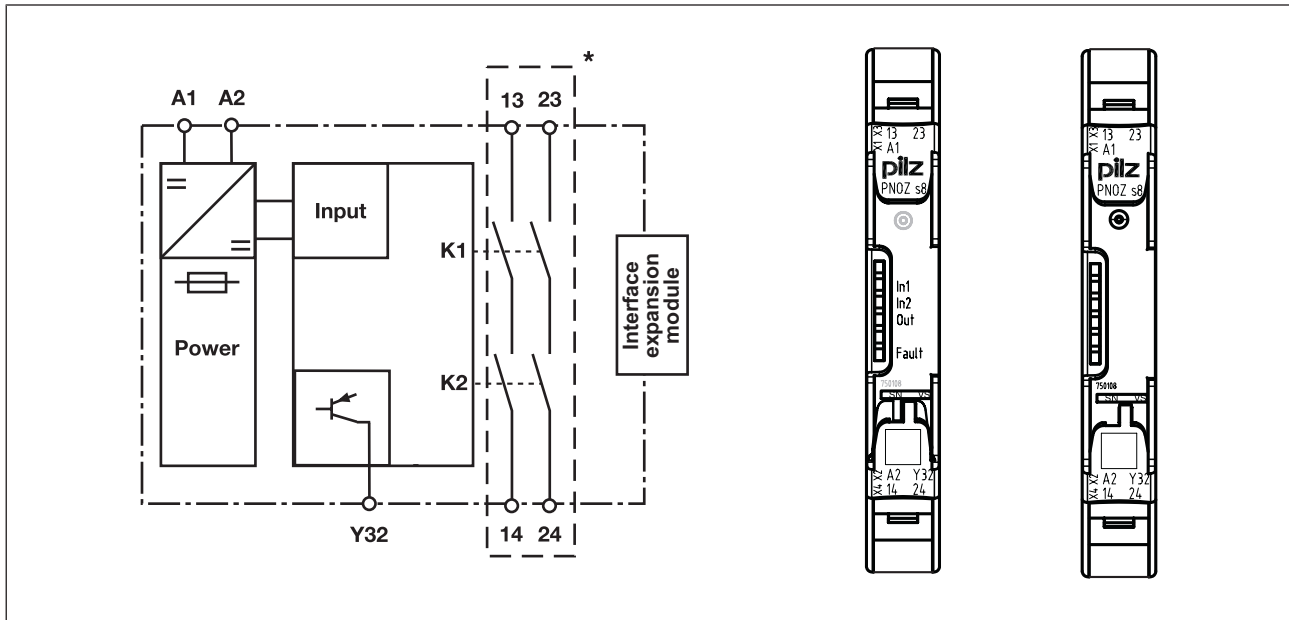


Fig.: Centre: Front view with cover, right: Front view without cover

*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:

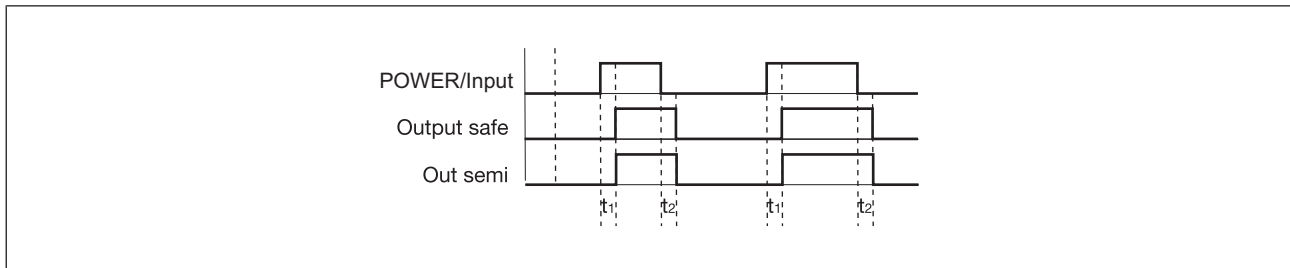
- ▶ Dual-channel operation via PNOZsigma connector

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

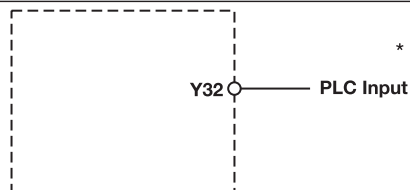
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

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.

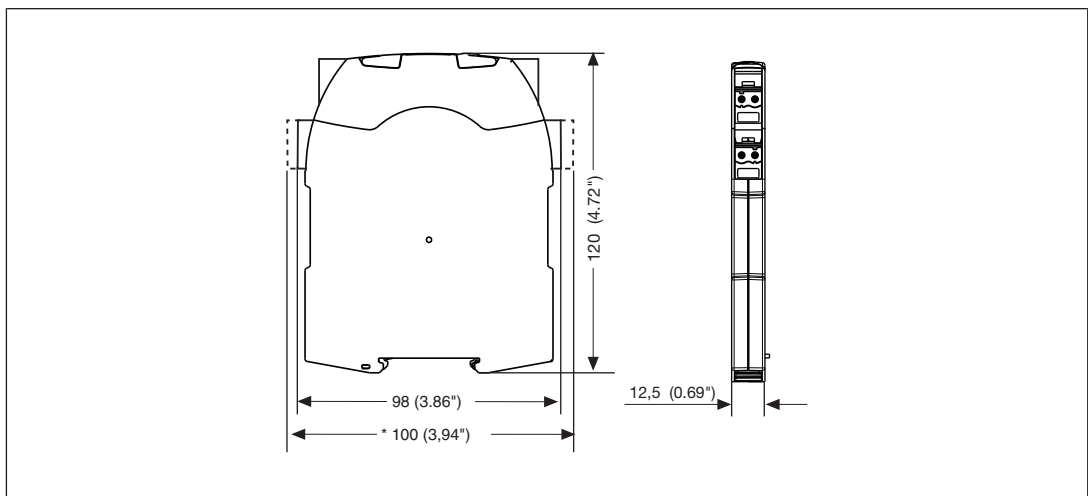
Semiconductor output



*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 RI- 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 I _K	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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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

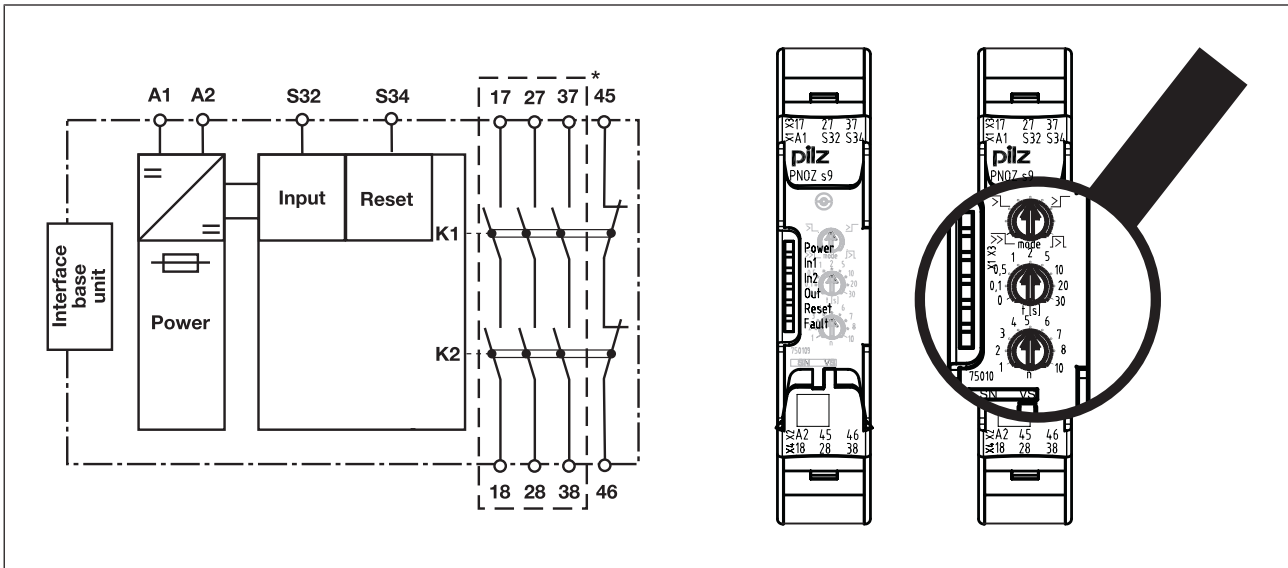





Fig.: Centre: Front view with cover, right: Front view without cover

*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

- ▶ Σ 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:

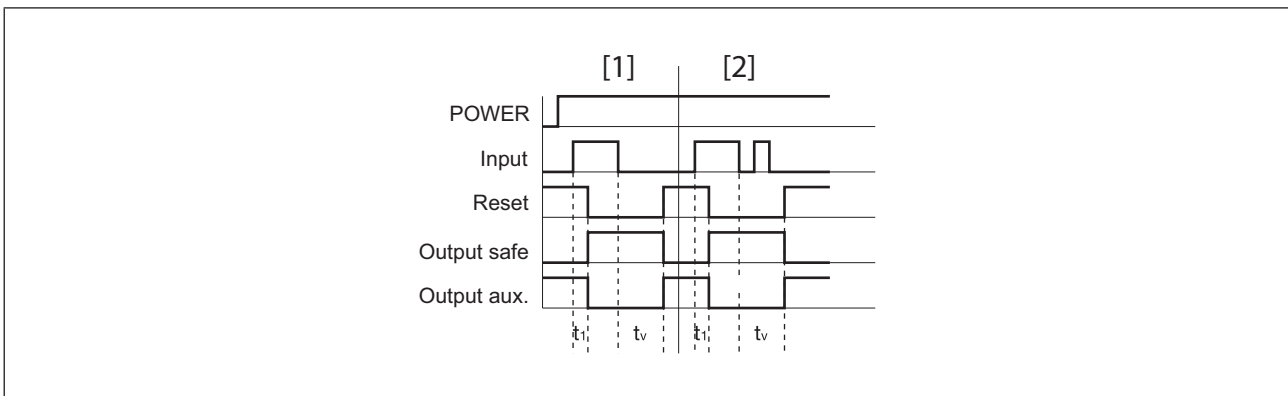
- ▶ Dual-channel operation via PNOZsigma connector

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

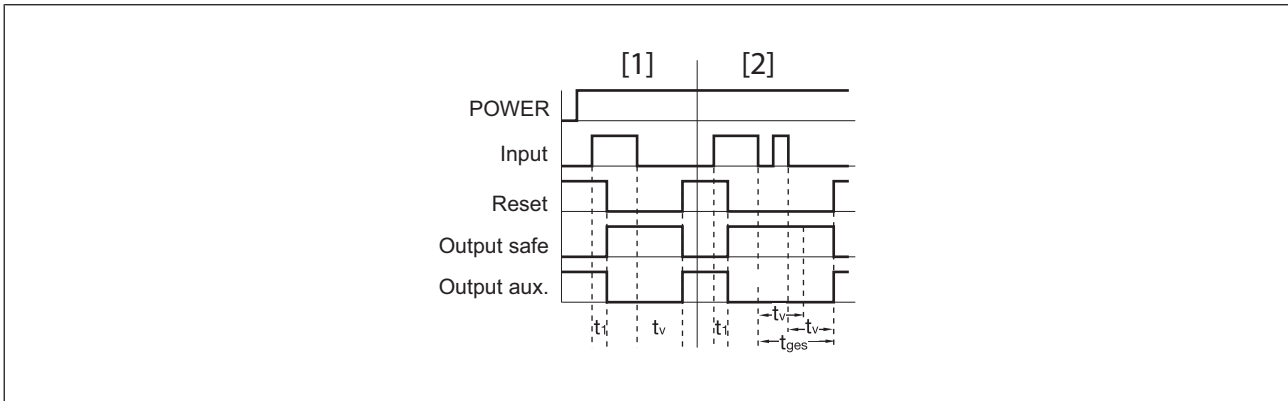


Legend

- ▶ POWER: Supply voltage
- ▶ Input: Input circuit
- ▶ Output safe: Safety contacts
- ▶ Output aux: Auxiliary contact
- ▶ Reset: Feedback loop input
- ▶ t_i : 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

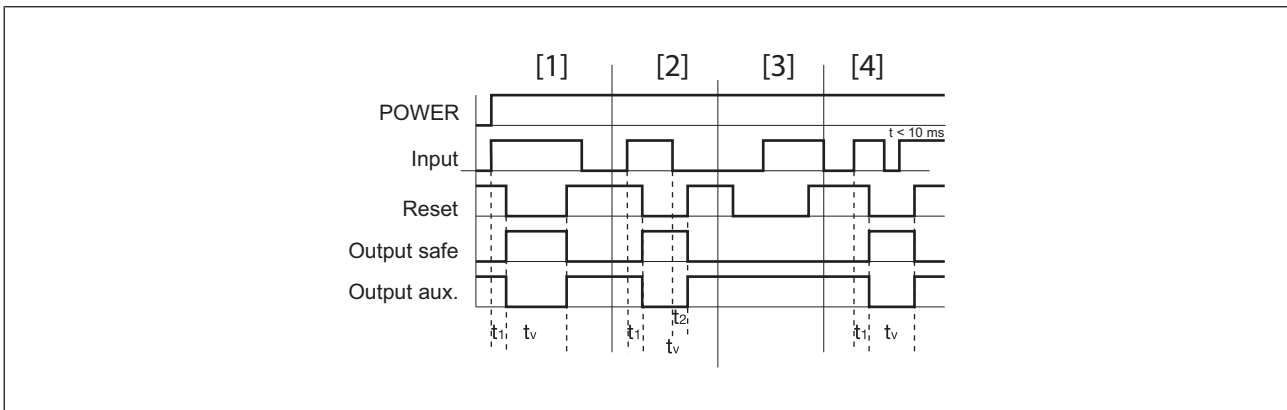


Legend

- ▶ POWER: Supply voltage
- ▶ Input: Input circuit
- ▶ Output safe: Safety contacts
- ▶ Output aux: Auxiliary contact
- ▶ Reset: Feedback loop input
- ▶ t_i : 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

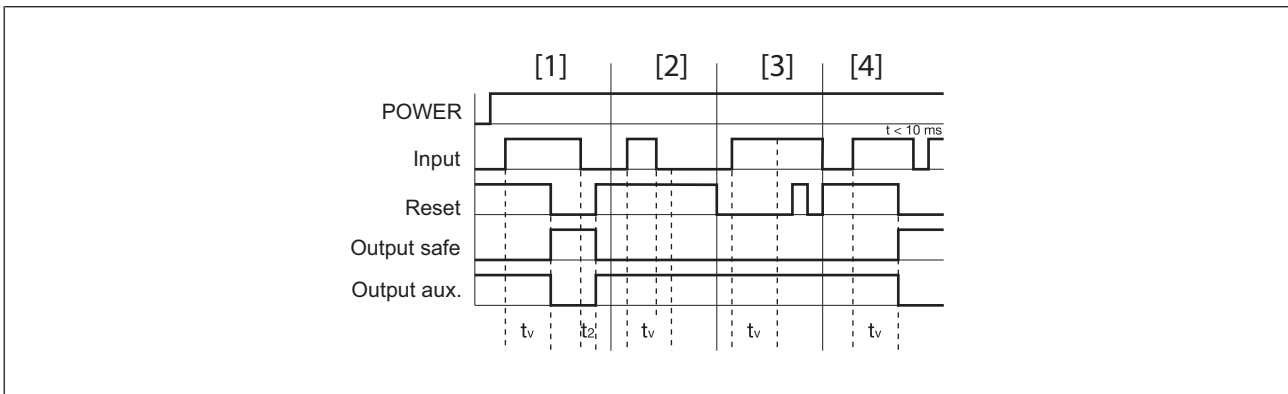


Legend

- ▶ 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
- ▶ t_v : 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).

Safety relays PNOZsigma PNOZ s9

- ▶ 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"

$n \times t[s] = \text{Delay time}$

Example:

$t = 4 \text{ s}, n = 5$

Delay time = $5 \times 4 = 20 \text{ s}$

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)		

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▶ 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

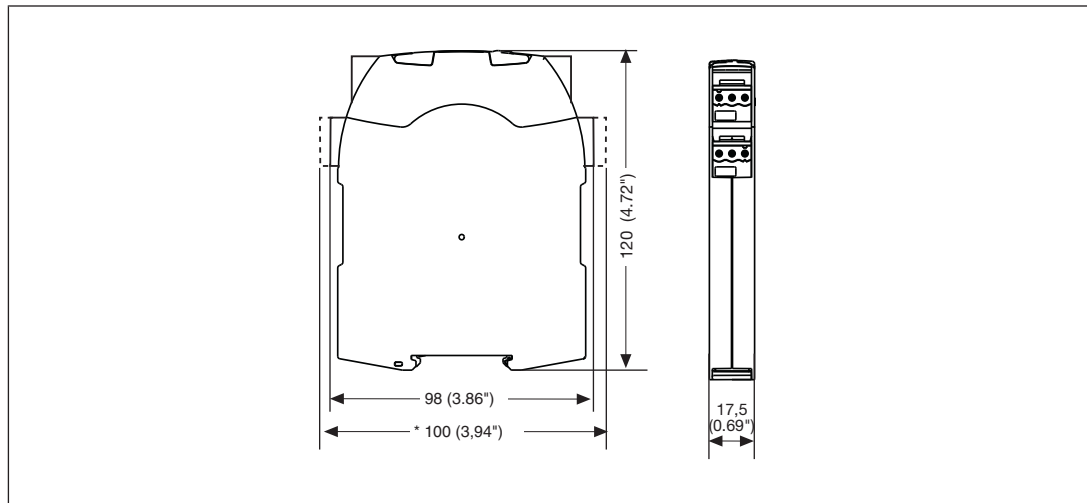
	Without feedback loop	With feedback loop
Without base unit		

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 R _{lmax}			
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 R _{lmax}			
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 A ² s	260 A ² s	260 A ² s
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 A ² s	160 A ² s	160 A ² s
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 t_v	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)	$t_v - 15 \% - 20 \text{ ms}$	$t_v - 15 \% - 20 \text{ ms}$	$t_v - 15 \% - 20 \text{ ms}$
Max. delay time	$t_v + 15 \% + 20 \text{ ms}$	$t_v + 15 \% + 20 \text{ ms}$	$t_v + 15 \% + 20 \text{ ms}$
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 mm ² , 24 - 12 AWG	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 24 - 12 AWG	0,2 - 2,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
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.

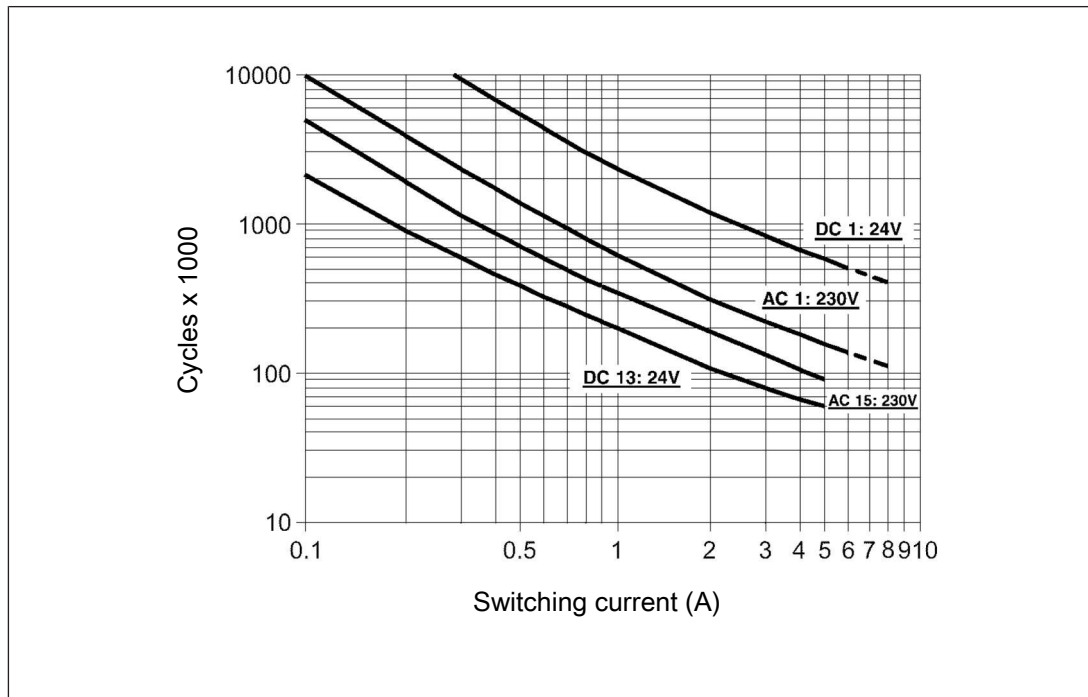


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s9

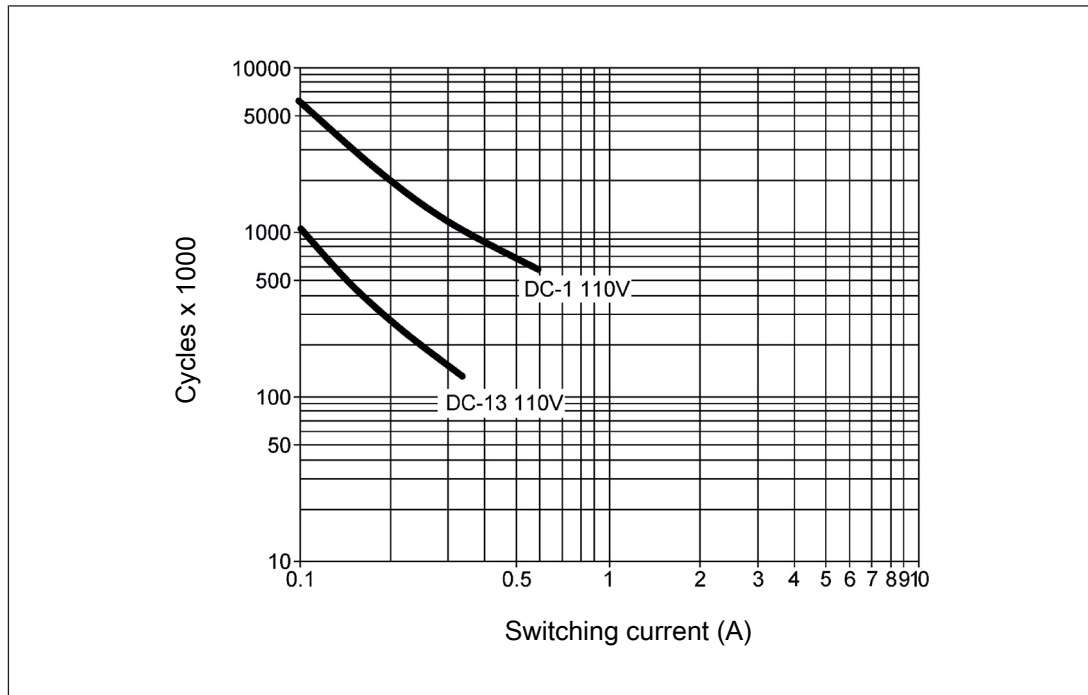


Fig.: Service life graphs at 110 V DC

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

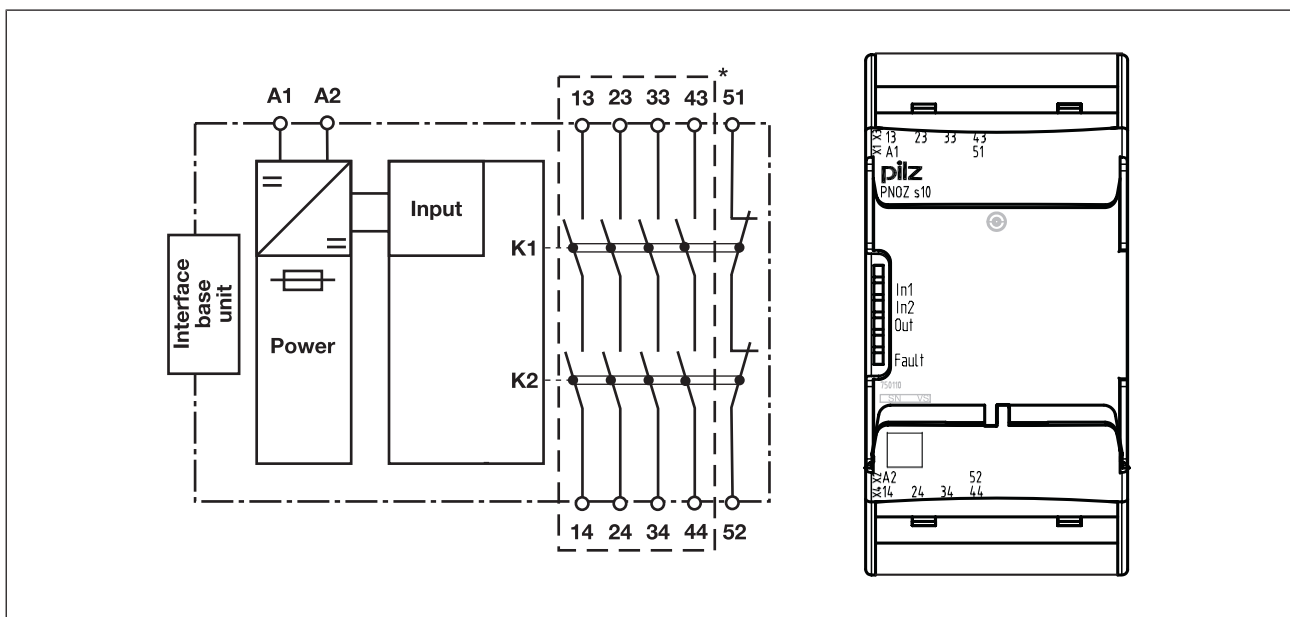
Safety relays PNOZsigma PNOZ s10



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

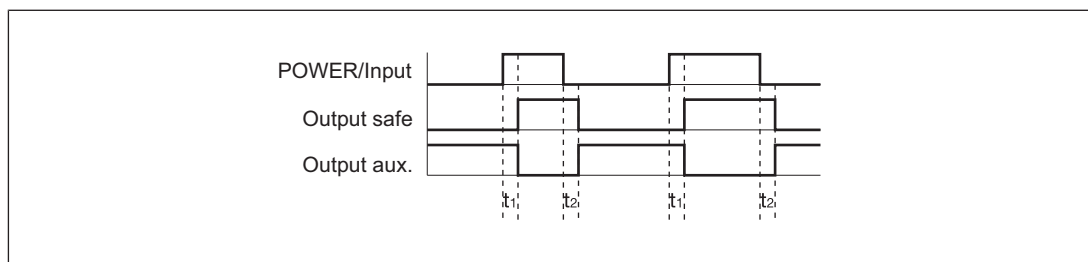
with PNOZsigma base unit:

- ▶ 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.

