



**PNOZ s6**

Safety relays

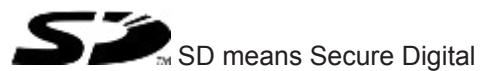


**pilz**

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## PNOZ s6 safety relay

The two-hand control relay meets the requirements of EN 574 Type IIIC. It forces the operator to keep his hands outside the danger zone area during the hazardous movement. The unit is suitable for use on controllers for metalworking presses as a component for simultaneous switching.

It can be used in applications with

- ▶ Mechanical presses (EN 692)
- ▶ Hydraulic presses (EN 693)
- ▶ Safety circuits in accordance with EN 60204-1

## For your safety

- ▶ Only install and commission the unit if you have read and understood these operating instructions and are familiar with the applicable regulations for health and safety at work and accident prevention.  
Ensure VDE and local regulations are met, especially those relating to safety.
- ▶ Any guarantee is rendered invalid if the housing is opened or unauthorised modifications are carried out.
- ▶ The two-hand circuit and the connected parts of the press control must conform to the relevant safety standards EN 574, EN 692 and EN 693
- ▶ To avoid inductive and capacitance coupling, the cables between the two-hand relay and the pushbuttons must be run separately to any power cables.
- ▶ On account of the low currents you should use gold-plated pushbutton contacts.

## Unit features

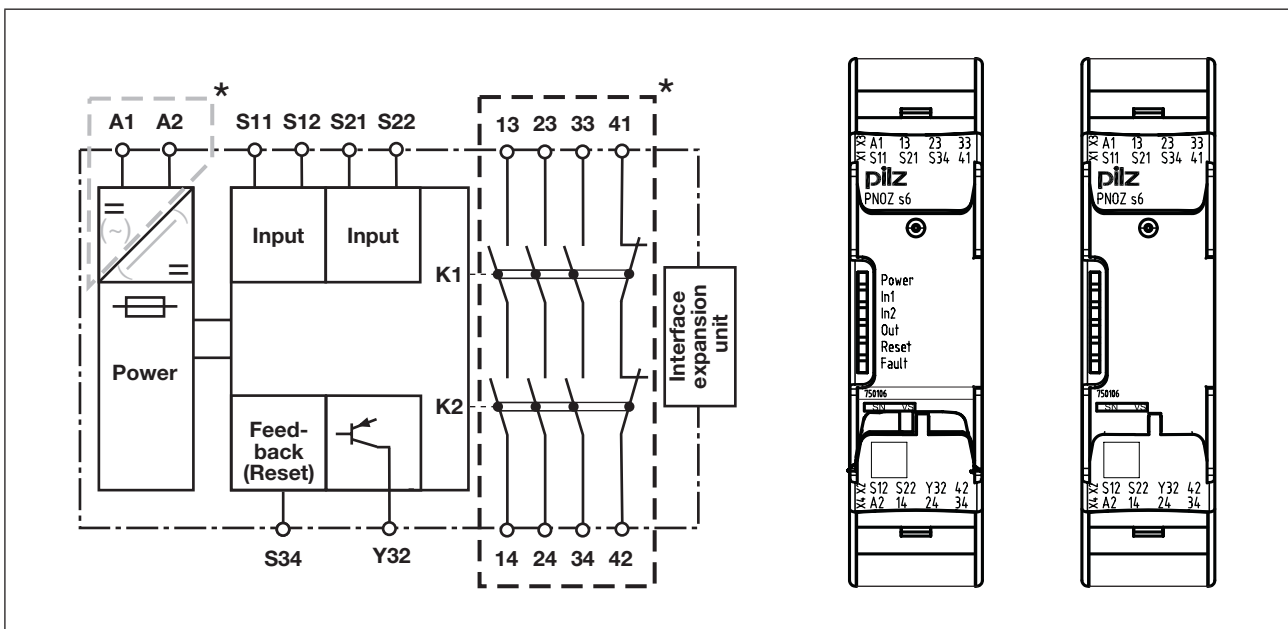
- ▶ Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- ▶ 1 semiconductor output
- ▶ Connection options for:
  - 2 control elements (pushbuttons)
- ▶ A connector can be used to connect 1 PNOZsigma contact expansion module
- ▶ LED for:
  - 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)

## Safety features

The two-hand control relay meets the following safety requirements:

- ▶ The circuit is redundant with built-in self-monitoring
- ▶ The safety function remains effective in the case of a component failure
- ▶ The circuit prevents a further press stroke in the case of:
  - Relay failure
  - Contact welding
  - Coil defect on a relay
  - Open circuit
  - Short circuit
- ▶ The unit has an electronic fuse.