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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:

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

$R_{l_{\max}}$ = 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

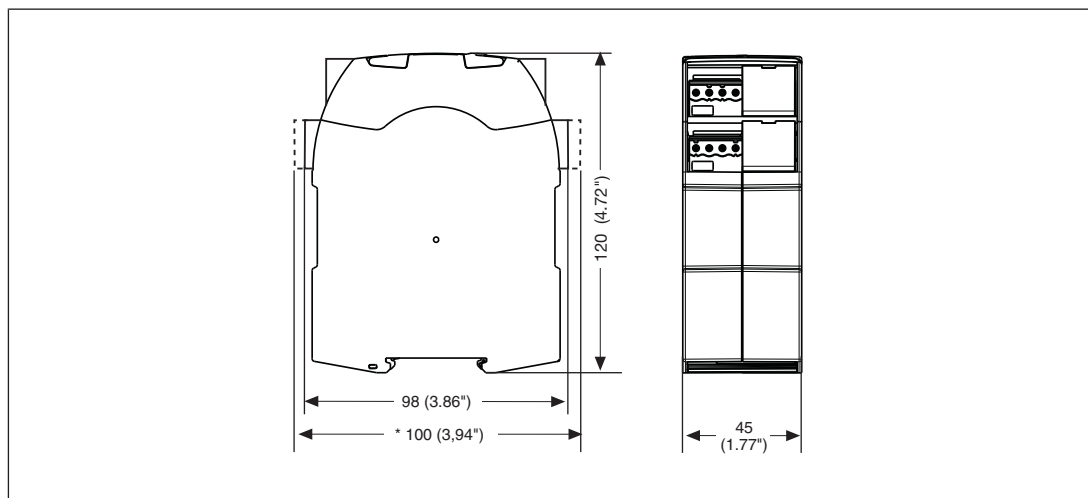
Preparing for operation

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 RI-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 A ² s	640 A ² s
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 A ² s	240 A ² s
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	AgSnO ₂ + 0,2 µm Au	AgSnO ₂ + 0,2 µm Au
Conventional thermal current while loading several contacts	750110	751110
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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.

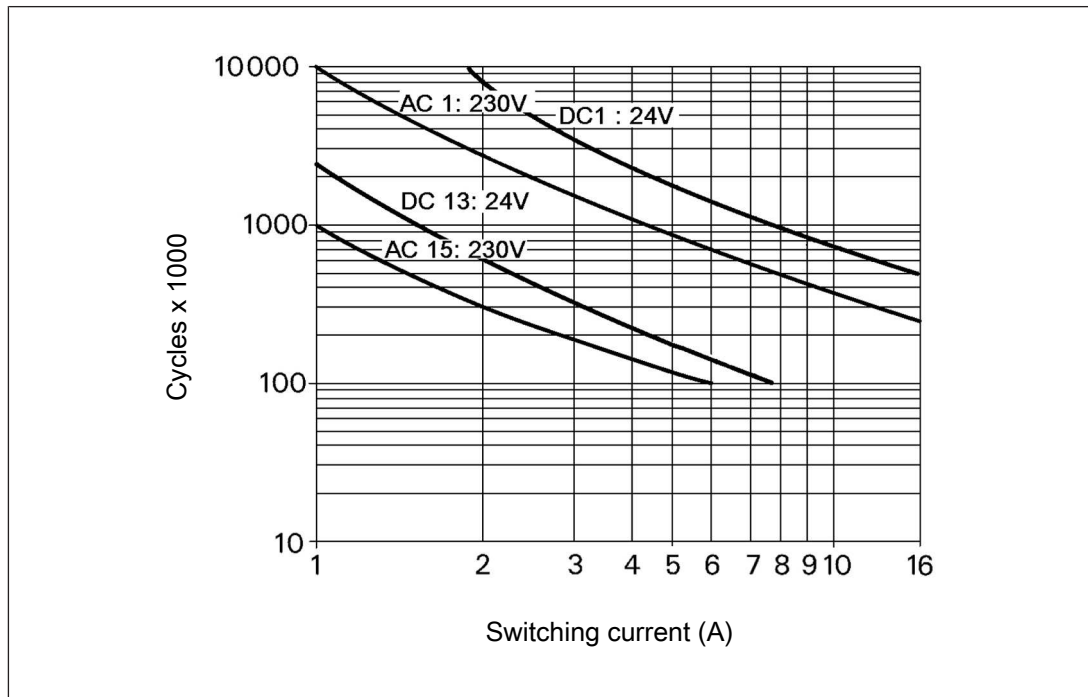


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s10

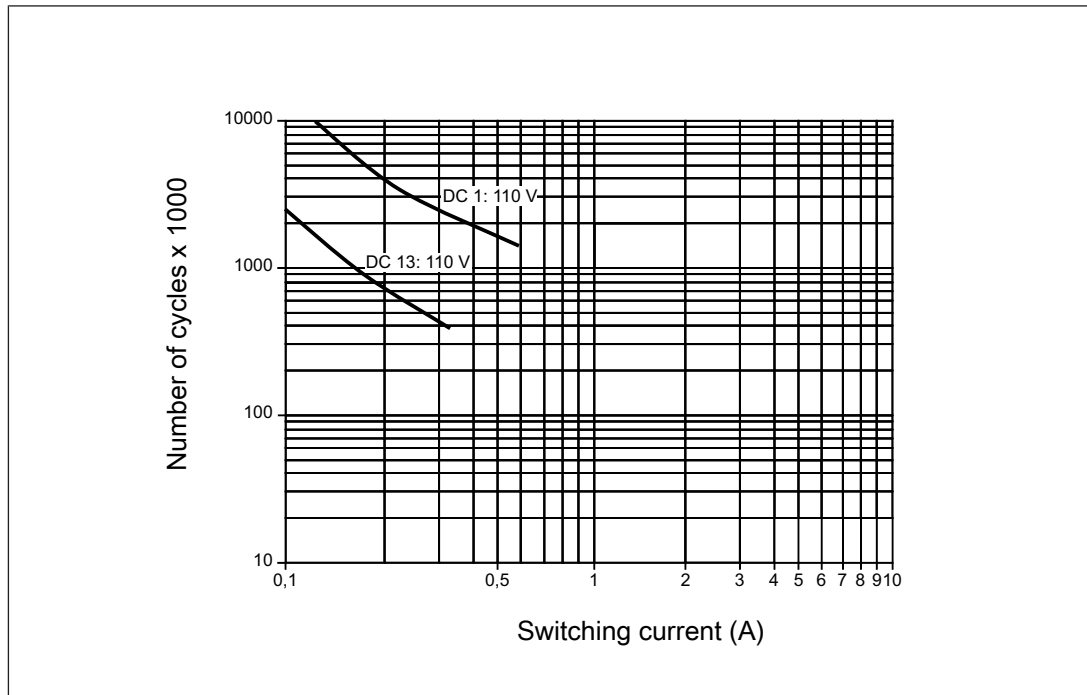


Fig.: Service life graphs at 110 V DC

Example

- ▶ Inductive load: 2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 300 000 cycles

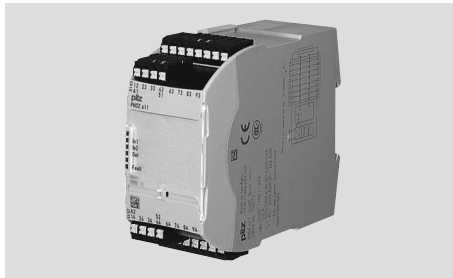
Provided the application to be implemented requires fewer than 300 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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

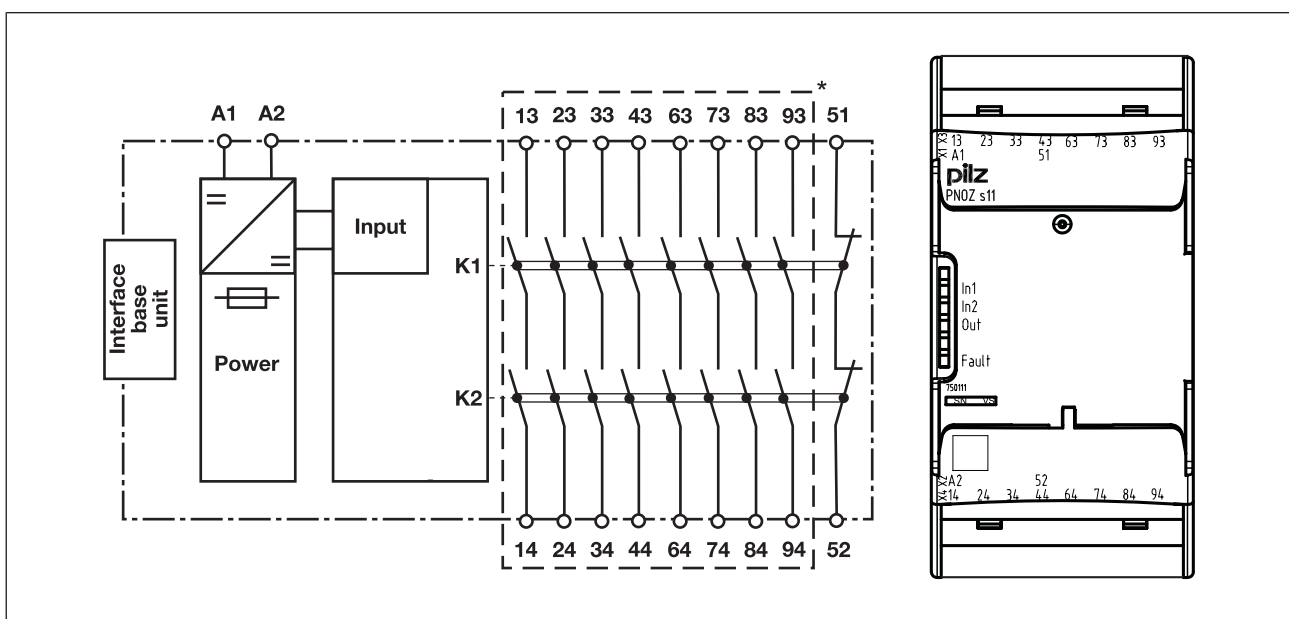
Safety relays PNOZsigma PNOZ s11



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

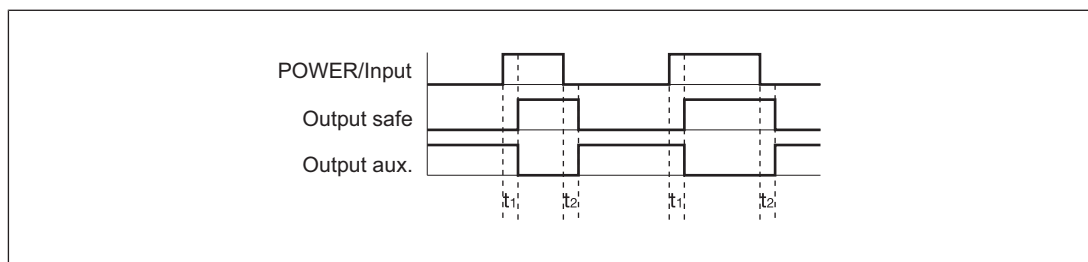
with PNOZsigma base unit:

- ▶ 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

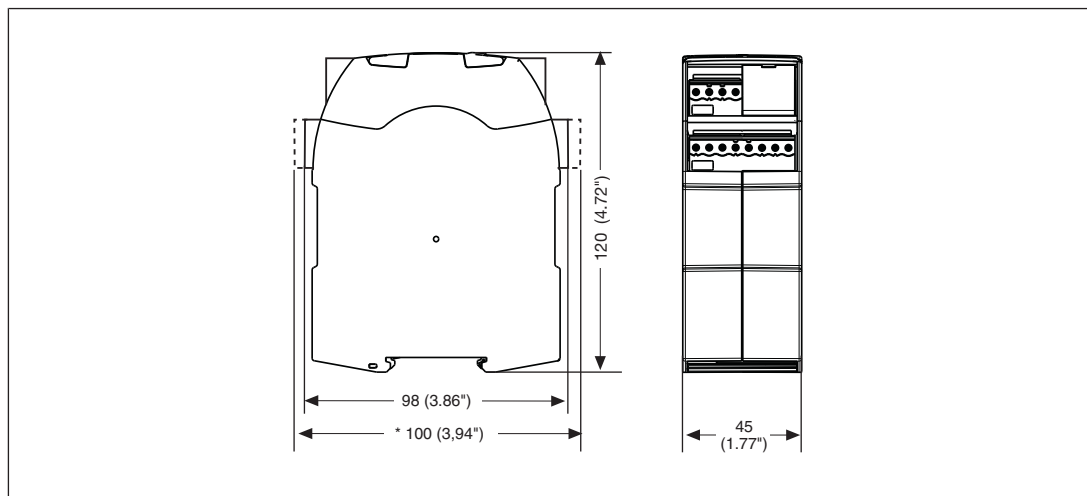
Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

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 RI-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 I _K	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 con- tacts		
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 con- tacts		
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 con- tacts		
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 con- tacts		
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
I _{th} 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.

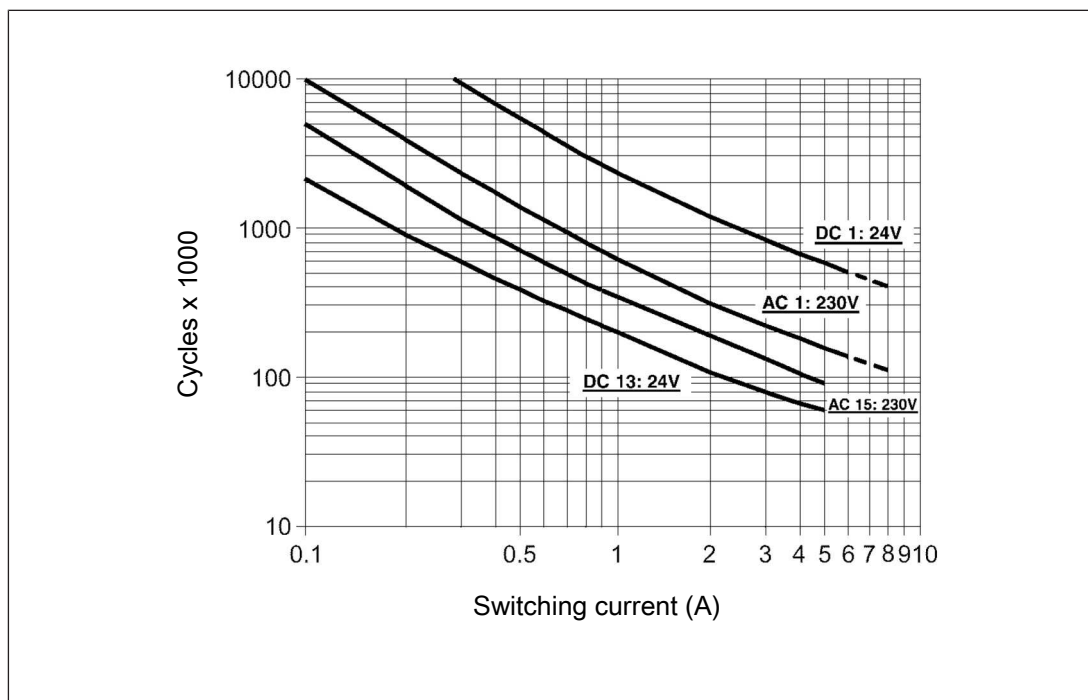


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma PNOZ s11

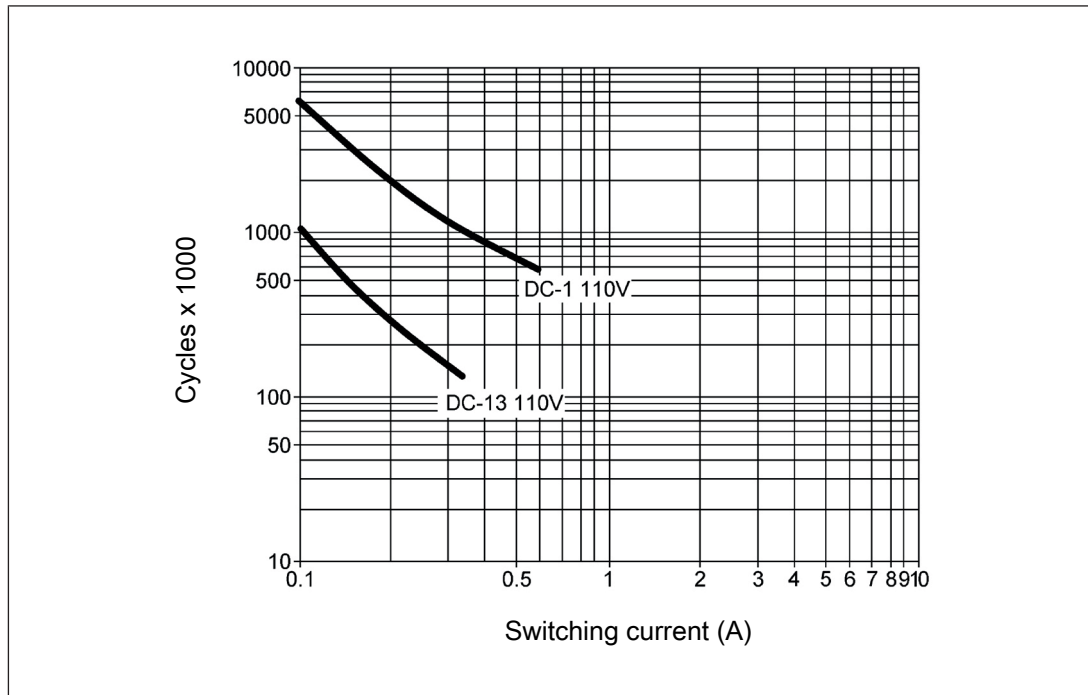


Fig.: Service life graphs at 110 V DC

Example

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

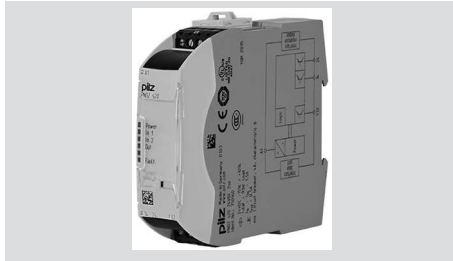
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see [Technical details \[785\]](#)) can be used in the calculation.

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

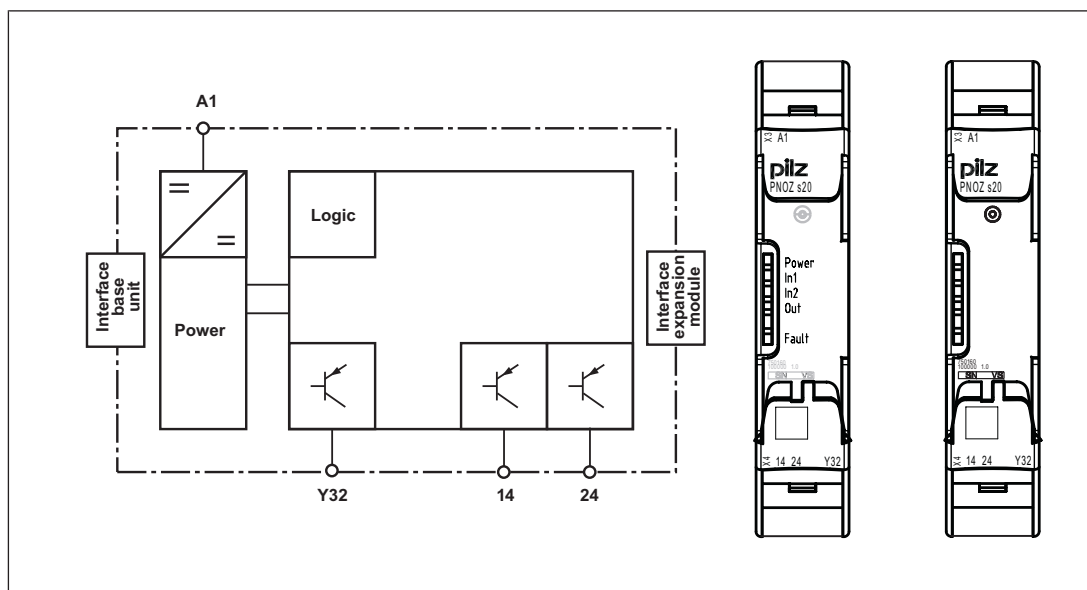


Fig.: Centre: Front view with cover, right: Front view without cover

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.

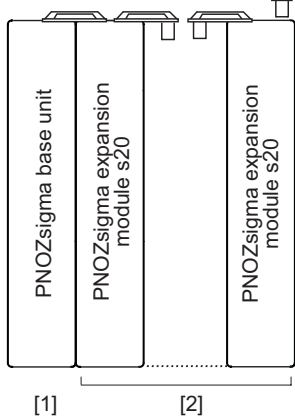
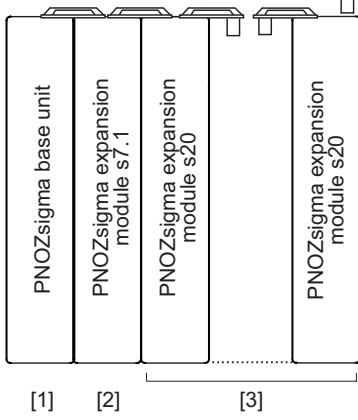
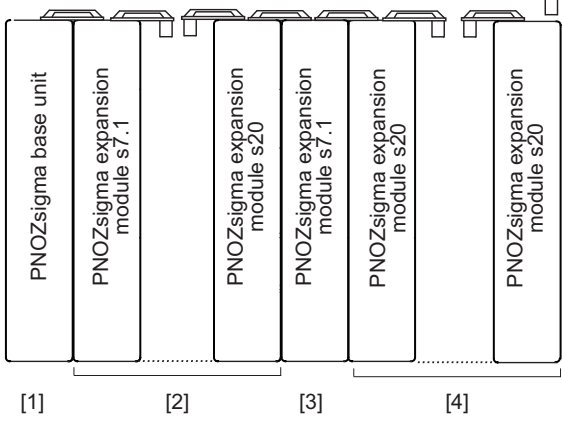
Connect the base unit and contact expansion module PNOZ s20

- ▶ 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.

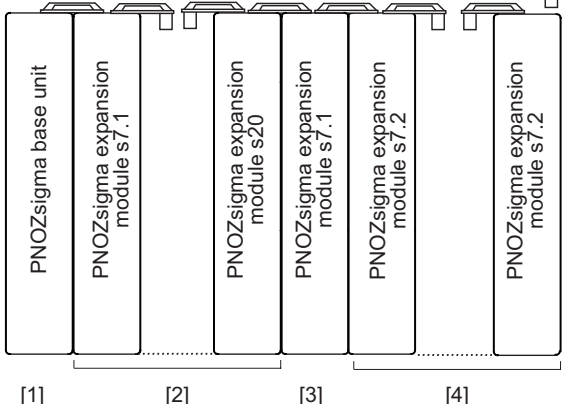
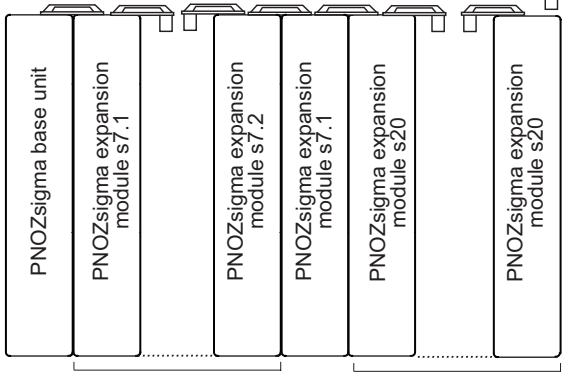
Connect the contact expansion module PNOZ s20 to the contact expansion modules PNOZsigma

- ▶ 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
<p>[1]: Base unit PNOZ s3/s4/s4.1/s5/s6/s6.1</p> <p>[2]: Up to 5 contact expansion modules PNOZ s20 (final block with terminator)</p>	 <p>The diagram shows a vertical stack of three modules. The leftmost module is labeled 'PNOZsigma base unit' and is marked with '[1]'. To its right are two 'PNOZsigma expansion module s20' units, with the second one marked with '[2]'. A dashed line indicates a connection between the two expansion modules.</p>
<p>[1]: Base unit PNOZsigma</p> <p>[2]: Contact expansion module PNOZ s7.1</p> <p>[3]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)</p>	 <p>The diagram shows a vertical stack of four modules. The leftmost is 'PNOZsigma base unit' ([1]), followed by 'PNOZsigma expansion module s7.1' ([2]), then 'PNOZsigma expansion module s20' ([3]), and finally another 'PNOZsigma expansion module s20' ([3]). A dashed line indicates a connection between the two s20 modules.</p>
<p>[1]: Base unit PNOZsigma</p> <p>[2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s20</p> <p>[3]: Contact expansion module PNOZ s7.1</p> <p>[4]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)</p>	 <p>The diagram shows a vertical stack of seven modules. From left to right: 'PNOZsigma base unit' ([1]), 'PNOZsigma expansion module s7.1' ([2]), 'PNOZsigma expansion module s20' ([2]), 'PNOZsigma expansion module s7.1' ([3]), 'PNOZsigma expansion module s20' ([3]), 'PNOZsigma expansion module s20' ([3]), and 'PNOZsigma expansion module s20' ([4]). A dashed line indicates a connection between the two s7.1 modules.</p>

Safety relays PNOZsigma PNOZ s20

Expansion options	Consider the max. power consumption of all the units used in the application
<p>[1]: Base unit PNOZsigma</p> <p>[2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s20</p> <p>[3]: Contact expansion module PNOZ s7.1</p> <p>[4]:* Up to 10 contact expansion modules PNOZ s7.2 (final block with terminator)</p>	
<p>[1]: Base unit PNOZsigma</p> <p>[2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s7.2</p> <p>[3]: Contact expansion module PNOZ s7.1</p> <p>[4]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)</p>	

*) 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.

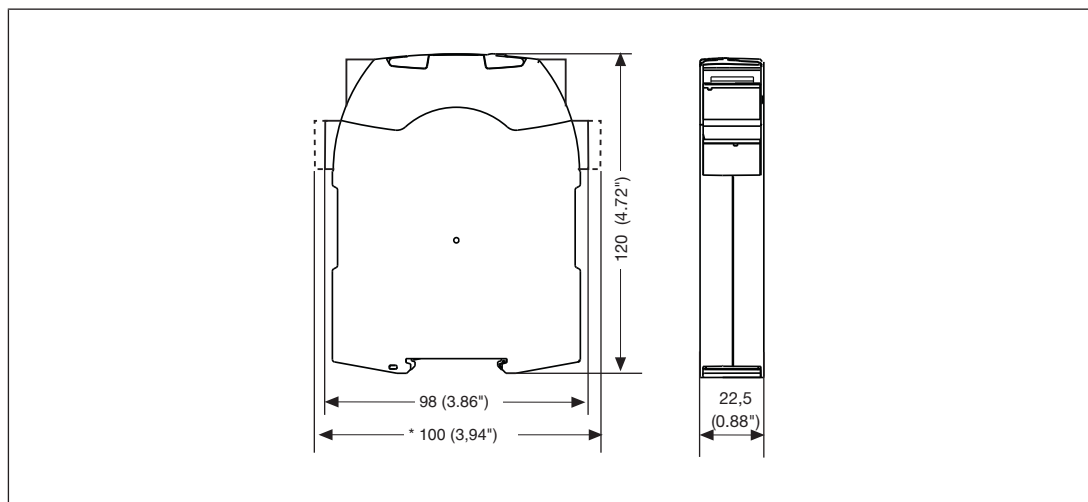
Safety output	Single-channel operation	Dual-channel operation

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 t_r 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

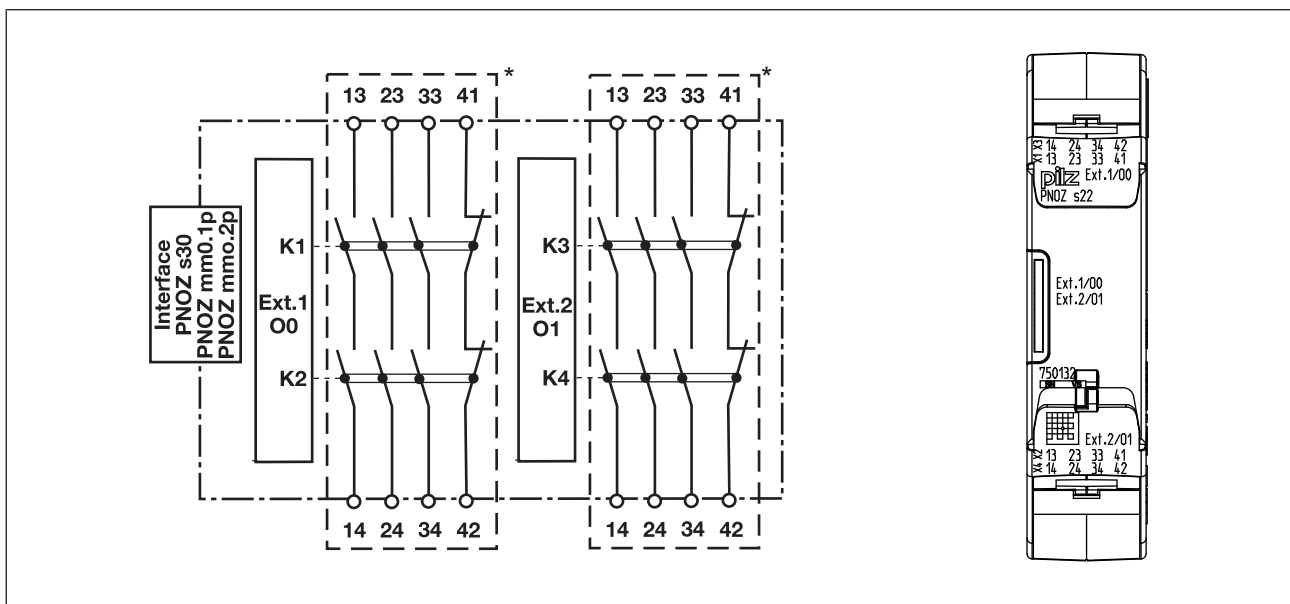
Safety relays PNOZsigma PNOZ s22



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

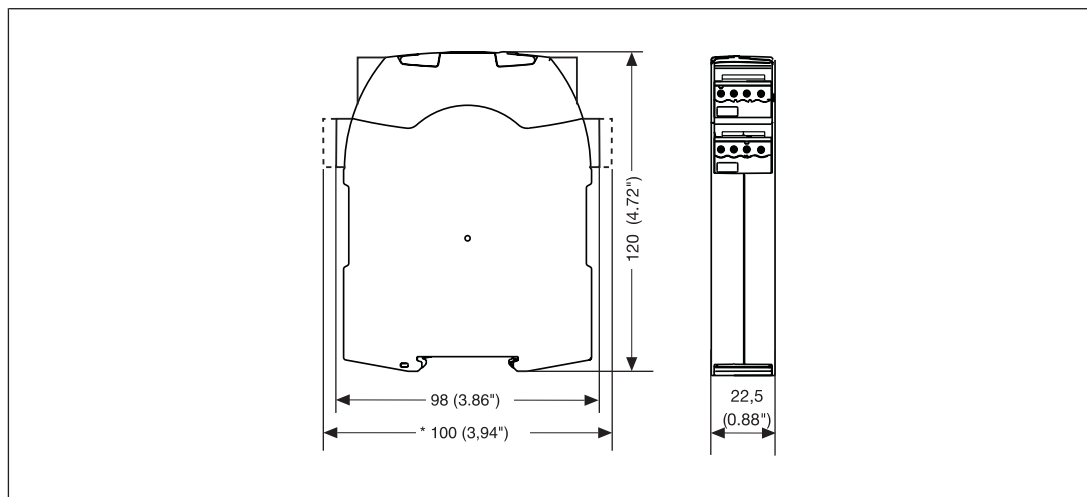
Preparing for operation

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, cULus Listed	CCC, EAC (Eurasian), TÜV, cULus 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
I _{th} 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm ² , 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 mm ² , 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.

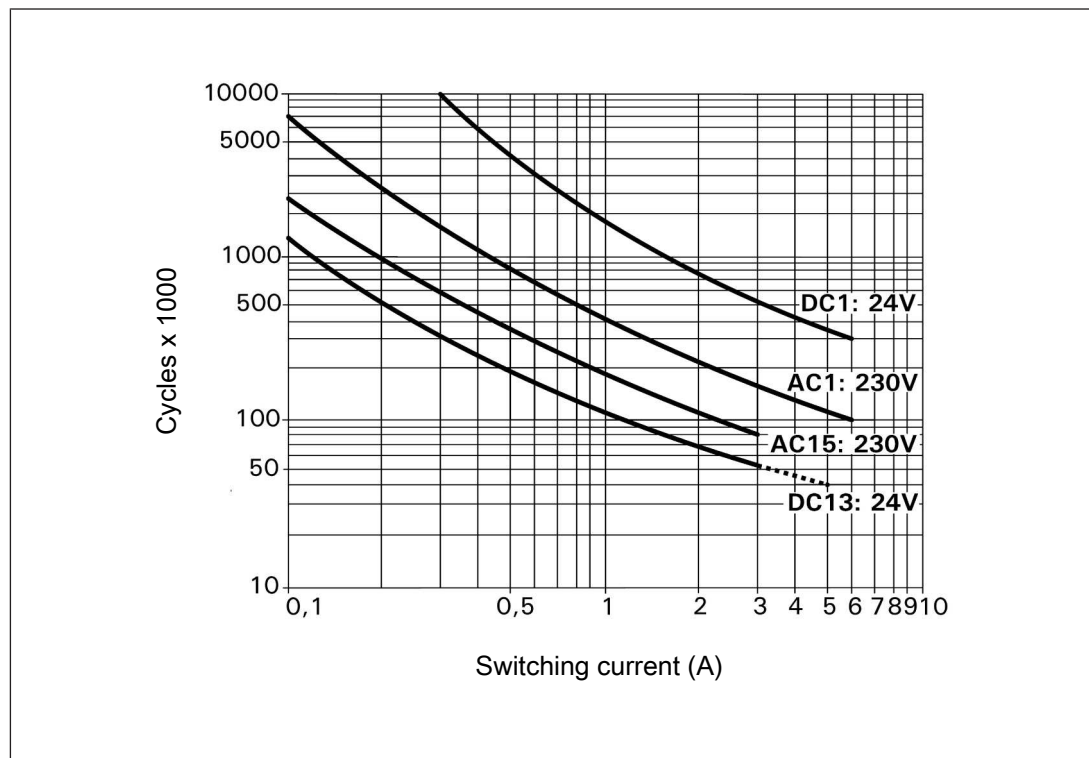


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma PNOZ s22

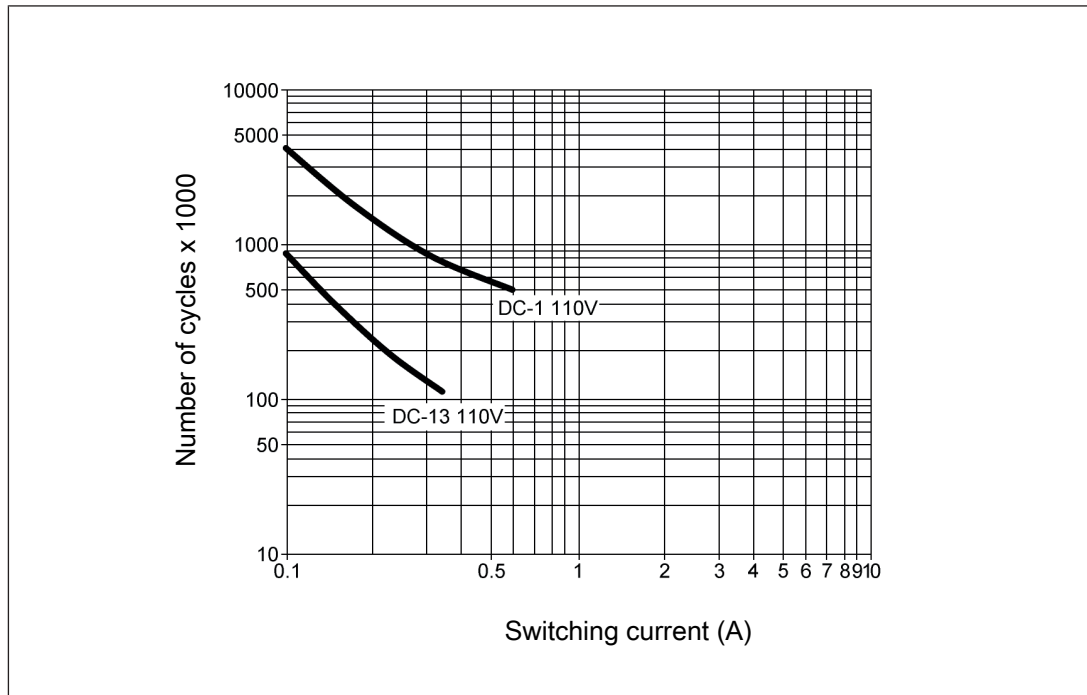


Fig.: Service life graphs at 110 VDC

Example

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

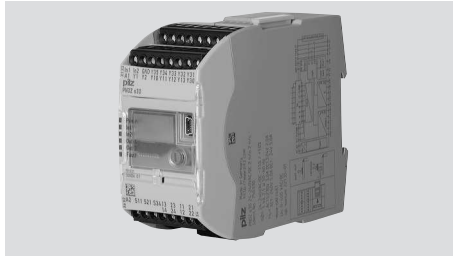
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see [Technical details \[804\]](#)) can be used in the calculation.

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

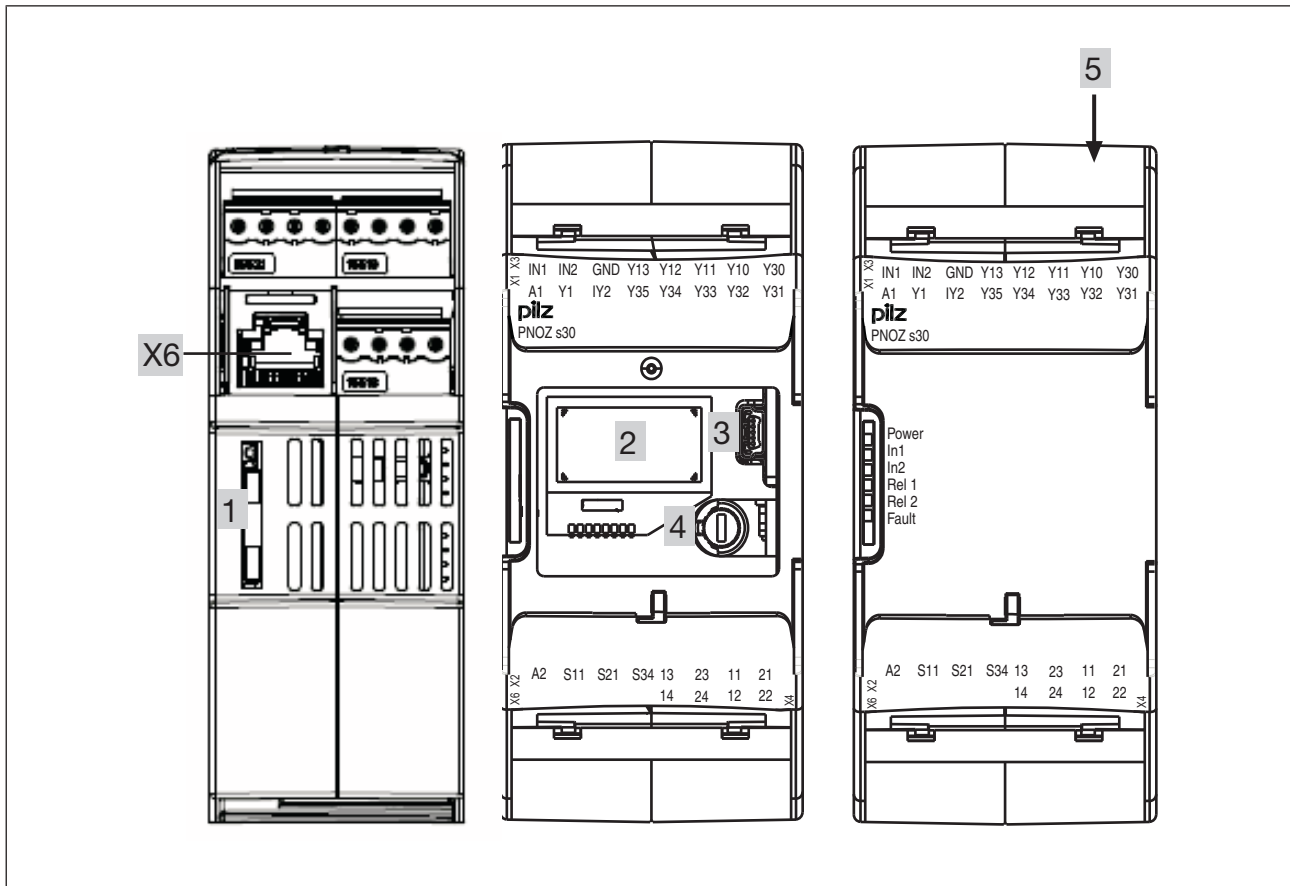


Fig.: Left: Side view, centre: Front view without cover, right: Front view with cover

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.

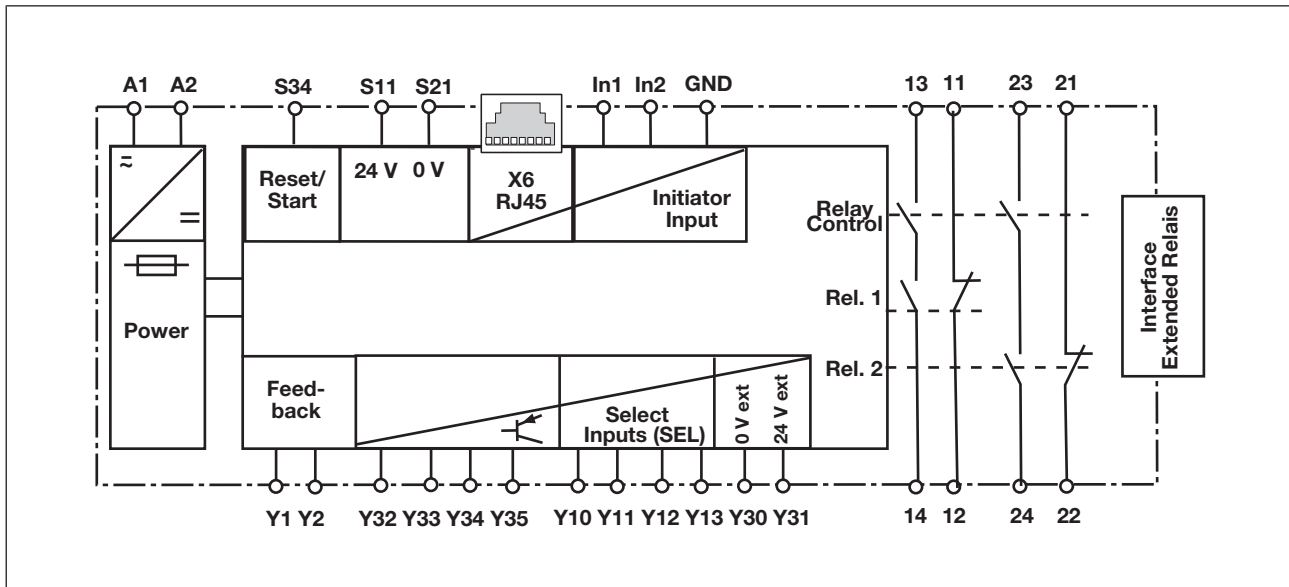
An interface is available to connect a contact expansion module PNOZsigma, enabling the number of outputs to be expanded.

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

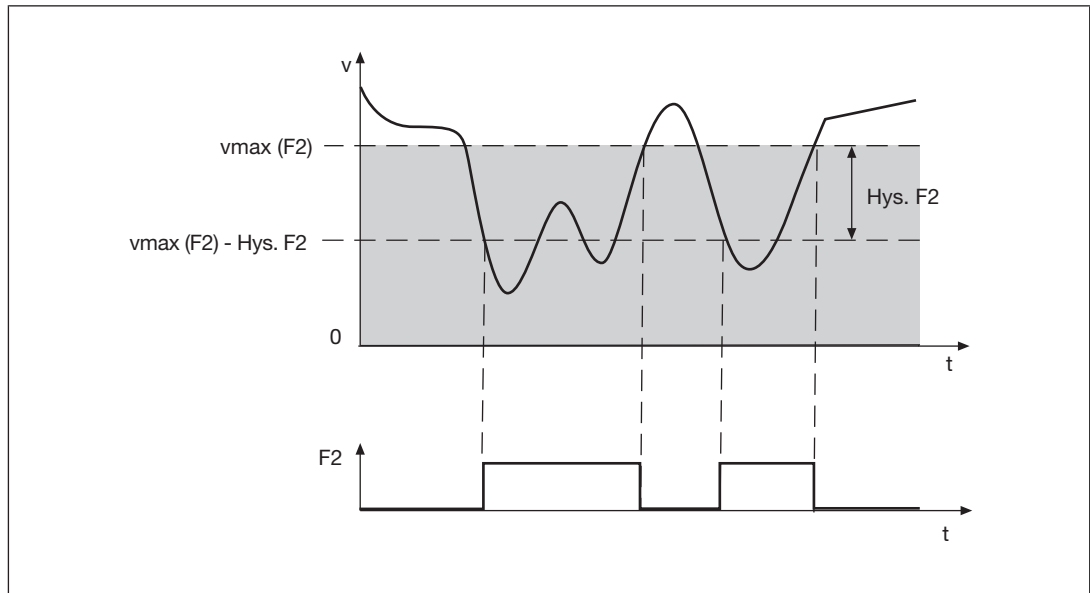
With standstill monitoring, the output is switched on when the value falls below the stated standstill value; if the standstill value is exceeded, the output switches off.

Speed

With speed monitoring, the output switches off when the configured value is exceeded.

Safety relays PNOZsigma PNOZ s30

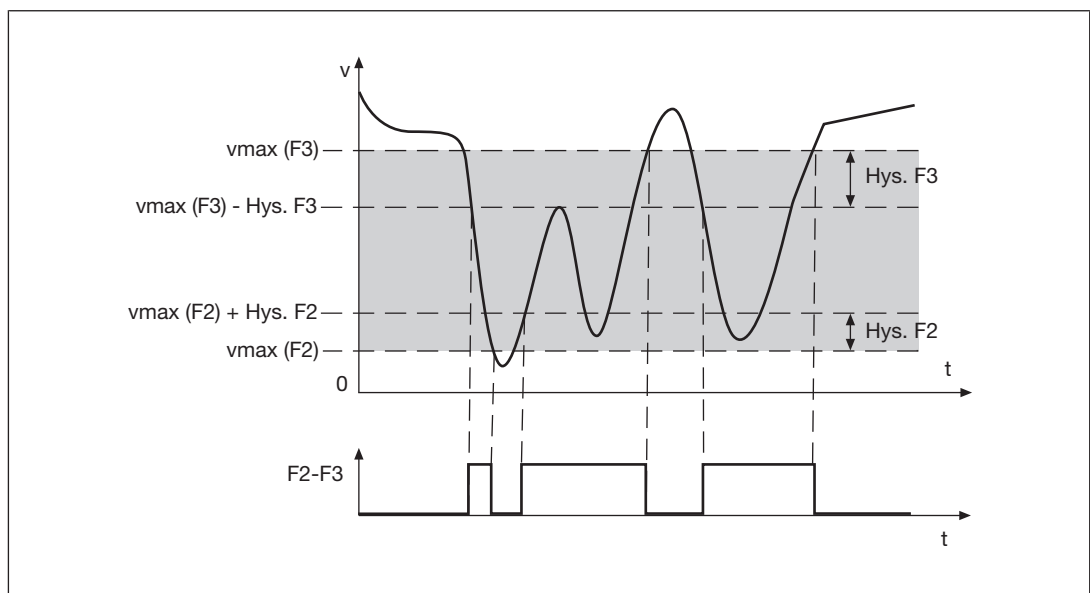
Timing diagram for standstill/speed monitoring:



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:



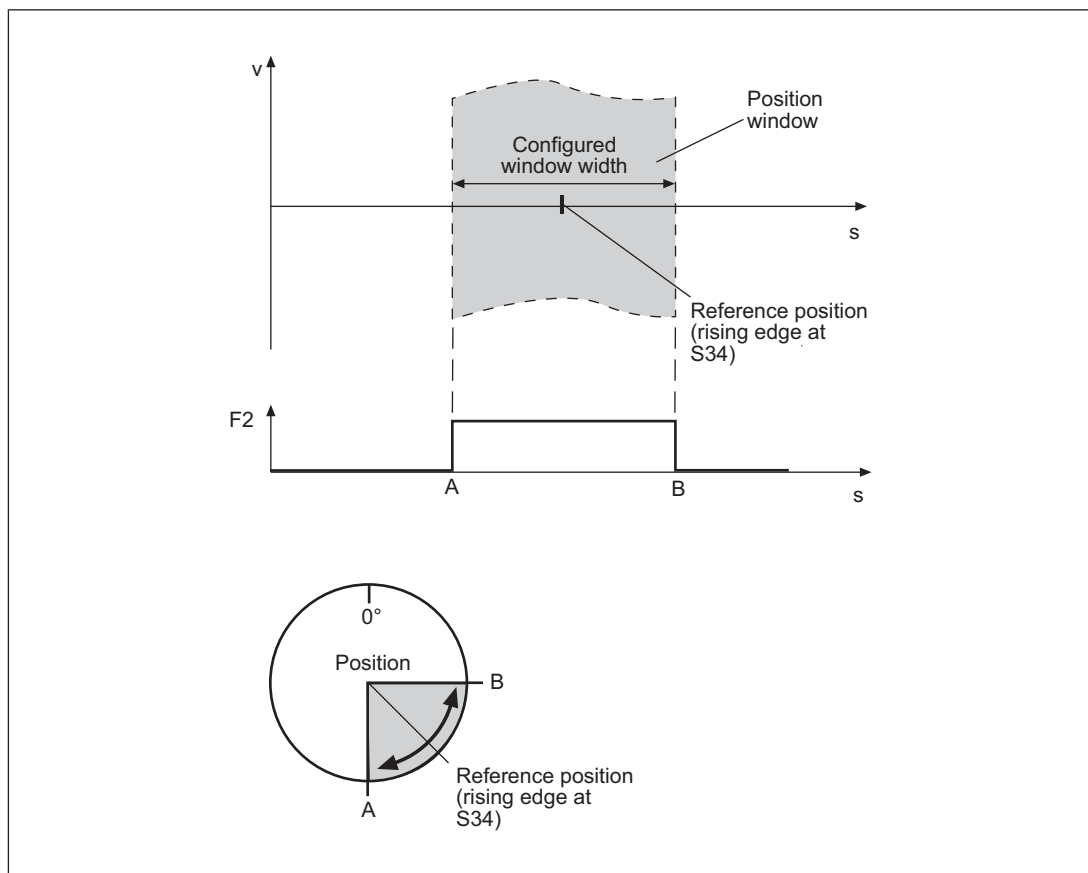
Safety relays PNOZsigma PNOZ s30

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.