## Block diagram/terminal configuration



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

Grey highlighted area: Applies only with  $U_B = 48 - 240 \text{ V AC/DC}$

\*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), safe 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.

## 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" 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).
- ▶ 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)

$R_l / \text{km}$  = 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.

### Preparing for operation

▶ Supply voltage

Supply voltage	AC	DC

▶ Input circuit

Input circuit	Single-channel	Dual-channel
Two-hand pushbuttons <b>with</b> detection of shorts across contacts		

▶ Feedback loop

	Feedback loop	
Contacts from external contactors		

▶ Semiconductor output

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### Legend

- ▶ S1/S2: Two-hand pushbuttons

### Operation

The unit is ready for operation when the Power LED is permanently lit.

LEDs indicate the status and errors during operation:

- LED on
- LED flashes



### Information

Status indicators and error indicators may occur independently. In the case of an error display, the "Fault" LED will light or flash (exception: "Supply voltage too low"). An LED that is also flashing indicates the potential cause of the error. An LED that is lit and is static indicates a normal operating status. Several status indicators and error indicators may occur simultaneously.

### Status indicators



#### Power

Supply voltage is present.



#### In1

Pushbutton at S11 is operated.



#### In2

Pushbutton at S21 is operated.



#### Out

Safety contacts are closed and semiconductor output Y32 carries a high signal.



#### Reset

24 V DC is present at S34.

### Error indicators

#### All LEDs off

Diagnostics: Short across contacts/earth fault; unit switched off

- ▶ Remedy: Rectify short across contacts/earth fault, switch off supply voltage for 1 min.



#### Fault

Diagnostics: Plug terminator not connected

- ▶ Remedy: Insert plug terminator, switch supply voltage off and then on again.



#### Fault

Diagnostics: Internal error, unit defective

- ▶ Remedy: Switch supply voltage off and then on again, change unit if necessary.



#### Power

Diagnostics: Supply voltage too low

- ▶ Remedy: Check the supply voltage.

**In1, In2 alternately****Fault**

Diagnostics: Connection error or short between S12 and S22 detected or internal error

- ▶ Remedy: Rectify connection error or short across contacts, switch supply voltage off and then on again.

**In1****Fault**

Diagnostics: Simultaneity exceeded: Channel 1 too late or power-up blocked due to short-term interruption at S11; input circuits not operated simultaneously

- ▶ Remedy: Open both input circuits, S12 and S22, simultaneously and then close again.

**In2****Fault**

Diagnostics: Simultaneity exceeded: Channel 2 too late or power-up blocked due to short-term interruption at S21; input circuits not operated simultaneously

- ▶ Remedy: Open both input circuits, S12 and S22, simultaneously and then close again.

**Faults - malfunctions**

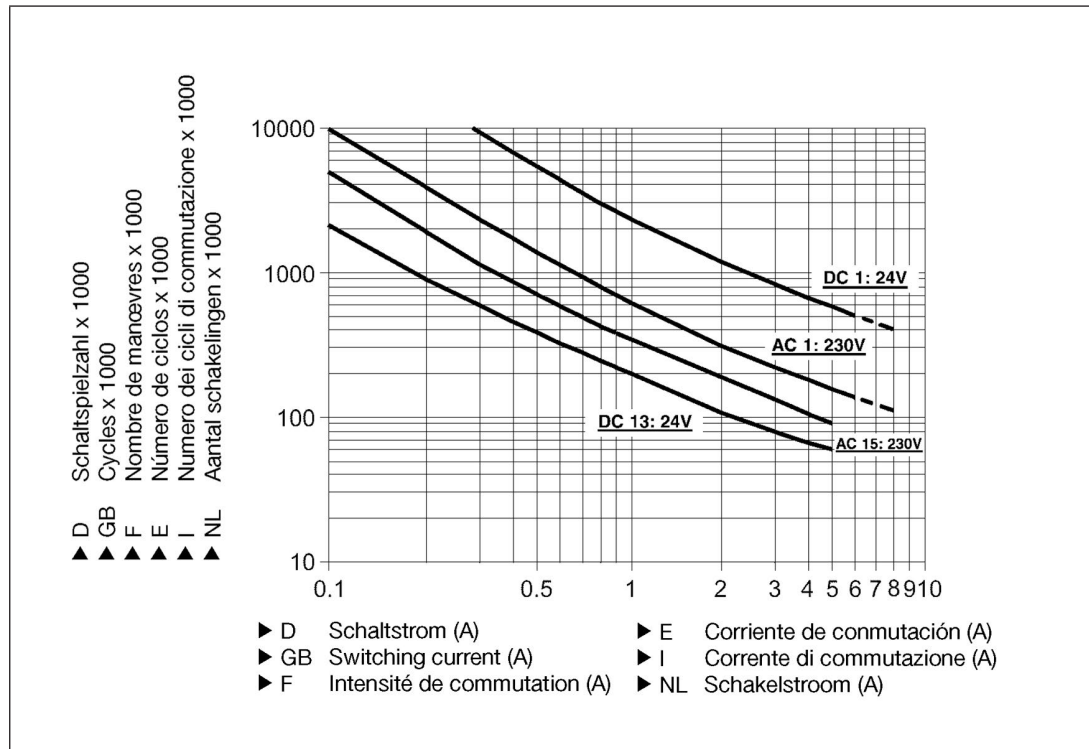
- ▶ Contact malfunctions: If the contacts have welded, reactivation will not be possible after the input circuit has opened.