Safety relays PNOZsigma PNOZ s30

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.

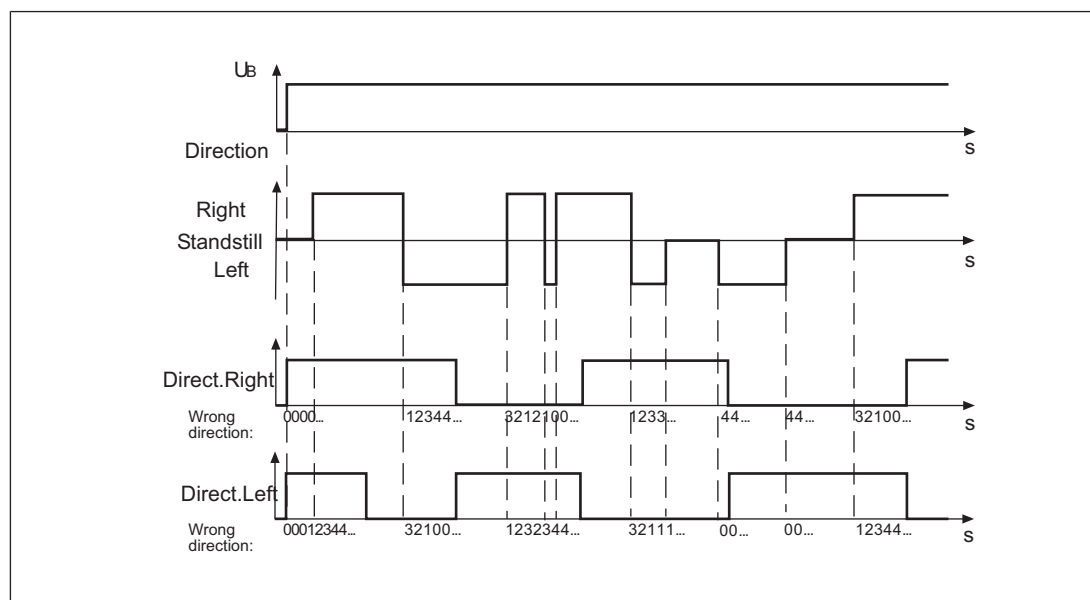
For both directions, a tolerance can be entered for the wrong direction. In other words, the drive can run in the wrong direction up to the set tolerance value, without the assigned output switching off.

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

Safety relays PNOZsigma PNOZ s30

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 (**f_{AB}/f_Z Verh.** setting in the menu).

Minimum speed:

- ▶ when **f_{AB}/f_Z Verh.** ≥ 1.0
 $f_Z = 70$ mHz or $f_{AB} = (f_{AB}/f_Z) \times 70$ 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 **f_{AB}/f_Z Verh.** ≥ 1.0
7.5 Z-pulses or $7.5 \times (f_{AB}/f_Z)$ AB-pulses
- ▶ when **f_{AB}/f_Z 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.

Safety relays PNOZsigma PNOZ s30

▶ **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

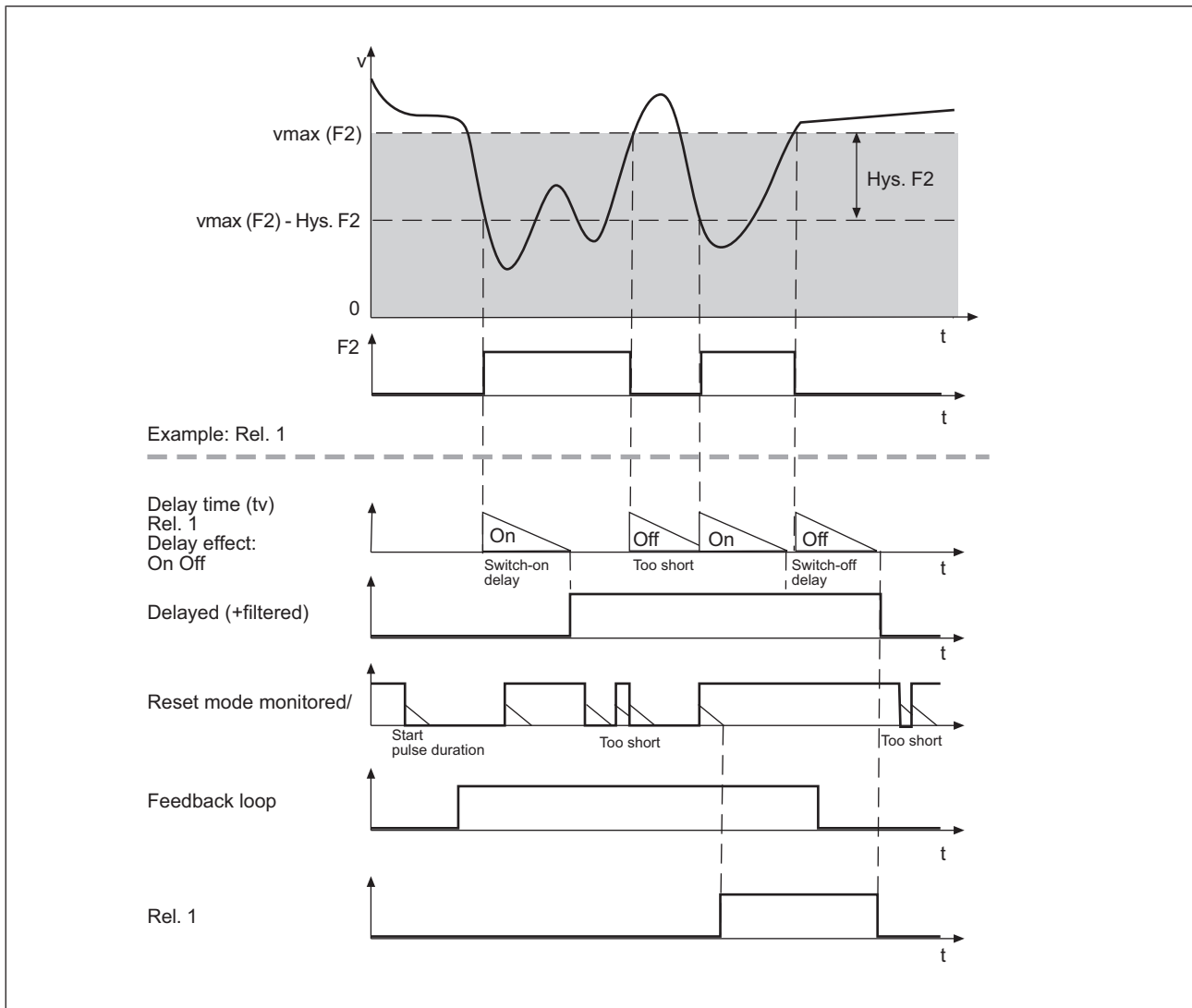
The semiconductor outputs can be operated in normally de-energised or normally energised mode.

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 /

Safety relays PNOZsigma PNOZ s30

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

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The following outputs are assigned to the switch functions:

- ▶ F1: Relay output Rel. 1
- ▶ F2: Relay output Rel. 2
- ▶ F3: Semiconductor output Out 1

The screenshot shows the configuration software interface for the PNOZsigma relay. It includes several configuration panels on the left and right, and a central parameter table.

Left Panel Settings:

- language: English
- input device: Sin/cos 1Vss
- global standstill: 2 Hz
- input device settings: 10 mHz-1 MHz
- f max (A/B): 20 kHz
- f max (Z):
- ratio: (0,0001-400,000:1)
- f(A/B):f(Z):
- position window width (1-24,900,000 Imp)
- Pos. 1:
- Pos. 2:
- Pos. 3:
- Pos. 4:
- incorrect direction (max. wrong) direction (1-24,900,000 Imp)
- direction left max. right
- direction right max. left
- name of configuration: Example 2
- CRC of configuration:

Central Parameter Table:

Hysteresis (0-50%)	F1	F2	F3	F4	F5	F6	F7	F8	F9
P0									
P1	Standstill	50 Hz	50 Hz						
P2	Standstill	3000 Hz	2800 Hz						
P3									
P4									
P5									
P6									
P7									
P8									
P9									
P10									
P11									
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			F3			
delay time effect (outputs)								
delay time 0 - 30s (outputs)								
reset mode	automatic	automatic			automatic			
output out logic					normally off			

Right Panel Settings:

- language: English
- input device: Sin/cos 1Vss
- global standstill: 2 Hz
- input device settings: 10 mHz-1 MHz
- f max (A/B): 20 kHz
- f max (Z):
- ratio: (0,0001-400,000:1)
- f(A/B):f(Z):
- position window width (1-24,900,000 Imp)
- Pos. 1:
- Pos. 2:
- Pos. 3:
- Pos. 4:
- incorrect direction (max. wrong) direction (1-24,900,000 Imp)
- direction left max. right
- direction right max. left
- name of configuration: Example 2
- CRC of configuration:

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:

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"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

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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.

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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

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▶ **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

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Chip card

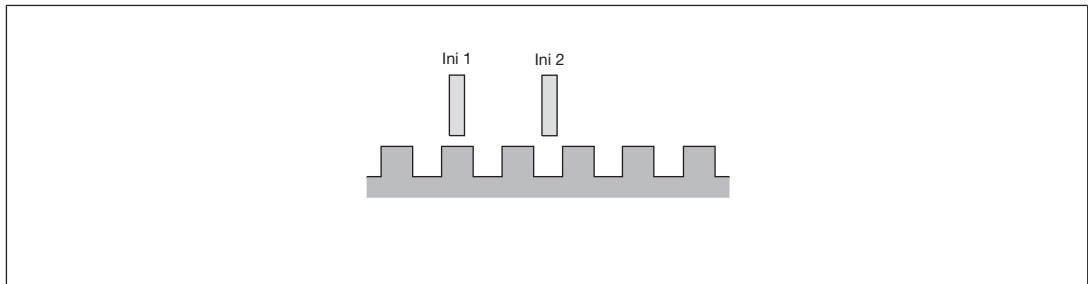
The set parameters, the name of the configuration, the check sum and the passwords are stored on the chip card (see section entitled "Using the chip card").

Input device types

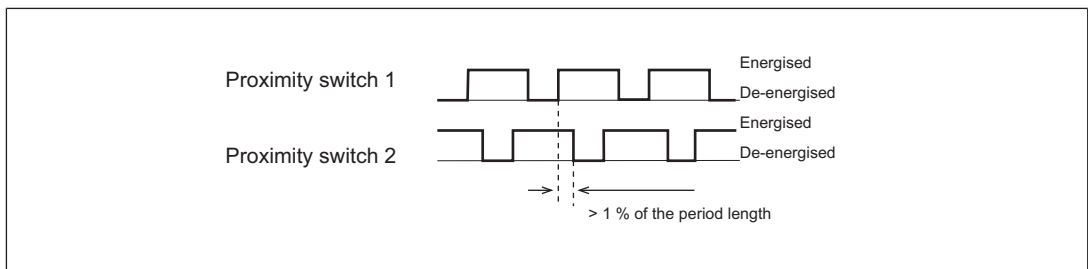
Proximity switch

- ▶ 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 f_{AB}/f_Z ("Encoder Settings" menu -> "Track Z" -> f_{AB}/f_Z Verh.)

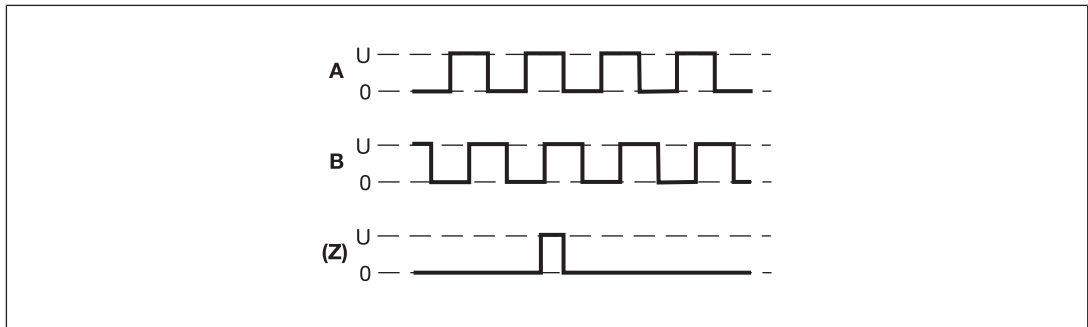
Please note the values stated in the technical details

Safety relays PNOZsigma PNOZ s30

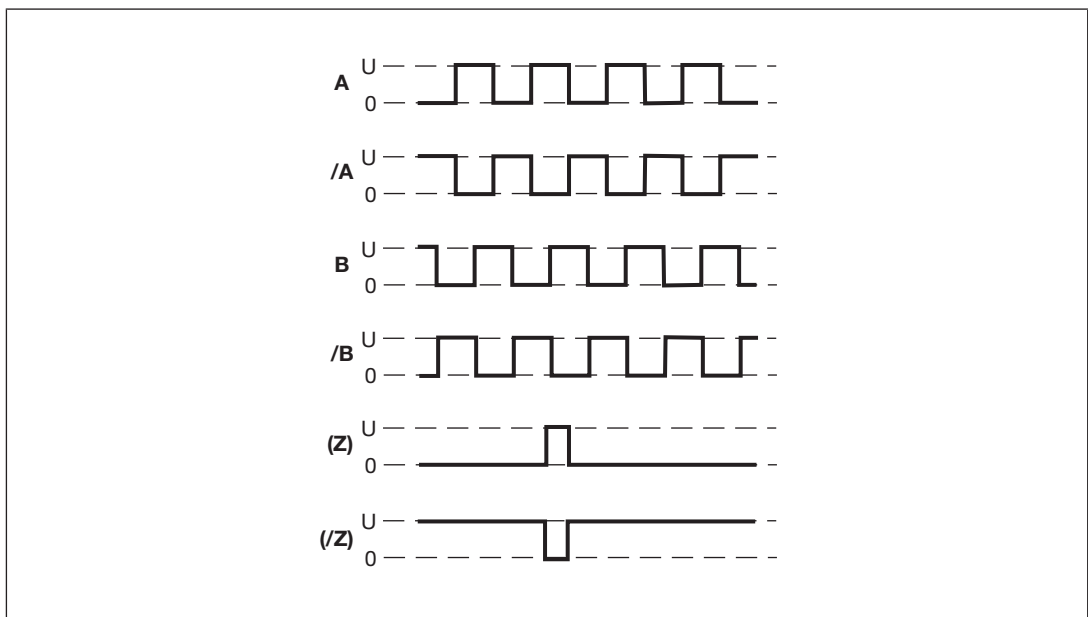
Output signals

Output signals TTL, HTL

- ▶ Single ended



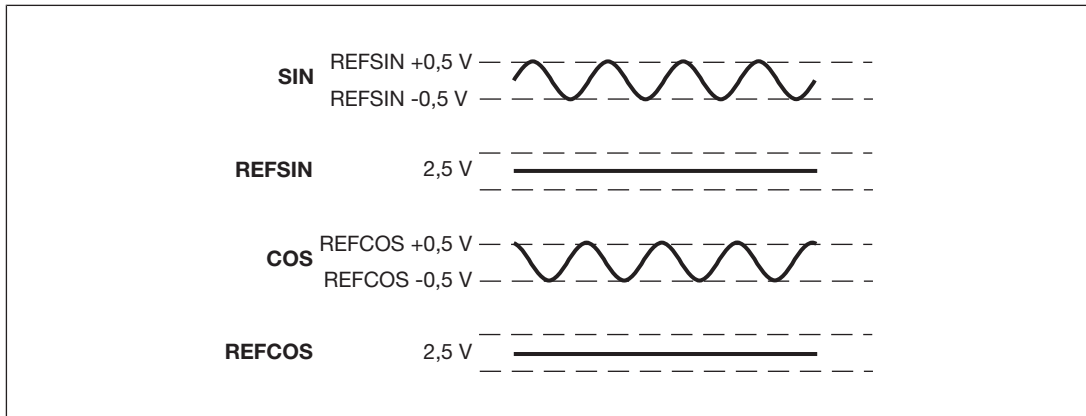
- ▶ Differential



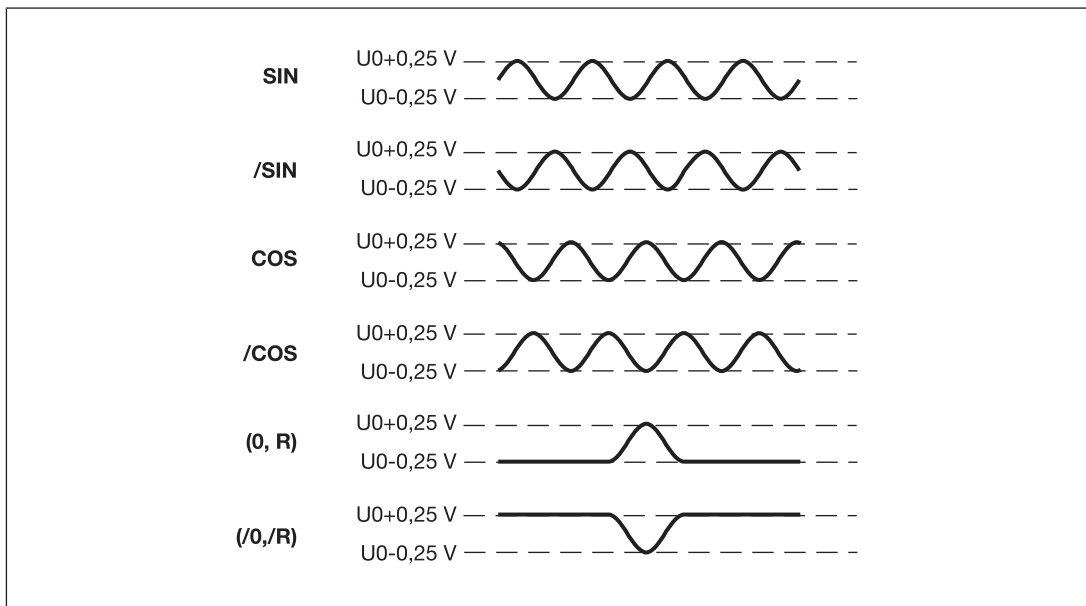
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Output signals Sin/Cos (1 Vss)

- ▶ 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:

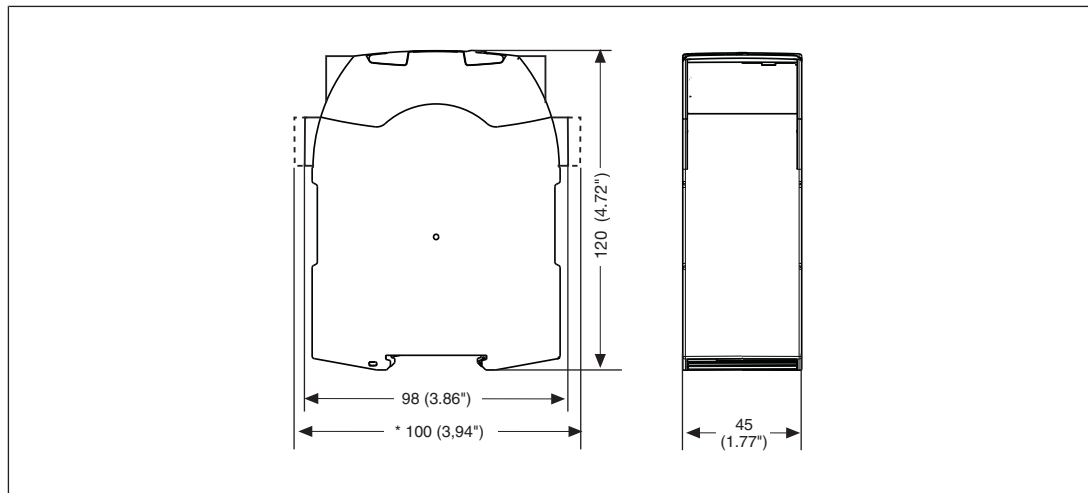
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module.
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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



Safety relays PNOZsigma PNOZ s30

Commissioning

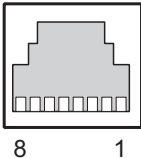
Wiring

General wiring guidelines

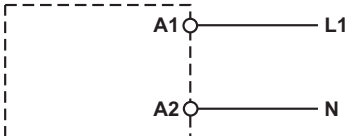
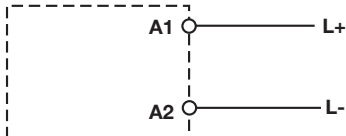
Note:

- ▶ 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
		

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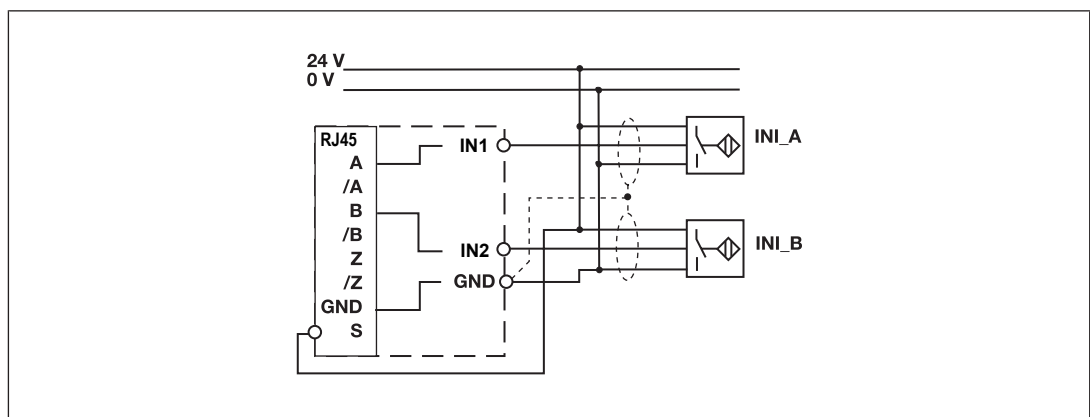
Connection of proximity switches

The following proximity switch combinations can be connected:

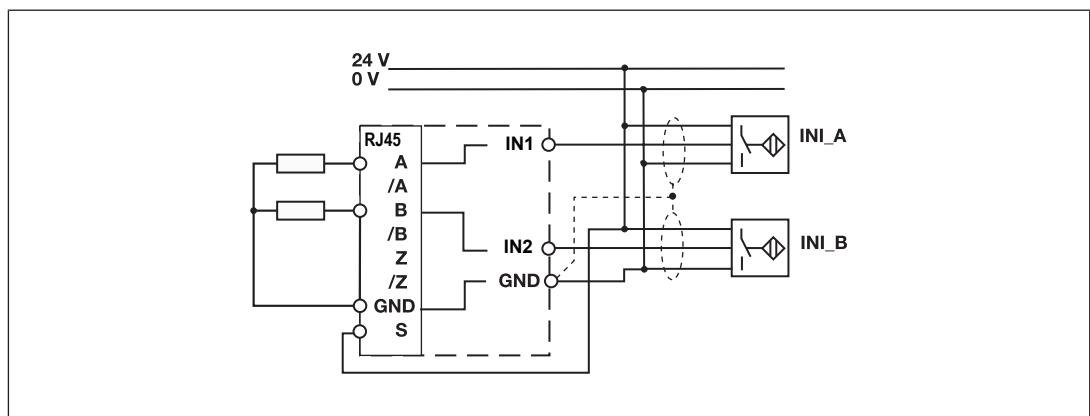
- ▶ A: pnp, B: pnp
- ▶ A: npn, B: npn
- ▶ A: pnp, B: npn
- ▶ A: npn, B: pnp

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.

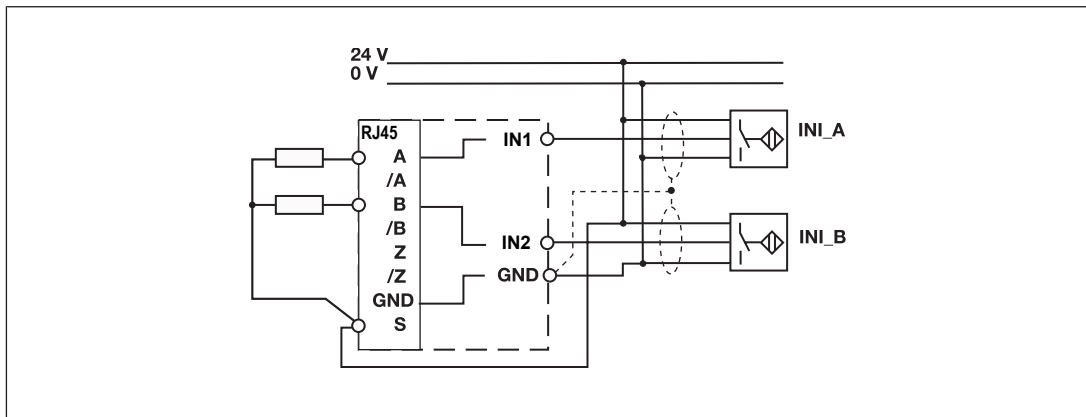


pnp proximity switch with resistor R = 10 kOhm



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npn proximity switch with resistor $R = 47\text{ k}\Omega$



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.

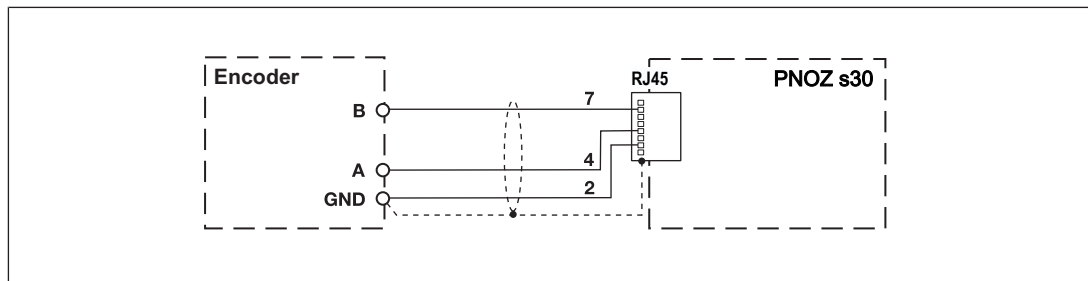
Connect rotary encoder to speed monitor

Encoder types:

- ▶ TTL single ended
- ▶ HTL single ended

Please note:

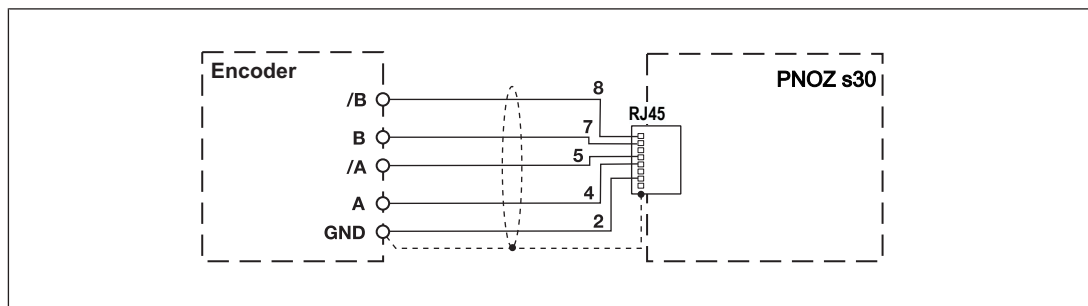
- ▶ Tracks/A, /B, Z and /Z must remain free



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Encoder types:

- ▶ TTL Differential
- ▶ HTL differential
- ▶ sin/cos 1 Vss
- ▶ Hiperface



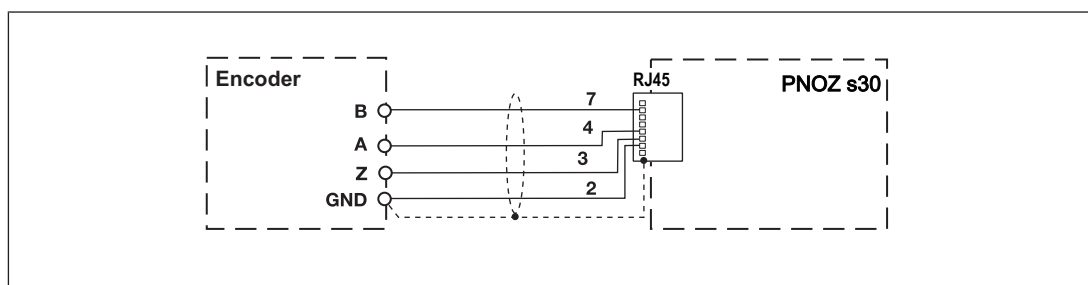
Connect rotary encoder with Z index to speed monitor

Encoder types:

- ▶ TTL single ended Z Index
- ▶ HTL single ended Z Index

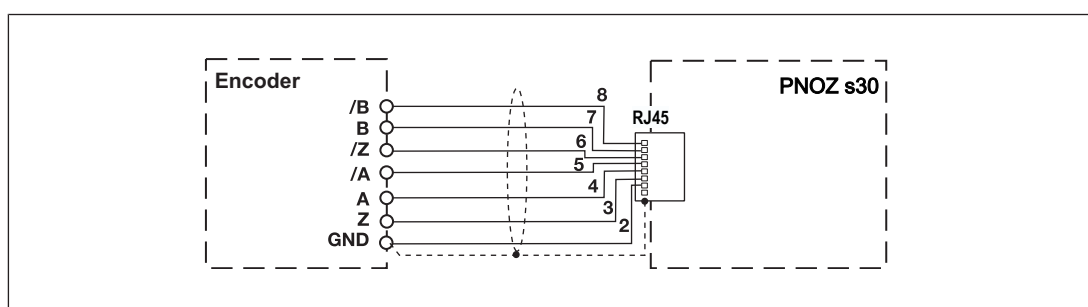
Please note:

- ▶ Tracks /A, /B and /Z must remain free



Encoder types:

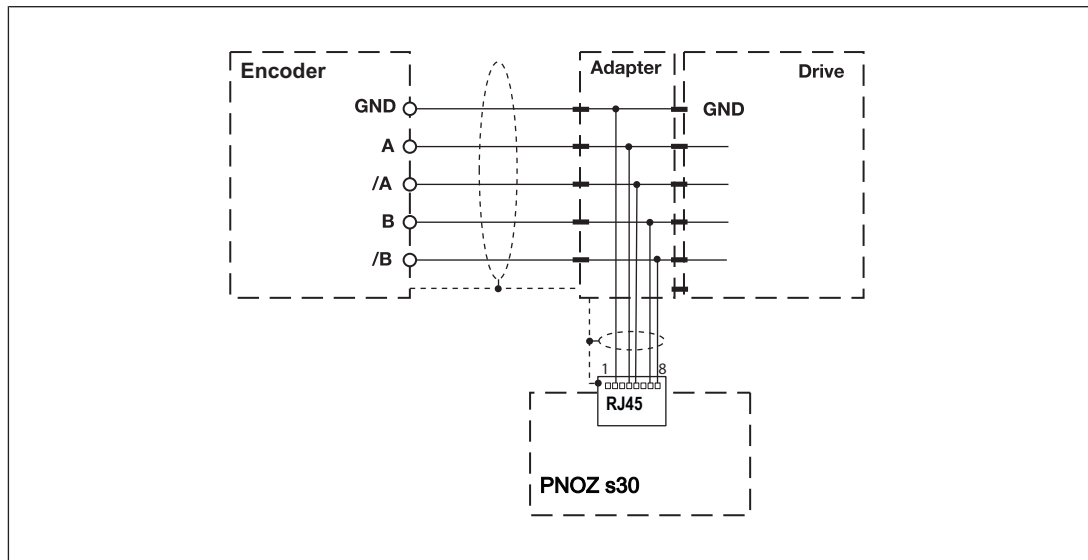
- ▶ TTL differential + Z Index
- ▶ HTL differential + Z Index
- ▶ sin/cos 1 Vss Z Index



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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

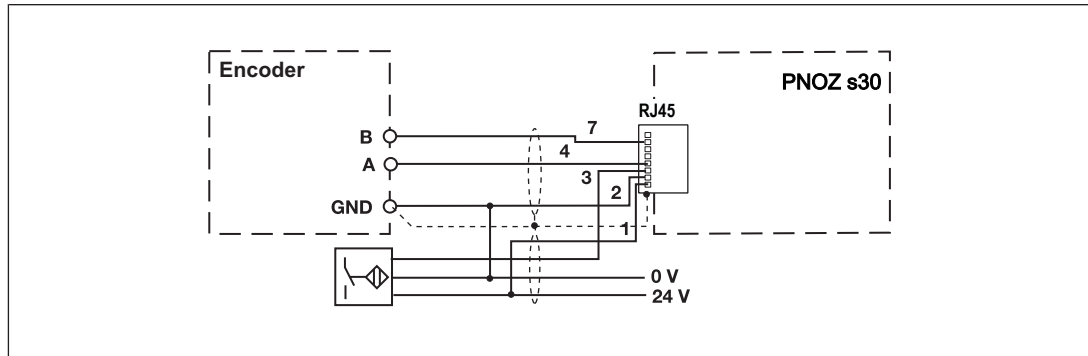
When connecting the encoders and proximity switches, please refer to the chapter entitled "EMC-compliant wiring".

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.

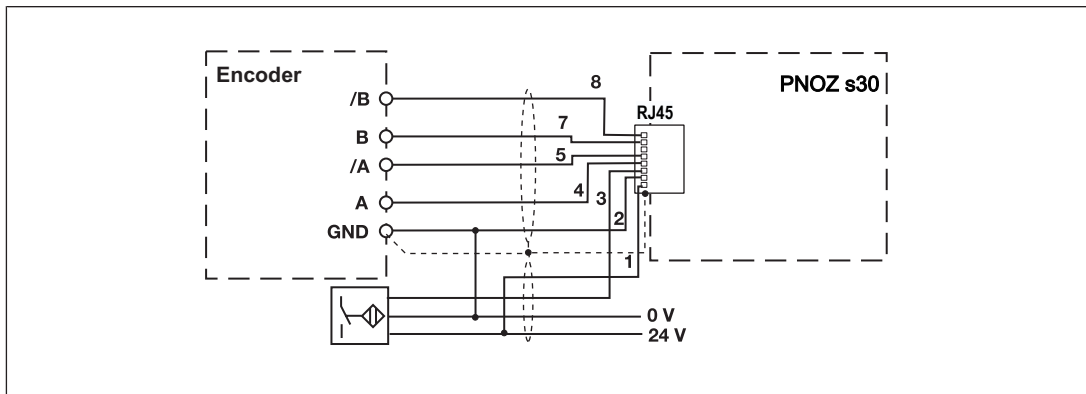


Sensor types:

- ▶ 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!!



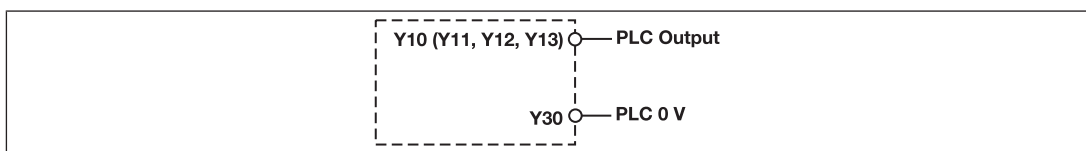
Reset circuit

Automatic start	Monitored start
automatic start must only be configured No wiring necessary!	

Feedback circuit

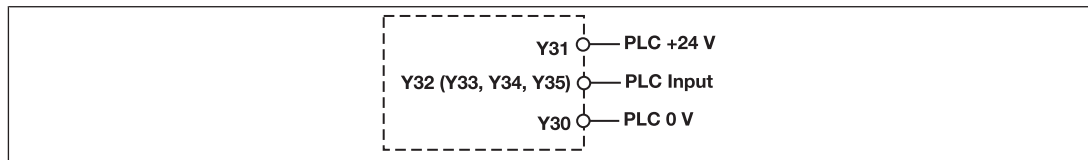
No feedback loop monitoring	Contacts from external contactors

Select inputs



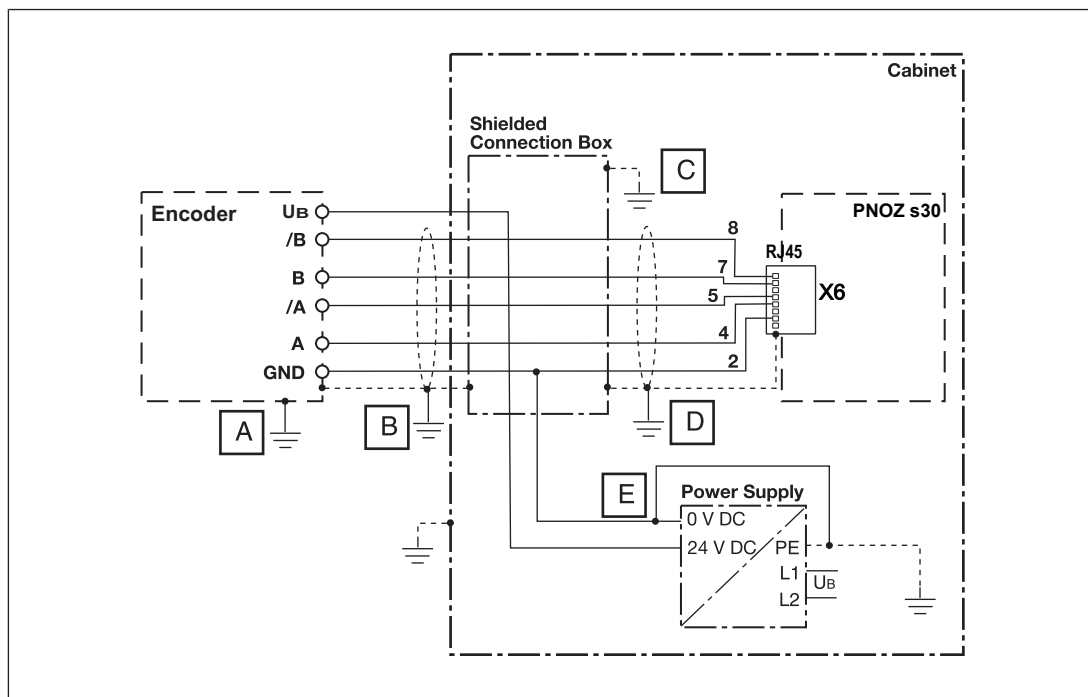
Safety relays PNOZsigma PNOZ s30

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:

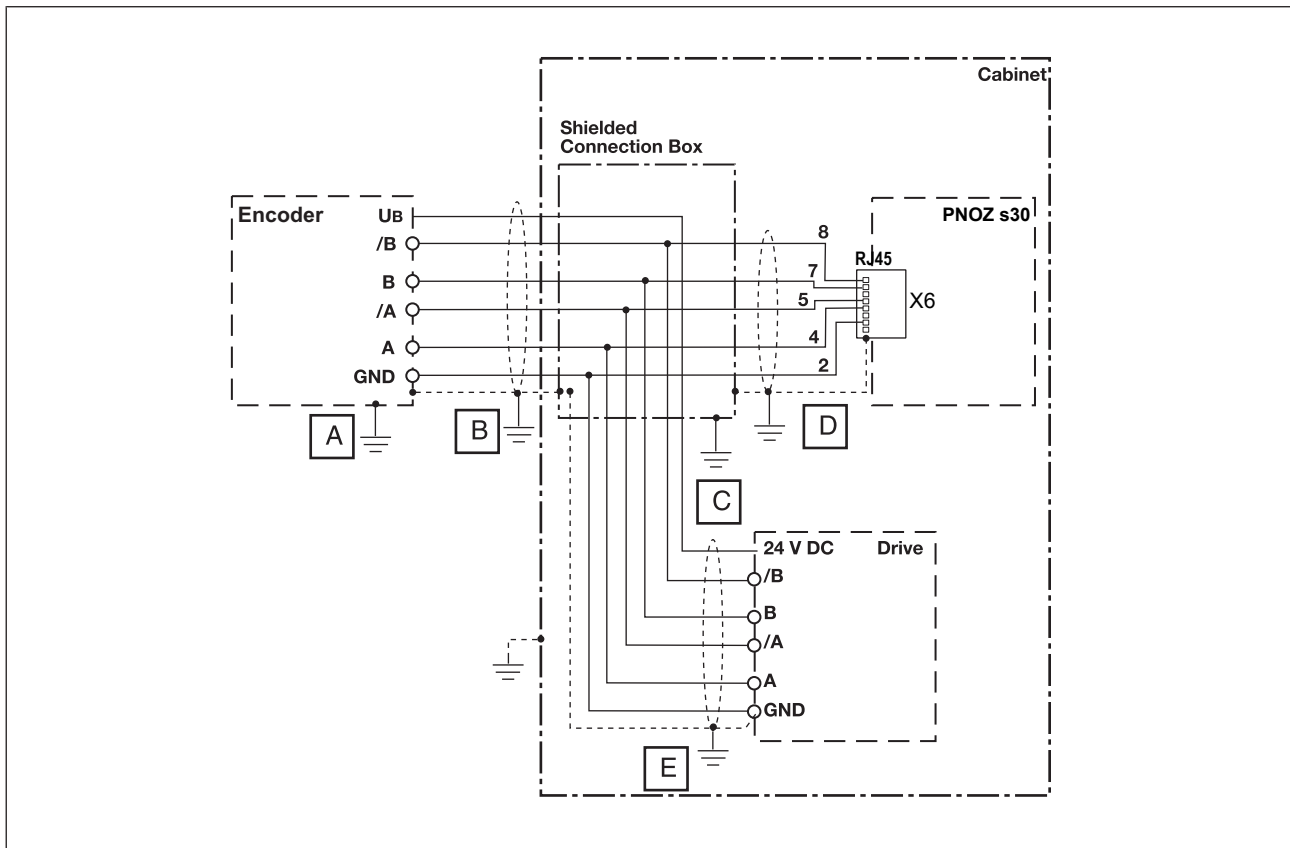
A or B or C or D or E

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:

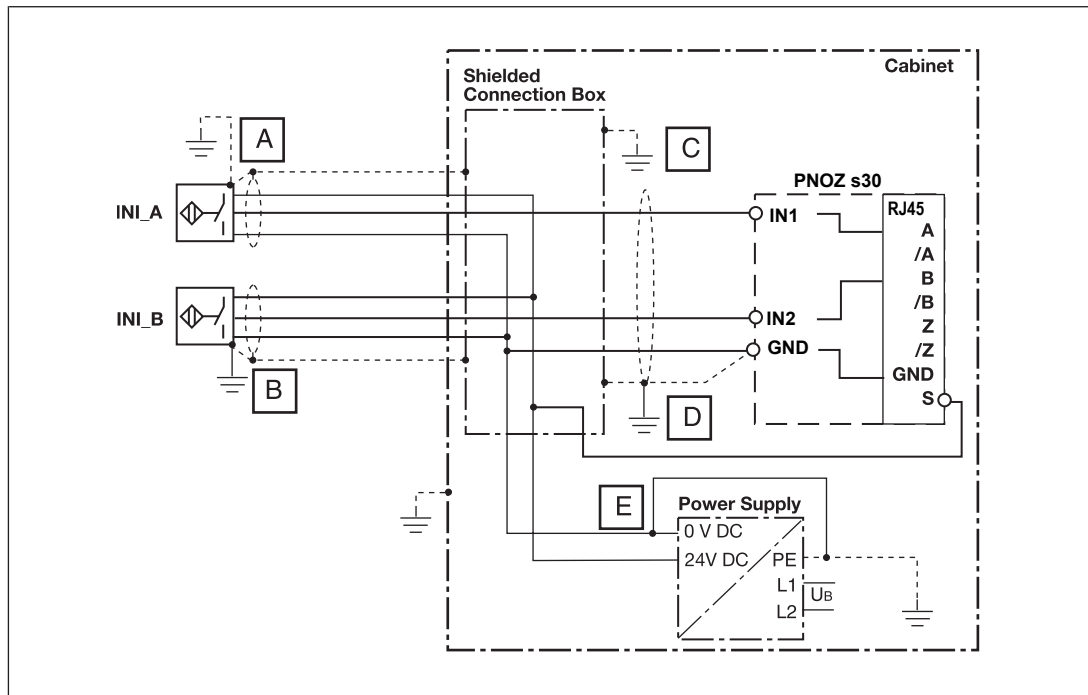
A or B or C or D or E

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.

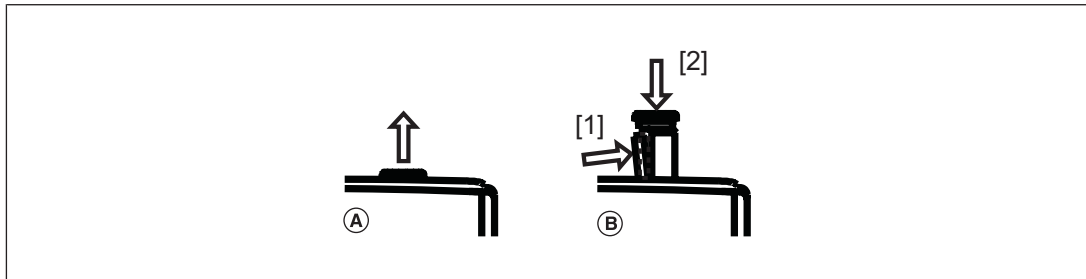
Create configuration overview

For a better overview, before entering the configuration values we recommend that they are entered in the form *PNOZ_s30_Config_Overview*.

language	input device										global standstill (10 mHz - 1 MHz)
delay time start-up (0-600s)	Hysteresis (0-50%)	F1	F2	F3	F4	F5	F6	F7	F8	F9	input device settings (10 mHz-1 MHz)
units	P0										f max (A/B)
conversion	P1										f max (Z)
mode select input	P2										ratio (0,0001-400.000:1)
Sel 1 (Y10) Sel 2 (Y11) Sel 3 (Y12) Sel 4 (Y13)	P3										position window width (1-24.900.000 Imp)
	P4										Pos. 1
	P5										Pos. 2
	P6										Pos. 3
delay time select input (0-30s)	P7										Pos. 4
assign outputs (functions) delay time effect (outputs) delay time 0 - 30s (outputs) reset mode output out logic	P8										incorrect direction (max. wrong) direction (1-24.900.000 Imp)
	P9	Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)		direction left max. right
	P10										direction right max. left
	P11										name of configuration
	P12										CRC of configuration
	P13										
	P14										
	P15										

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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**



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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.

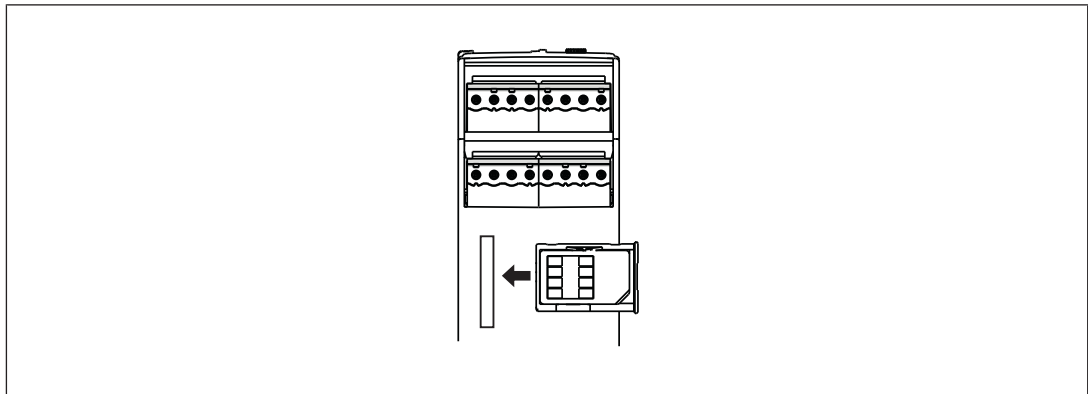
When the chip card is inside the unit:

- ▶ 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**.

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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 configuration to SIM: No?		Write configuration 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 configuration to SIM: No?		Insert rewritable SIM Card!

Do not allow data to be written to the chip card


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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 containing the data from device 1.
- ▶ Insert chip card in device 2.
- ▶ Confirm the message **Load SIM Yes?**.
The data is transferred.

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Duplicate chip card

You can also create copies of a chip card and its data.

Proceed as follows:

- ▶ Remove chip card containing 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.

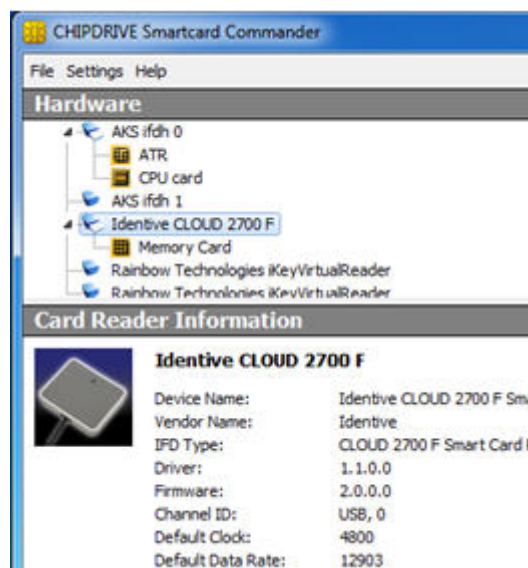
Save configuration with Software SmartCardCommander

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**.



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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.