## 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.

$U_B$  24 VDC



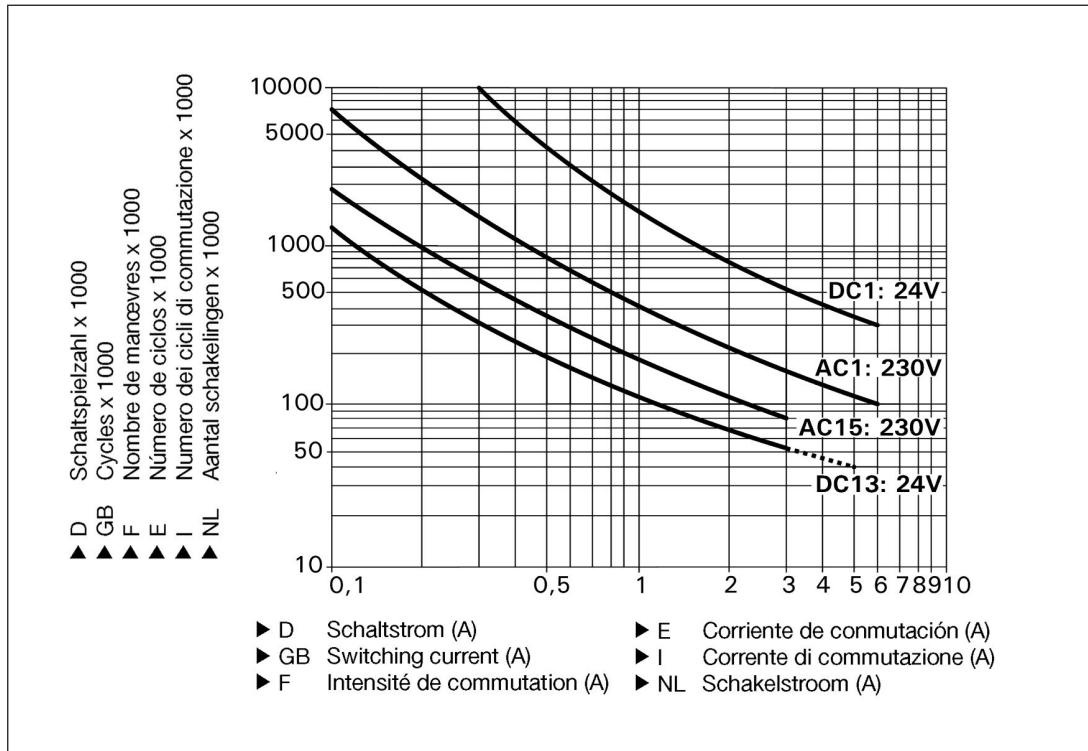
### Example

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

Provided the application requires fewer than 2,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

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

U<sub>B</sub> 48-240 VAC/DC



### Example

- ▶ Inductive load: 0,2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 1,000,000 cycles

Provided the application requires fewer than 1,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