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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

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- ▶ **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

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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

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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)

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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	<p>No encoder selected:</p> <ul style="list-style-type: none"> - Undefined <p>Proximity switch (Ini):</p> <ul style="list-style-type: none"> - Initiator A: pnp B: pnp - Initiator A: npn B: pnp - Initiator A: pnp B: npn - Initiator A: npn B: npn <p>Rotary encoder:</p> <p>TTL</p> <ul style="list-style-type: none"> - TTL differential (A, /A, B, /B) - TTL single ended (A, B) <p>TTL with Z-Index</p> <ul style="list-style-type: none"> -TTL diff. Z index (A, /A, B, /B, Z, /Z) - TTL single Z index (A, B, Z) <p>HTL</p> <ul style="list-style-type: none"> - HTL differential (A, /A, B, /B) - HTL single ended (A, B) <p>HTL with Z-Index</p> <ul style="list-style-type: none"> - HTL diff. Z index (A, /A, B, /B, Z, /Z) - HTL single Z index (A, B, Z) <p>Sin/Cos 1 Vss</p> <ul style="list-style-type: none"> - sin/cos 1 Vss (A, /A, B, /B) <p>Sin/Cos 1 Vss with Z-Index</p> <ul style="list-style-type: none"> - sin/cos 1 Vss Z Index (A, /A, B, /B, Z, /Z) <p>Hiperface</p> <ul style="list-style-type: none"> - Hiperface (A, /A, B, /B)

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Level	Designation on the display	Description	Settings
			<p>Rotary encoder + pnp proximity switch</p> <p>TTL + pnp proximity switch *</p> <ul style="list-style-type: none"> - TTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - TTL single (A, B), Z Freq Inipnp (Z) <p>HTL + pnp proximity switch *</p> <ul style="list-style-type: none"> - HTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - HTL single (A, B), Z Freq Inipnp (Z) <p>sin/cos 1 Vss + pnp proximity switch *</p> <ul style="list-style-type: none"> - sin/cos 1 Vss (A, /A, B, /B), Z Freq Inipnp (Z) <p>Hiperface + pnp proximity switch *</p> <ul style="list-style-type: none"> - Hiperface (A, /A, B, /B), Z Freq Inipnp (Z) <p>* Alternatively, a track from an HTL encoder can also be used instead of a pnp proximity switch</p> <p>The configuration is the same as with the pnp proximity switch as Z-frequency monitoring.</p>
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	

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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)	

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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

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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	

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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	<p>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).</p> <p>When used as an error output, the following applies: Fault: Output off No error: Output on</p> <p>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).</p> <p>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</p>	-Off -F1...F9 -F2-F3 -F4-F5 -F6-F7 -F8-F9 -error
1	Start mode	Select start behaviour	

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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		

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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

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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

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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

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Level	Menu designation	Description	Display/Settings
1	Error Stack Entries	<p>Error stack entries</p> <p>Up to 20 error stack entries are displayed</p> <p>Repairable errors: Level 2, 3 and 4 (can be rectified by user)</p> <p>System errors: Level 2 and 3 (internal error, information for Pilz Service).</p>	<p>Repairable error:</p> <p>Level 2:</p> <p>1st line: Seq. No. "Err.:", error number</p> <p>2nd + 3rd line: Plain text to describe error for the user</p> <p>Level 3:</p> <p>1st line: Seq. No. "Repairable"</p> <p>2nd line: "System time"</p> <p>3rd line: System time when the error occurred</p> <p>Level 4:</p> <p>Information for Pilz Service</p> <p>System errors:</p> <p>Level 2:</p> <p>1st line: Seq. No. "Err.:", error number</p> <p>2nd line: "System Error"</p> <p>3rd line: System time when the error occurred</p> <p>Level 3:</p> <p>Information for Pilz Service</p>
1	Input Module SW Version Va.b	For internal purposes only	
1	Main Unit SW Version Va.b	For internal purposes only	

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Level	Menu designation	Description	Display/Settings
-	Actual Errors	<p>Up to 8 errors are displayed.</p> <p>Repairable errors: Level 2, 3 and 4 (can be rectified by user)</p> <p>System errors: Level 2 and 3 (internal error, information for Pilz Service).</p> <p>The error messages can be hidden with "Escape".</p>	<p>Repairable error:</p> <p>Level 2:</p> <p>1st line: Seq. No. "Err.:", error number</p> <p>2nd + 3rd line: Plain text to describe error for the user</p> <p>Level 3:</p> <p>1st line: Seq. No. "Repairable"</p> <p>2nd line: "System time"</p> <p>3rd line: System time when the error occurred</p> <p>Level 4:</p> <p>Information for Pilz Service</p> <p>System errors:</p> <p>Level 2:</p> <p>1st line: Seq. No. "Err.:", error number</p> <p>2nd line: "System Error"</p> <p>3rd line: System time when the error occurred</p> <p>Level 3:</p> <p>Information for Pilz Service</p>
-	Error Faulty Signal: A/A B/B Z/Z	<p>Error message: Incorrect signal at one or more tracks.</p> <p>The message</p> <ul style="list-style-type: none"> - is continually updated. - can be ignored temporarily. 	
-	AB frequency deviation	<p>Error message: Frequency difference between the proximity switches on tracks A and B</p> <p>The message</p> <ul style="list-style-type: none"> - is continually updated - can be ignored temporarily 	
-	Chip card messages		

Safety relays PNOZsigma PNOZ s30

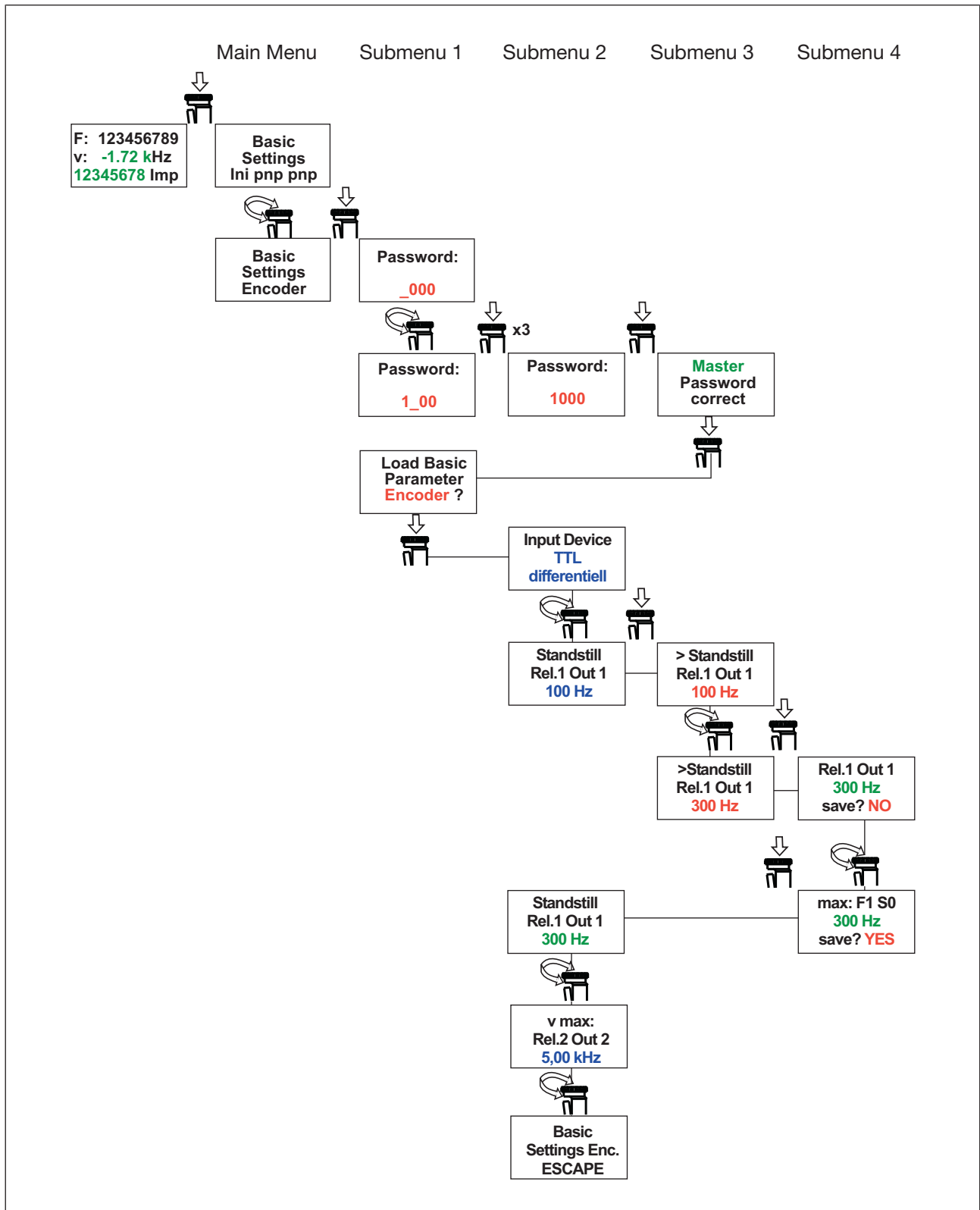
Level	Menu designation	Description	Display/Settings
-	Please insert SIM Card!	Appears when the device is operated without a chip card or when a defective chip card is inserted, appears again when parameters are changed. Info: The message disappears after 30 s or by pressing the rotary knob	
-	Please 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 mm ² , 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1,00 mm ² , 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,20 - 1,50 mm ² , 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 mm ² , 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.

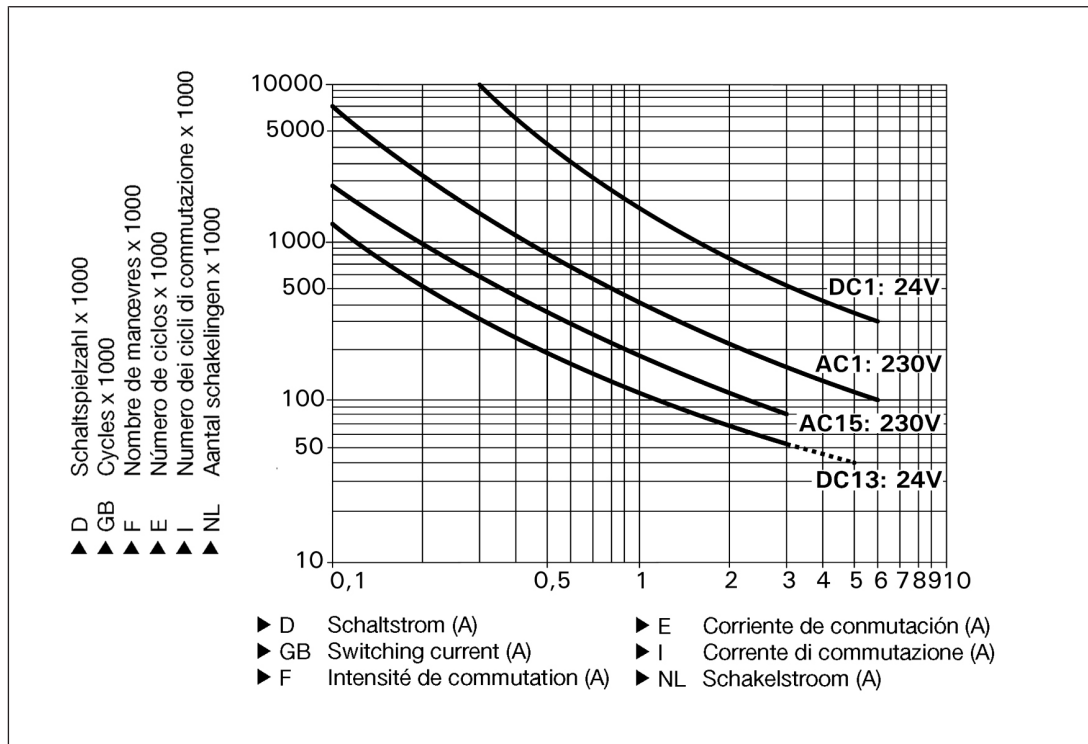
The PFH value depends on the switching frequency and the load on the relay output. If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates 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 1V_{ss}, reference voltage
- ▶ Sin/Cos output signals 1V_{ss}, 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-trying 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

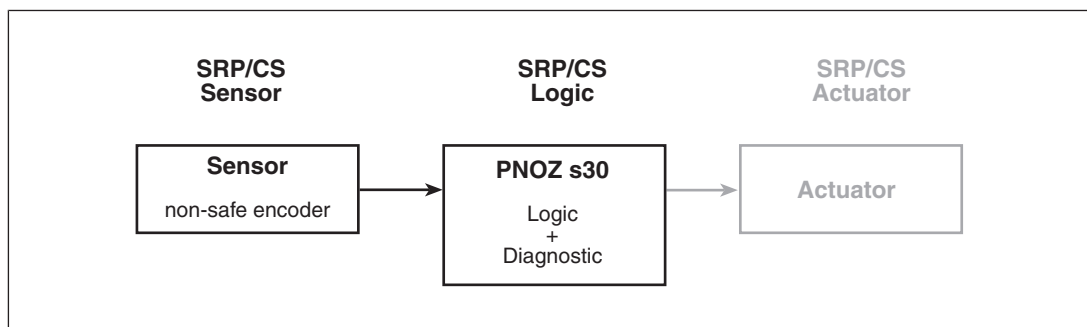
Permitted encoder types:

- ▶ 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	PL d (Cat. 2)	2
Speed range		
Direction		
Standstill		
Position		

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 1V_{ss}, reference voltage
- ▶ Sin/Cos output signals 1V_{ss}, differential

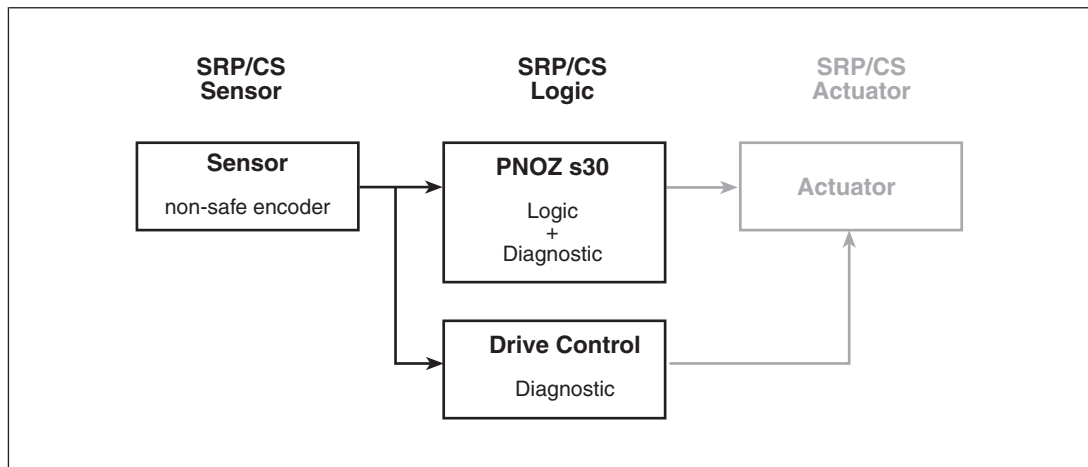
Requirements of the drive controller

- ▶ Parameters for the control loops and motor control must be set in such a way as to guarantee stable 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	PL d (Cat. 2)	2
Speed range		
Direction		
Standstill		
Position		

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

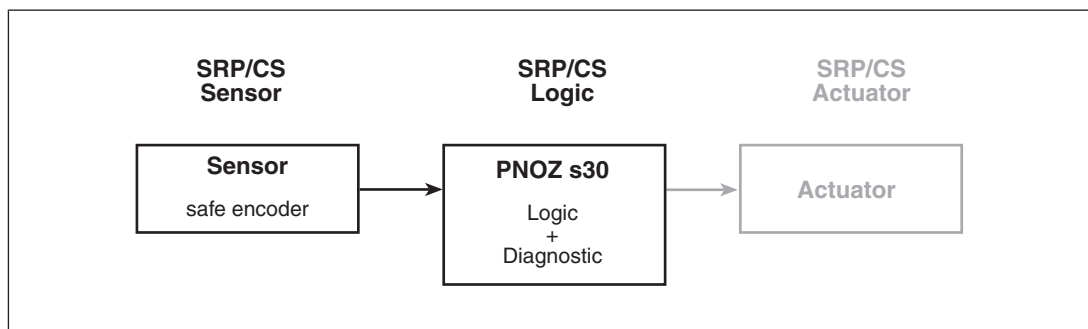
Permitted encoder types:

- ▶ 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	PL e (Cat.4)	3
Speed range		
Direction		
Standstill		
Position		

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:

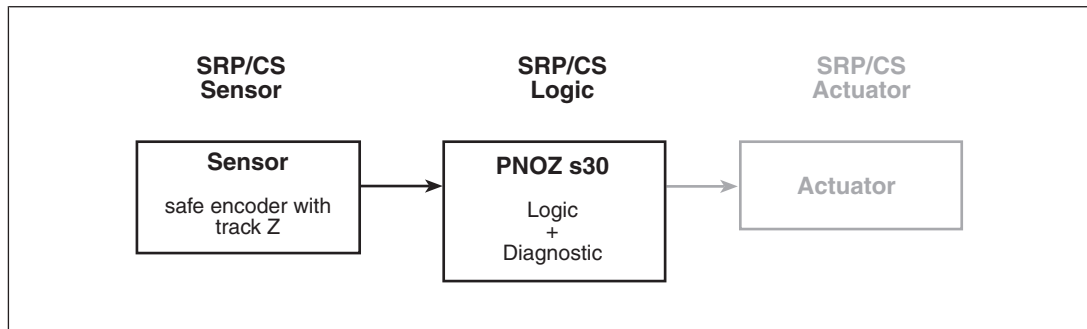
- ▶ Rotary safe encoder
- ▶ Linear safe encoder

Permitted output signals:

- ▶ Square output signals TTL, differential with Z index
- ▶ Square output signals HTL, differential with Z index
- ▶ Sin/Cos output signals 1V_{ss}, reference voltage with Z index
- ▶ Sin/Cos output signals 1V_{ss}, 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

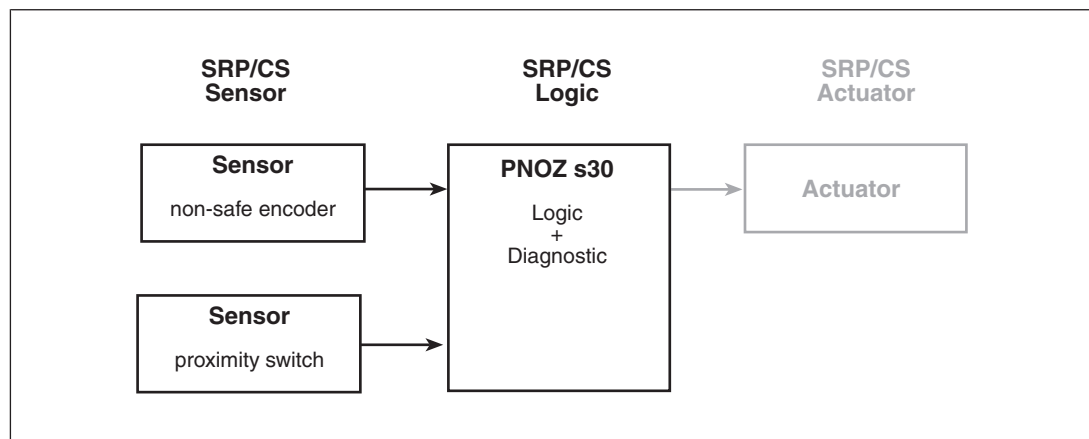
Permitted encoder types:

- ▶ 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 (**f_{AB}/f_Z Verh.** setting in the menu) and is calculated as follows:

- ▶ when **f_{AB}/f_Z Verh.** ≥ 1.0
 $f_Z = 70$ mHz or $f_{AB} = (f_{AB}/f_Z) \times 70$ 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 (**f_{AB}/f_Z Verh.** setting in the menu) and is calculated as follows:

- ▶ when **f_{AB}/f_Z Verh.** ≥ 1.0
7.5 Z-pulses or $7.5 \times (f_{AB}/f_Z)$ AB-pulses
- ▶ when **f_{AB}/f_Z 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:

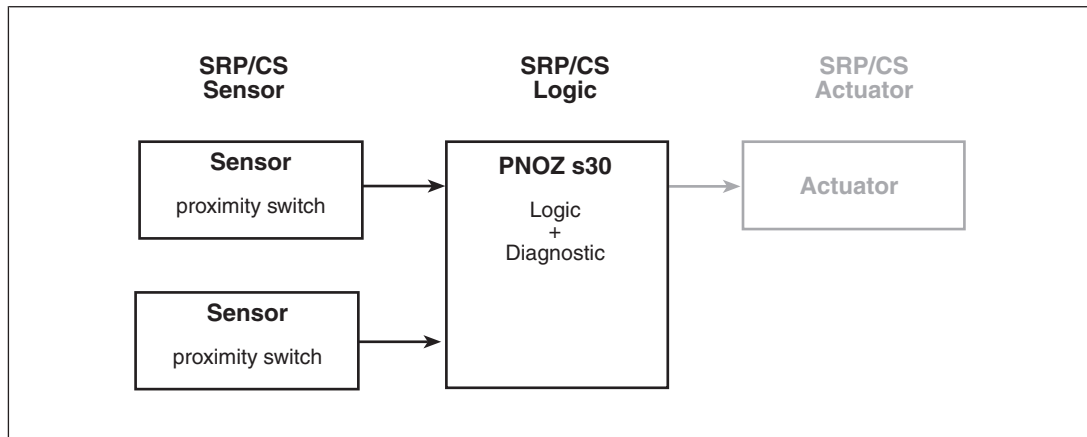
- ▶ Inductive proximity switches

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:

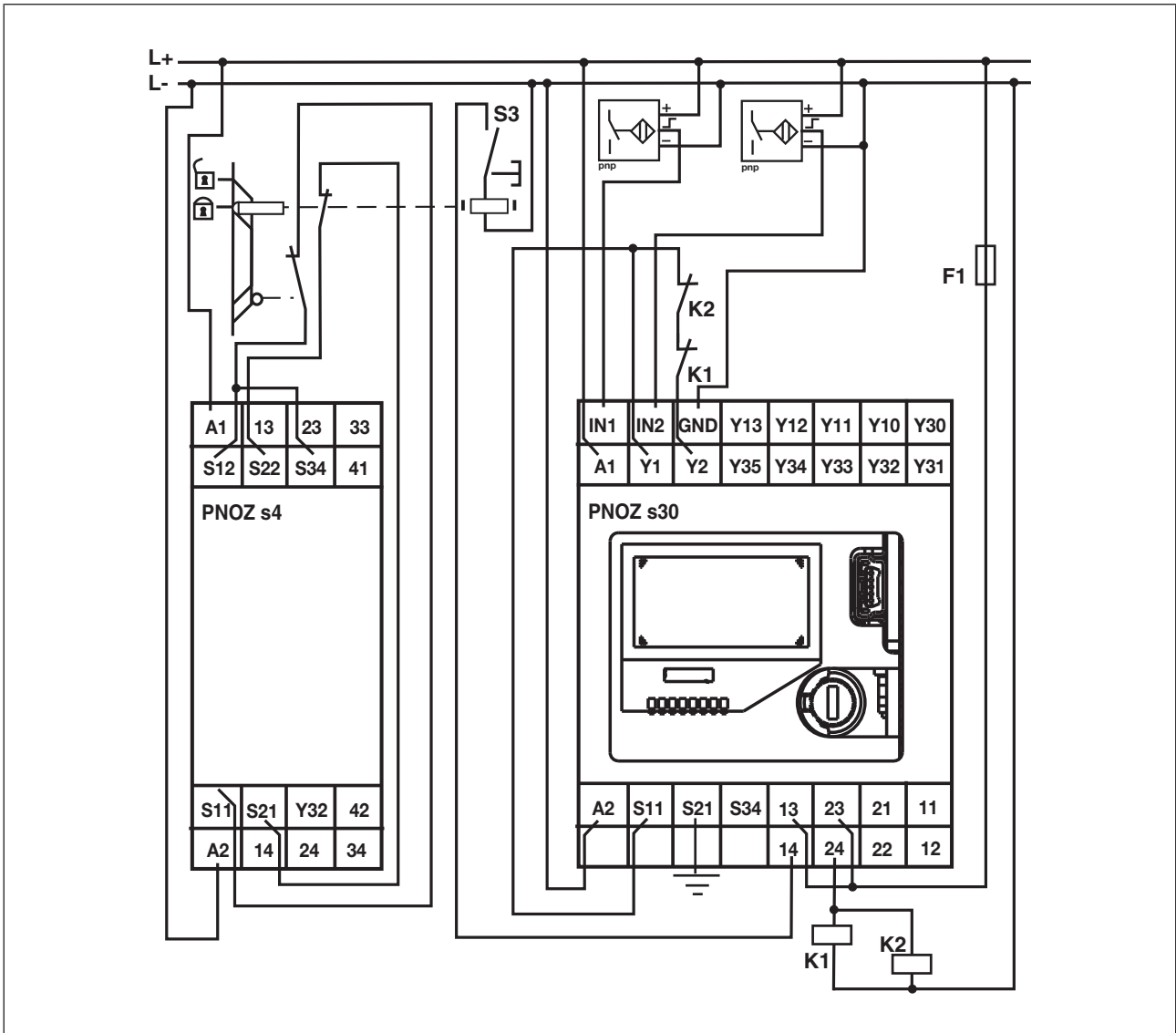
Common cause failures (CCF) are possible for the sensor subsystem. An appropriate analysis must be carried out.