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

## Technical details

General	750106	750136	751106	751136
Approvals	CCC, CE, GOST, KOSHA, TÜV, cULus Listed	CCC, CE, GOST, KOSHA, TÜV, cULus Listed	CCC, CE, GOST, KOSHA, TÜV, cULus Listed	CCC, CE, GOST, KOSHA, TÜV, cULus Listed
Electrical data	750106	750136	751106	751136
Supply voltage				
Voltage	24 V	48 - 240 V	24 V	48 - 240 V
Type	DC	AC/DC	DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	–	7,0 VA	–	7,0 VA
Output of external power supply (DC)	3,5 W	3,5 W	3,5 W	3,5 W
Frequency range AC	–	50 - 60 Hz	–	50 - 60 Hz
Residual ripple DC	20 %	20 %	20 %	20 %
Continuous duty	100 %	100 %	100 %	100 %
Max. overall cable resistance R <sub>lmax</sub> per input circuit	30 Ohm	30 Ohm	30 Ohm	30 Ohm
Voltage at				
Input circuit DC	24,0 V	24,0 V	24,0 V	24,0 V
Feedback loop DC	24,0 V	24,0 V	24,0 V	24,0 V
Current at				
Feedback loop	15,0 mA	15,0 mA	15,0 mA	15,0 mA
N/O contact	20 mA	20 mA	20 mA	20 mA
N/C contact	10 mA	10 mA	10 mA	10 mA
Number of output contacts				
Instantaneous safety contacts (N/O)	3	3	3	3
Auxiliary contacts (N/C)	1	1	1	1
Min. unit fuse protection	1,00 A	1,00 A	1,00 A	1,00 A
Max. unit fuse protection F1	Max. cable cross section	Max. cable cross section	Max. cable cross section	Max. cable cross section
Two-hand control relay type				
In accordance with the standard	EN 574	EN 574	EN 574	EN 574
Type	III C	III C	III C	III C
Inputs	750106	750136	751106	751136
Number	2	2	2	2

<b>Semiconductor outputs</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Number	1	1	1	1
Voltage	24,0 V	24,0 V	24,0 V	24,0 V
Current	20 mA	20 mA	20 mA	20 mA
<b>Relay outputs</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Max. short circuit current IK	1 kA	1 kA	1 kA	1 kA
Utilisation category				
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1
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	6,0 A	6,0 A	6,0 A	6,0 A
Max. power	1500 VA	1500 VA	1500 VA	1500 VA
Auxiliary contacts, 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	6,0 A	6,0 A	6,0 A	6,0 A
Max. power	150 W	150 W	150 W	150 W
Safety contacts, AC1 at	240 V	240 V	240 V	240 V
Max. current	6,0 A	6,0 A	6,0 A	6,0 A
Min. current	0,01 A	0,01 A	0,01 A	0,01 A
Max. power	1500 VA	1500 VA	1500 VA	1500 VA
Safety contacts, DC1 at	24 V	24 V	24 V	24 V
Max. current	6,0 A	6,0 A	6,0 A	6,0 A
Min. current	0,01 A	0,01 A	0,01 A	0,01 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
Auxiliary contacts, AC15 at	230 V	230 V	230 V	230 V
Max. current	5,0 A	3,0 A	5,0 A	3,0 A
Auxiliary contacts, DC13 (6 cycles/min) at	24 V	24 V	24 V	24 V
Max. current	5,0 A	4,0 A	5,0 A	4,0 A
Safety contacts, AC15 at	230 V	230 V	230 V	230 V
Max. current	5,0 A	3,0 A	5,0 A	3,0 A
Safety contacts, DC13 (6 cycles/min) at	24 V	24 V	24 V	24 V
Max. current	5,0 A	4,0 A	5,0 A	4,0 A

<b>Relay outputs</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Contact fuse protection, external safety contacts				
In accordance with the standard	<b>EN 60947-5-1</b>	<b>EN 60947-5-1</b>	<b>EN 60947-5-1</b>	<b>EN 60947-5-1</b>
Blow-out fuse, quick	<b>10 A</b>	<b>6 A</b>	<b>10 A</b>	<b>6 A</b>
Blow-out fuse, slow	<b>6 A</b>	<b>4 A</b>	<b>6 A</b>	<b>4 A</b>
Circuit breaker, 24V AC/DC, characteristic B/C	<b>6 A</b>	<b>4 A</b>	<b>6 A</b>	<b>4 A</b>
Contact fuse protection, external auxiliary contacts				
Blow-out fuse, quick	<b>10 A</b>	<b>6 A</b>	<b>10 A</b>	<b>6 A</b>
Blow-out fuse, slow	<b>6 A</b>	<b>4 A</b>	<b>6 A</b>	<b>4 A</b>
Circuit breaker, 24 V AC/DC, characteristic B/C	<b>6 A</b>	<b>4 A</b>	<b>6 A</b>	<b>4 A</b>
Contact material	<b>AgCuNi + 0,2 µm Au</b>	<b>AgCuNi + 0,2 µm Au</b>	<b>AgCuNi + 0,2 µm Au</b>	<b>AgCuNi + 0,2 µm Au</b>
<b>Conventional thermal current while loading several contacts</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Ith per contact at UB AC				
Conv. therm. current with 1 contact	–	<b>6,00 A</b>	–	<b>6,00 A</b>
Conv. therm. current with 2 contacts	–	<b>6,00 A</b>	–	<b>6,00 A</b>
Conv. therm. current with 3 contacts	–	<b>4,50 A</b>	–	<b>4,50 A</b>
Ith per contact at UB DC				
Conv. therm. current with 1 contact	<b>6,00 A</b>	<b>6,00 A</b>	<b>6,00 A</b>	<b>6,00 A</b>
Conv. therm. current with 2 contacts	<b>6,00 A</b>	<b>6,00 A</b>	<b>6,00 A</b>	<b>6,00 A</b>
Conv. therm. current with 3 contacts	<b>6,00 A</b>	<b>4,50 A</b>	<b>6,00 A</b>	<b>4,50 A</b>