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

Connection



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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)

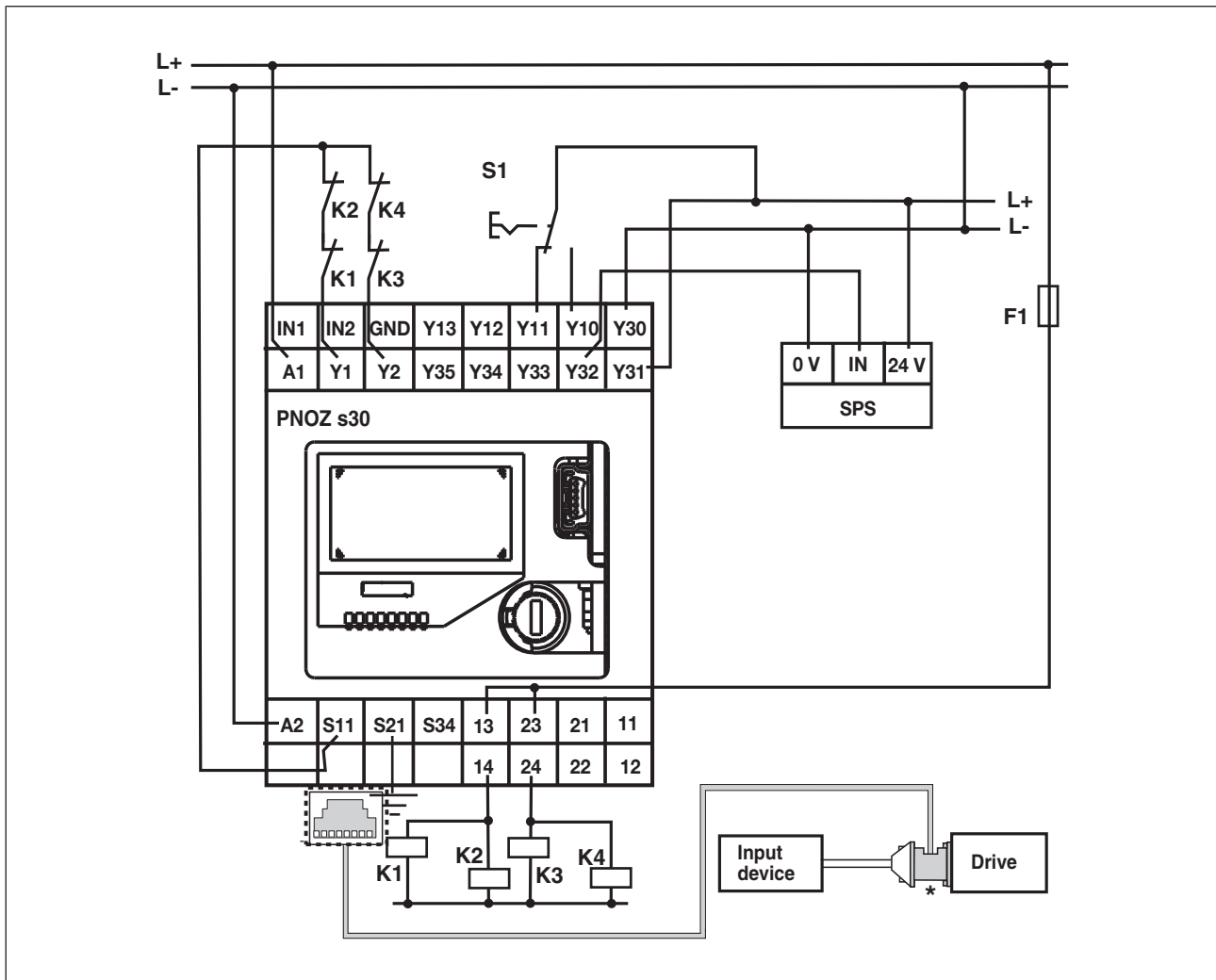
Safety relays PNOZsigma PNOZ s30

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%)		<table border="1"> <thead> <tr> <th></th> <th>F1</th> <th>F2</th> <th>F3</th> <th>F4</th> <th>F5</th> <th>F6</th> <th>F7</th> <th>F8</th> <th>F9</th> </tr> </thead> <tbody> <tr> <td>P0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P1</td> <td>Standstill</td> <td>50 Hz</td> <td>50 Hz</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P2</td> <td>Standstill</td> <td>3000 Hz</td> <td>2800 Hz</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P11</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P13</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P14</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P15</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>										F1	F2	F3	F4	F5	F6	F7	F8	F9	P0										P1	Standstill	50 Hz	50 Hz							P2	Standstill	3000 Hz	2800 Hz							P3										P4										P5										P6										P7										P8										P9										P10										P11										P12										P13										P14										P15										input device settings (10 mHz-1 MHz)		f max (A/B)		20 kHz		f max (Z)			
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Safety relays PNOZsigma PNOZ s30

Connection



* The PNOZ msi adapters are available from Pilz as accessories

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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

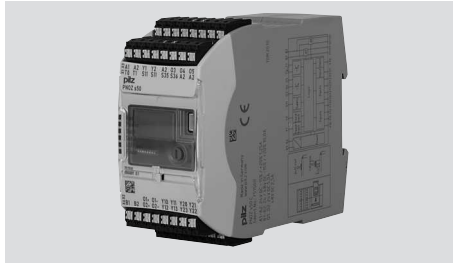
Accessories

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

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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 VDCSupply 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

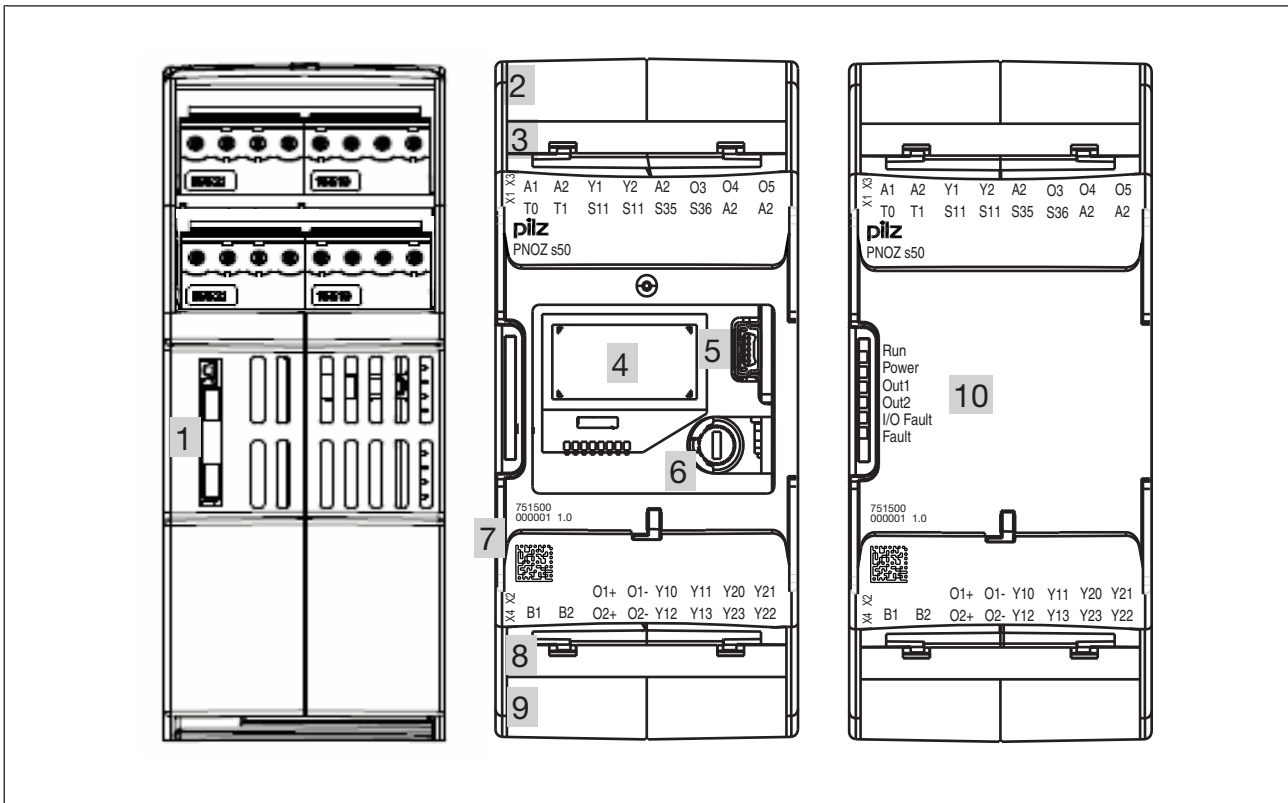


Fig.: Left: Side view, centre: Front view without cover, right: Front view with cover

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

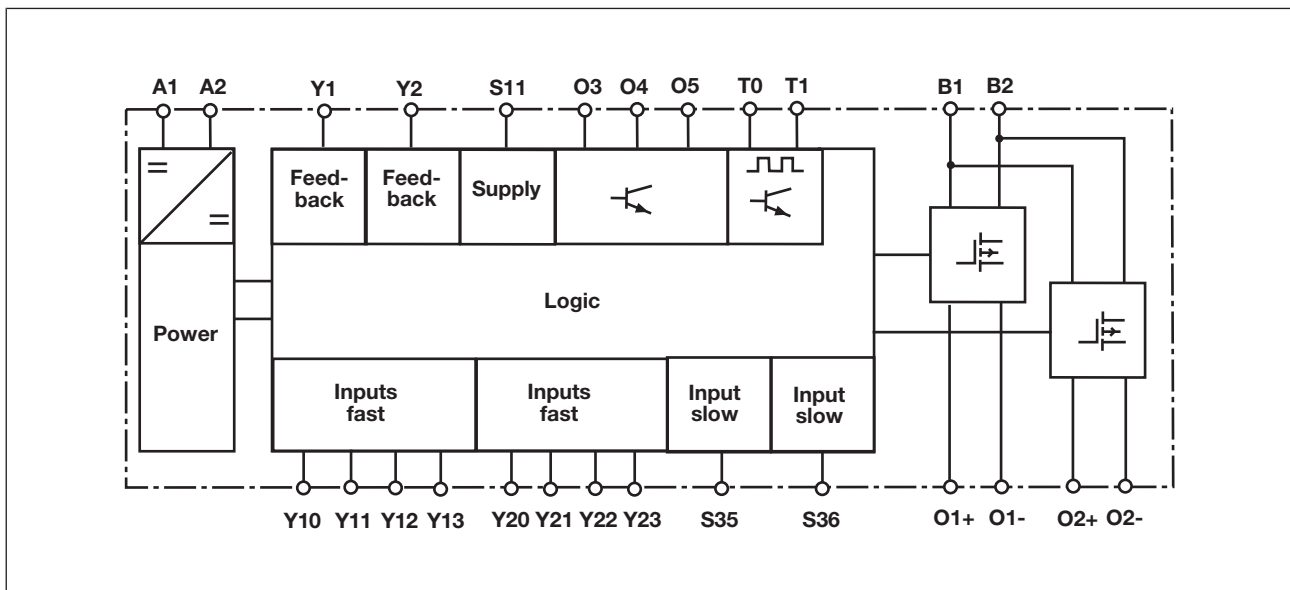


Fig.: Block diagram

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).

Safety relays PNOZsigma PNOZ s50

Both poles are switched (e.g. O1+, O1-).

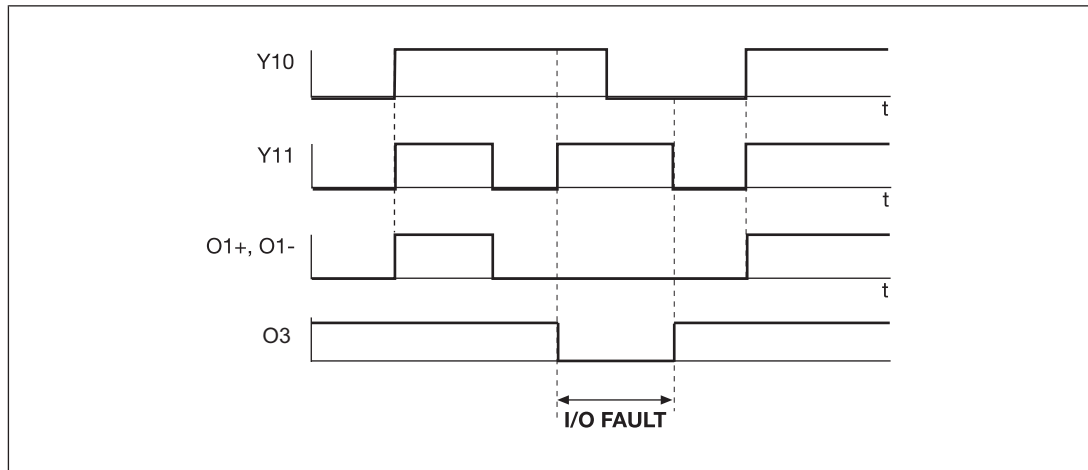


Fig.: Start-up condition for inputs Y10/Y11

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.

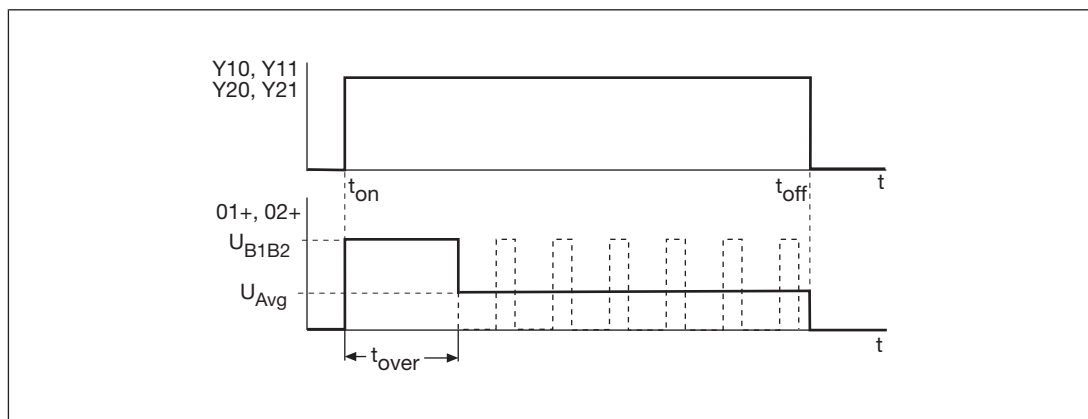


Fig.: Switching the power circuits on and off

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.

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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

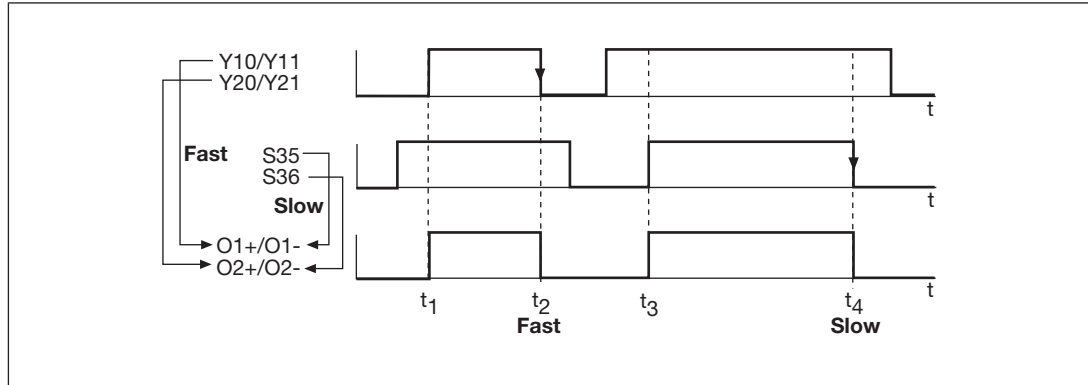


Fig.: Conditions for fast and slow shutdown

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.

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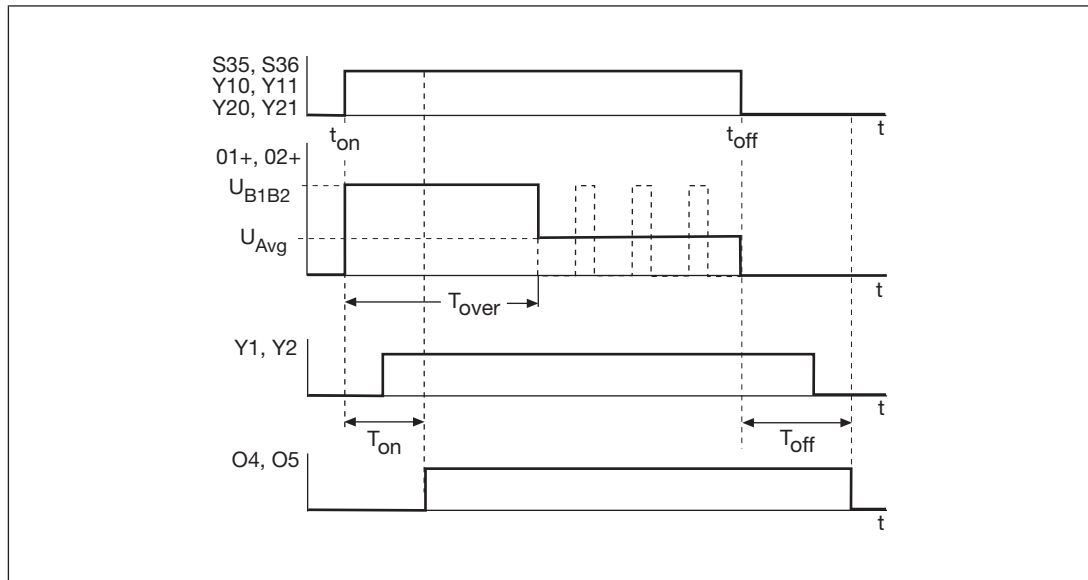


Fig.: Ventilation and application time

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

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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

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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

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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 \[!\[\]\(fa6f3af6bfa46c5d4a2d362681095beb_img.jpg\) 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

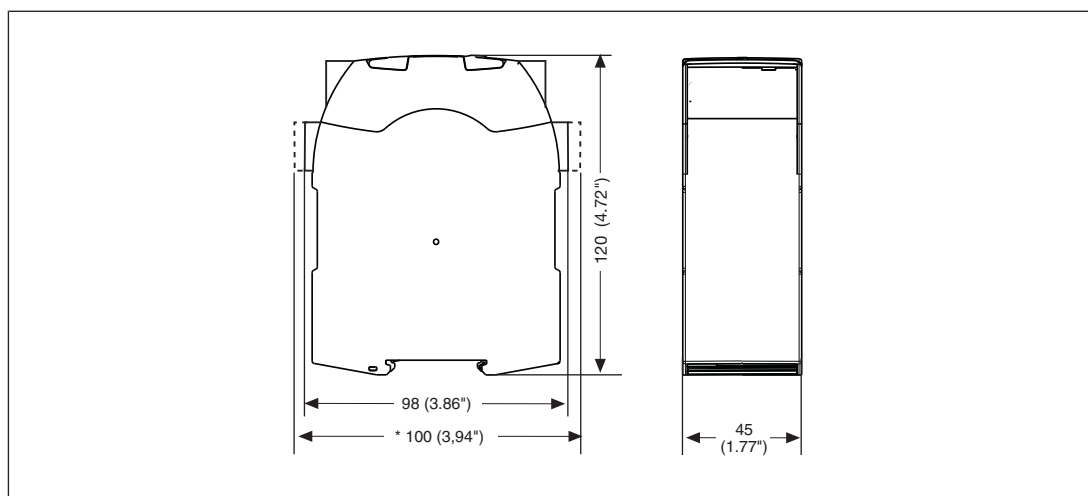
General installation guidelines

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



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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.

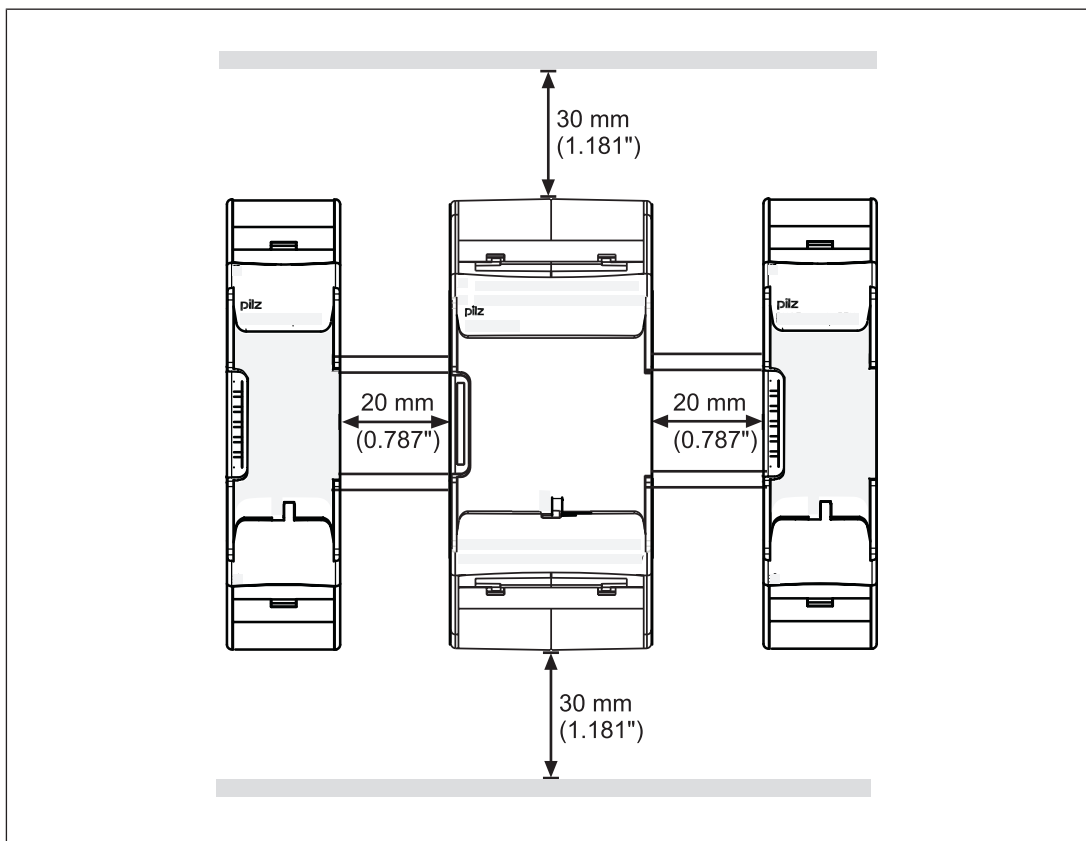


Fig.: Mounting distances for the PNOZ s50

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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.

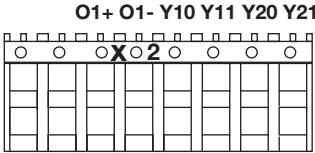
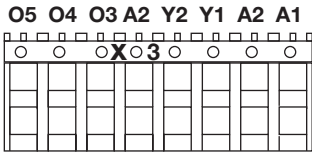
Possible remedy: Exclude the error by using separate multicore cable for supply voltages

- ▶ Use appropriate wiring to exclude short circuits between the outputs!

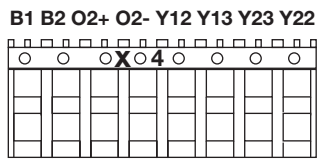
Pin assignment

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

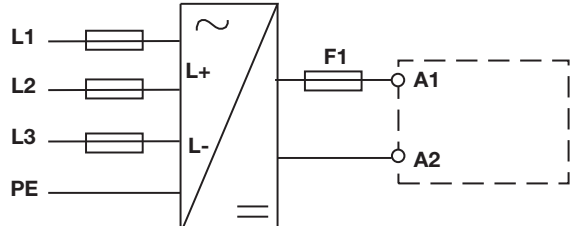
Safety relays PNOZsigma PNOZ s50

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

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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	
<p>Please note: The supply voltage must be protected with a fuse.</p> <p>Fuse F1: Circuit breaker, 24 VDC, 4 A, characteristic B/C</p>	

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.

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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	
<p>Please note: The supply voltage must be protected with a fuse.</p> <p>Fuse F1: Circuit breaker 24 V, 48 VDC, 10 A, characteristic B/C</p>	

Power circuit

Power circuit	
Dual-pole outputs	

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Inputs

Fast shutdown

<p>Activation via safe single-pole outputs</p>	
<p>Link Y12 – Y13 Link Y22 – Y23</p> <p>PLC: Safety control system</p>	
<p>Activation via safe dual-pole outputs</p>	
<p>Link Y10 – Y11 Link Y20 – Y21</p> <p>PLC: Safety control system</p>	

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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

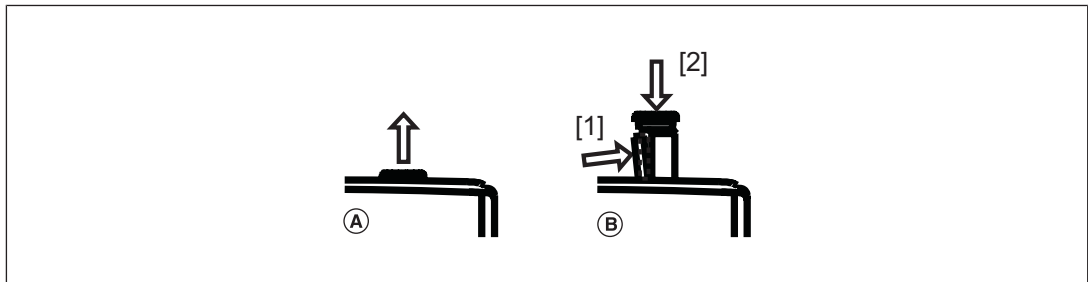
Feedback loop	
A N/C contact is shown in the connection diagram. A N/O contact can also be configured.	
Feedback loop with test pulses	
Please note the allocation of the test pulses and feedback loops: T0 <-> Y1 T1 <-> Y2	

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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 password consists of 6 figures in the range 000000 ... 999999.
- ▶ The password can be changed at any time in the menu.



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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):

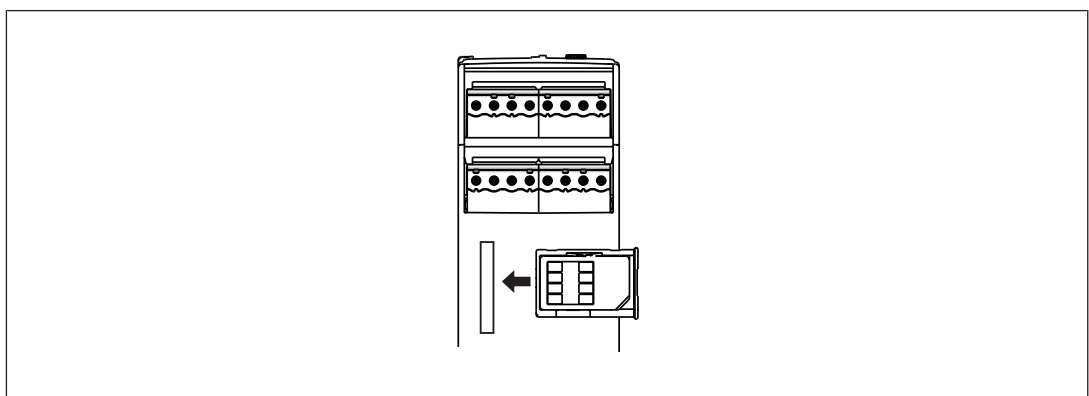
- ▶ The data is written to the chip card during configuration.

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

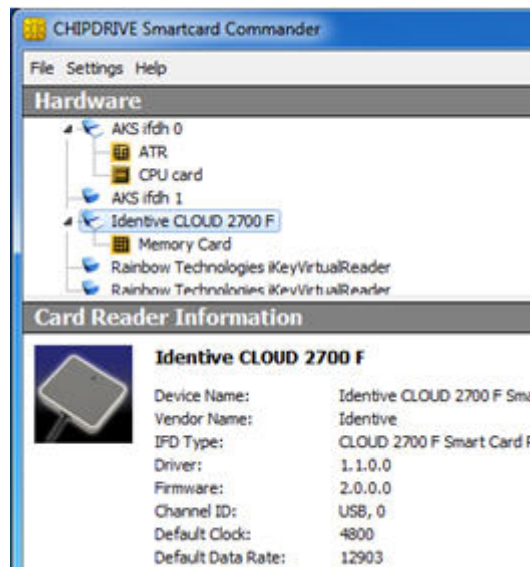
You have the option to save a PNOZ s50 configuration from the chip card to your computer. The configuration can be saved on the computer and then downloaded to other chip cards.

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]).

Safety relays PNOZsigma PNOZ s50

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.

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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.

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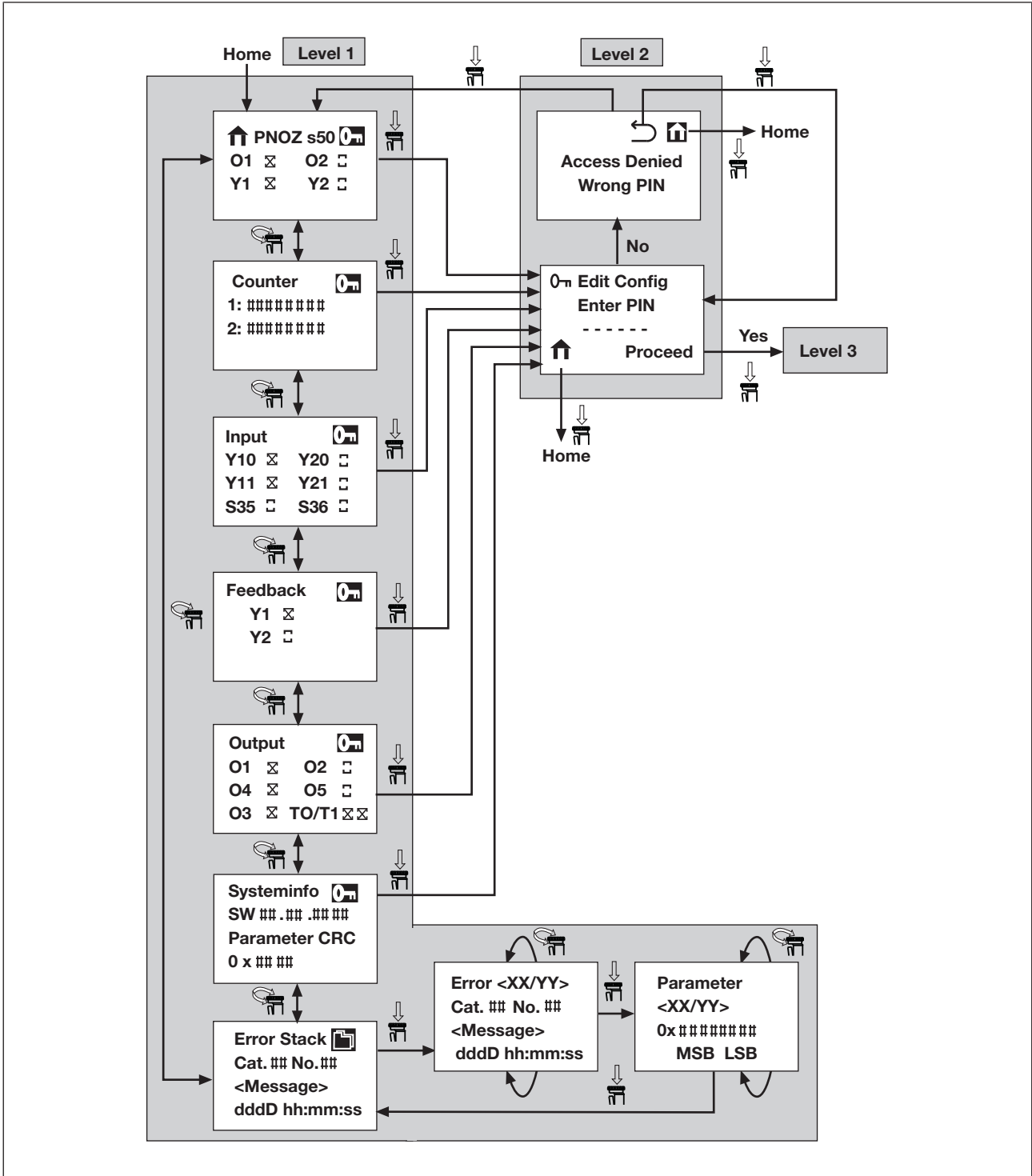


Fig.: Menu overview of Levels 1 and 2

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Level 3: Configuration

The device is configured in Level 3.

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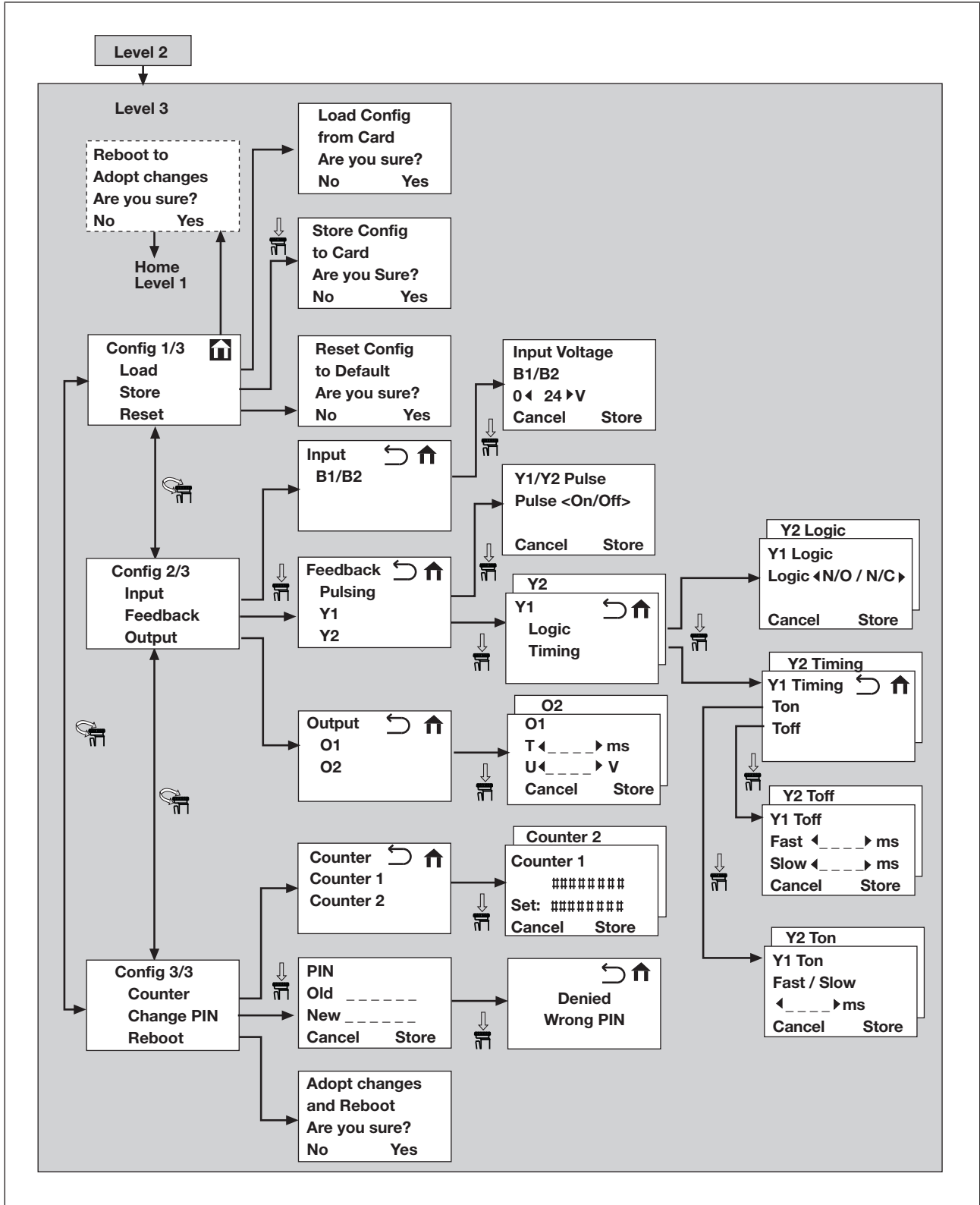


Fig.: Menu overview of Level 3





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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.

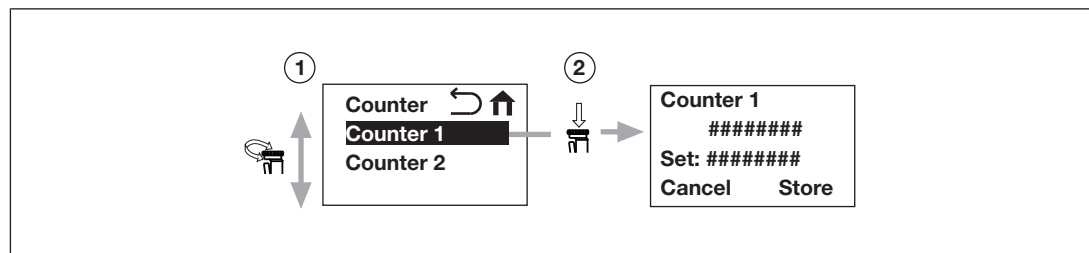


Fig.: Moving from line to line

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.

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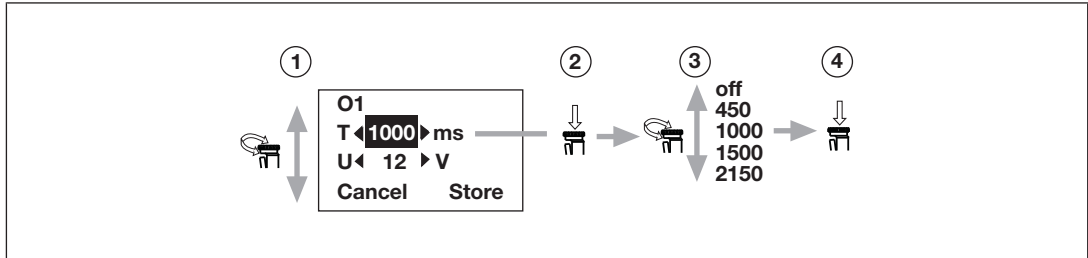


Fig.: Changing numeric values

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.	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> No Cipcard detected Proceed? No Yes </div>	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.	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Cipcard is defect, remove Or replace Proceed </div>	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.		

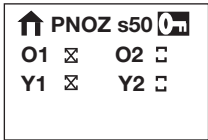

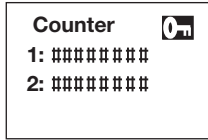

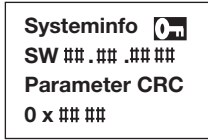

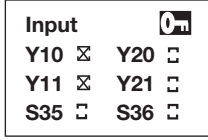

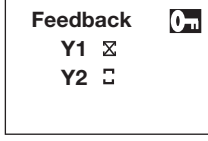

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Overview	Display	Description
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Memories are unequal, Copy Ext. To Int. ? Int. To Ext. ? </div>	<p>Ext. To Int. – Switch to the next menu to download parameters from the chip card to the device memory</p> <p>Int. To Ext. – Switch to the next menu to upload parameters from the device memory to the chip card</p>
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Copy from Ext. Memory and Restart? No Yes </div>	<p>No – Return to the previous menu</p> <p>Yes – Download parameters from the chip card to the device memory</p>
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Copy from Int. Memory and Restart? No Yes </div>	<p>No – Return to the previous menu</p> <p>Yes – Upload parameters from the device memory to the chip card</p>
<p>Chipcard is Invalid The parameters on the chip card are invalid.</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Cipcard is Invalid, Copy Int. to Ext.? No Yes </div>	<p>No – 1. Use a valid chip card or insert chip card holder only. 2. Restart device with No.</p> <p>Yes – Upload parameters from the device memory to the chip card</p>









Safety relays PNOZsigma PNOZ s50

Status display and configuration


Level 1: Status indicators

Overview	Display	Description
PNOZ s50 C Start-up display	 <p>↑ PNOZ s50  O1 ☒ O2 ☐ Y1 ☒ Y2 ☐</p>	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	 <p>Counter  1: ##### 2: #####</p>	1: Counter for output O1+/ O1- 2: Counter for output O2+/ O2-
Systeminfo	 <p>Systeminfo  SW ##.##.### Parameter CRC 0 x ###</p>	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	 <p>Input  Y10 ☒ Y20 ☐ Y11 ☒ Y21 ☐ S35 ☐ S36 ☐</p>	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 Y21 – 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	 <p>Feedback  Y1 ☒ Y2 ☐</p>	Y1 – Standard input for feedback loop 1 Y2 – Standard input for feedback loop 2

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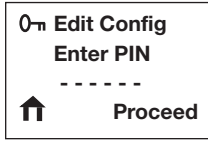
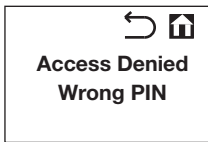
Overview	Display	Description
<p>Output</p> <p>States of the outputs are displayed</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Output </p> <p>O1  O2 </p> <p>O4  O5 </p> <p>O3  TO/T1  </p> </div>	<p>O1 – Failsafe output for power circuit 1</p> <p>O2 – Failsafe output for power circuit 2</p> <p>O3 – Failsafe output for fault signal</p> <p>O4 – Failsafe output for status of power circuit 1</p> <p>O5 – Failsafe output for status of power circuit 1</p> <p>TO/T1 – Test pulse output 0/1</p>

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Overview	Display	Description
<p>Error Stack Error messages are displayed</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Error Stack  Cat. ### No. ### <Message> dddD hh:mm:ss</p> </div>	<p>Current error stack entry</p> <p>Cat. – Error class (hexadecimal)</p> <p>No. – Error number (hexadecimal)</p> <p><Message> – Error text</p> <p>dddD hh:mm:ss – Power-on time since Power On: Days, hours, minutes, seconds</p>
	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Error <XX/YY> Cat. ## No. ## <Message> dddD hh:mm:ss</p> </div>	<p>Error stack entries</p> <p><XX/YY> – Entry number/number of entries (decimal)</p> <p>Cat. – Error class (hexadecimal)</p> <p>No. – Error number (hexadecimal)</p> <p><Message> – Error text</p> <p>dddD hh:mm:ss – Power-on time since error occurred: Days, hours, minutes, seconds</p>
	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Parameter <XX/YY> 0x##### MSB LSB</p> </div>	<p>Parameters of a selected entry in the error stack</p> <p><XX/YY> – Current parameter/number of available parameters (decimal)</p> <p>0x##### – Parameters (hexadecimal), grouped by MSB and LSB</p>

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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:

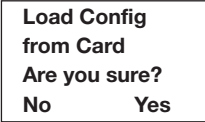
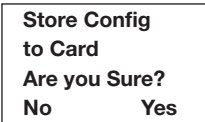
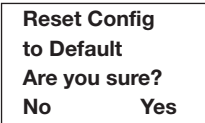

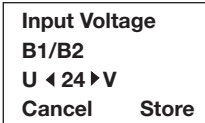
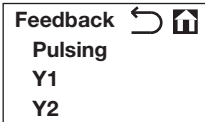
Function	Terminal	Description	Parameter	Value	In display menu
Supply voltage, power circuits 1 and 2	B1/B2	Supply voltage	Input Voltage	24 V	Input -> Input Voltage
Test pulses	Y1/Y2	Test pulses on feedback loops	Pulsing	On	Feedback -> Pulsing -> Y1/Y2 Pulse
Power circuit 1	O1+/O1-	Reduced voltage	U	6 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


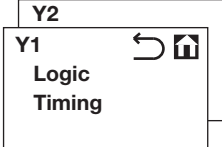
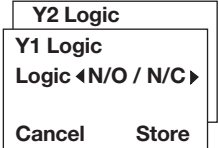
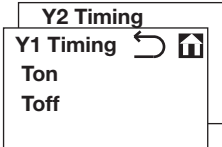
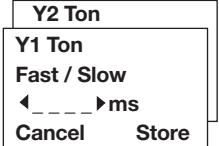
Function	Terminal	Description	Parameter	Value	In display menu
Power circuit 2	O2+/O2-	Reduced voltage	U	6 V	Output -> O2
		Overexcitation time	T	100 ms	Output -> O2
	Y2	Maximum ventilation time	Ton	30 ms	Feedback -> Y2 -> Y1 Timing -> Y2 Ton
		Maximum application time, fast shutdown	Toff fast	30 ms	Feedback -> 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	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Config 1/3  Load Store Reset </div>	<p>Load – Switches to the Load menu to download the configuration from the chip card</p> <p>Store – Switches to the Store menu to save the configuration to the chip card</p> <p>Reset – Switches to the Reset menu to reset the configuration to the default settings</p>
Config 2/3	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Config 2/3 Input Feedback Output </div>	<p>Input – Switches to the Input menu to configure the supply voltage for the power element</p> <p>Feedback – Switches to the Feedback menu to configure the feedback loops</p> <p>Output – Switches to the Output menu to configure the properties of the power outputs O1+/O1- and O2+/O2-</p>
Config 3/3	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Config 3/3 Counter Change PIN Reboot </div>	<p>Counter – Switches to the Counter menu to enter a start value for the counter</p> <p>Change PIN – Switches to the Change PIN menu to change the password</p> <p>Reboot – Switches to the Reboot menu to restart the device</p>

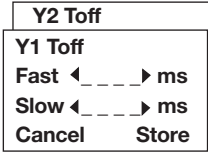
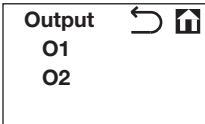
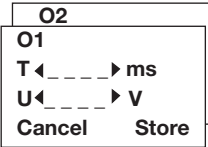
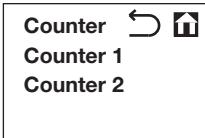
Safety relays PNOZsigma PNOZ s50

Overview	Display	Description
Load configuration from chip card		
Load Config from Card Download parameters from the chip card to the device		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		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		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		B1/B2 – Switch to the Input Voltage menu to configure the inputs B1/B2
Input Voltage Configure the supply voltage to the power circuits		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		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

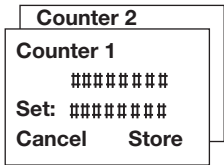
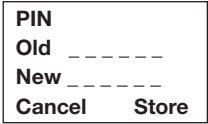

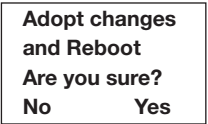
Safety relays PNOZsigma PNOZ s50

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

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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-

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Overview	Display	Description
<p>Counter 1 or Counter 2</p> <p>Switch to menu to set the counter for the number of operations for power circuits O1+/O1- or O2+/O2-</p>		<p>Counter 1 – Event counter 1 - Configure number of operations for load at power circuit O1+/O1-</p> <p>Counter 2 – Event counter 2 - Configure number of operations for load at power circuit O2+/O2-</p> <p>##### – Old counter status</p> <p>Set: – Enter new counter status, e.g. when a used load is applied Value range: 0 ... 99999999</p> <p>Store – Confirm entry</p> <p>Cancel – Exit menu without confirming the entry</p>
Change password		
<p>PIN</p> <p>Change password</p>		<p>Old – Enter the old password</p> <p>New – Enter the new password</p> <p>Cancel – Exit menu without confirming the entry</p> <p>Store – Adopt new password</p>
<p>Denied Wrong PIN</p> <p>Error message</p>		<p>You entered an incorrect password</p>
Restart after changing configuration		
<p>Adopt changes and Reboot</p> <p>Restart and adopt configuration</p>		<p>No – Do not restart</p> <p>Yes – Restart</p>

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.

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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		

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Connection

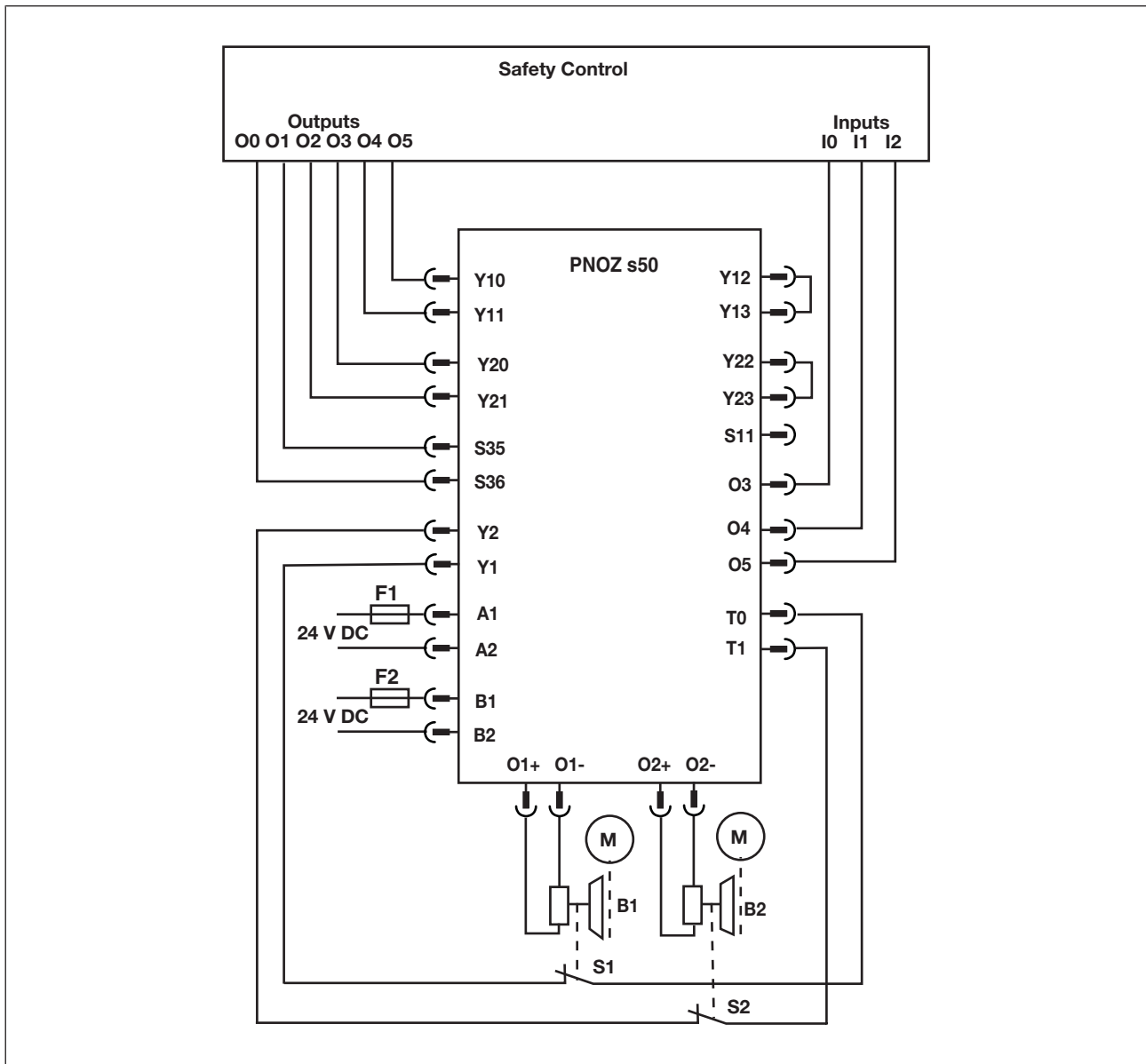


Fig.: Connection example: Two mechanical holding brakes

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

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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

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Mechanical data	
Mounting type	plug-in
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	0,2 - 2,5 mm ² , 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	EN ISO 13849-1: 2015	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	Category					
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.

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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 re-quired between adjacent devices	Ambient tem-perature	Number of power circuits	Max. permitted output current at $U_{B1/B2} = 24 \text{ V}$	Max. permitted output current at $U_{B1/B2} = 48 \text{ V}$
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 tem-perature	Number of power circuits	Max. permitted output current at $U_{B1/B2} = 24 \text{ V}$	Max. permitted output current at $U_{B1/B2} = 48 \text{ V}$	Utilisation cat-egory
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.

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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