<b>Times</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Delay-on de-energisation (reaction time in accordance with EN 574)				
N/O contact	<b>30 ms</b>	<b>30 ms</b>	<b>30 ms</b>	<b>30 ms</b>
N/C contact	<b>40 ms</b>	<b>40 ms</b>	<b>40 ms</b>	<b>40 ms</b>
Recovery time	<b>250 ms</b>	<b>250 ms</b>	<b>250 ms</b>	<b>250 ms</b>
Supply interruption before de-energisation	<b>20 ms</b>	<b>20 ms</b>	<b>20 ms</b>	<b>20 ms</b>
Simultaneity, channel 1 and 2	<b>0,5 s</b>	<b>0,5 s</b>	<b>0,5 s</b>	<b>0,5 s</b>
<b>Environmental data</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Climatic suitability	<b>EN 60068-2-78</b>	<b>EN 60068-2-78</b>	<b>EN 60068-2-78</b>	<b>EN 60068-2-78</b>
Ambient temperature				
Temperature range	<b>-10 - 55 °C</b>	<b>-10 - 55 °C</b>	<b>-10 - 55 °C</b>	<b>-10 - 55 °C</b>
Storage temperature				
Temperature range	<b>-40 - 85 °C</b>	<b>-40 - 85 °C</b>	<b>-40 - 85 °C</b>	<b>-40 - 85 °C</b>
EMC	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</b>	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</b>	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</b>	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</b>
Vibration				
In accordance with the standard	<b>EN 60068-2-6</b>	<b>EN 60068-2-6</b>	<b>EN 60068-2-6</b>	<b>EN 60068-2-6</b>
Frequency	<b>10,0 - 55,0 Hz</b>	<b>10,0 - 55,0 Hz</b>	<b>10,0 - 55,0 Hz</b>	<b>10,0 - 55,0 Hz</b>
Max. amplitude	<b>0,35 mm</b>	<b>0,35 mm</b>	<b>0,35 mm</b>	<b>0,35 mm</b>
Airgap creepage				
In accordance with the standard	<b>EN 60947-1</b>	<b>EN 60947-1</b>	<b>EN 60947-1</b>	<b>EN 60947-1</b>
Overvoltage category	<b>III / II</b>	<b>III / II</b>	<b>III / II</b>	<b>III / II</b>
Pollution degree	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
Rated insulation voltage	<b>250 V</b>	<b>250 V</b>	<b>250 V</b>	<b>250 V</b>
Rated impulse withstand voltage	<b>4,00 kV</b>	<b>4,00 kV</b>	<b>4,00 kV</b>	<b>4,00 kV</b>
Protection type				
Mounting (e.g. cabinet)	<b>IP54</b>	<b>IP54</b>	<b>IP54</b>	<b>IP54</b>
Housing	<b>IP40</b>	<b>IP40</b>	<b>IP40</b>	<b>IP40</b>
Terminals	<b>IP20</b>	<b>IP20</b>	<b>IP20</b>	<b>IP20</b>
<b>Mechanical data</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Mounting position	<b>Any</b>	<b>Any</b>	<b>Any</b>	<b>Any</b>
Mechanical life	<b>10,000,000 cycles</b>	<b>10,000,000 cycles</b>	<b>10,000,000 cycles</b>	<b>10,000,000 cycles</b>
Material				
Bottom	<b>PC</b>	<b>PC</b>	<b>PC</b>	<b>PC</b>
Front	<b>PC</b>	<b>PC</b>	<b>PC</b>	<b>PC</b>
Top	<b>PC</b>	<b>PC</b>	<b>PC</b>	<b>PC</b>

<b>Mechanical data</b>	<b>750106</b>	<b>750136</b>	<b>751106</b>	<b>751136</b>
Cross section of external conductors with screw terminals				
1 core flexible	<b>0,25 - 2,50 mm<sup>2</sup>, 24 - 12 AWG</b>	<b>0,25 - 2,50 mm<sup>2</sup>, 24 - 12 AWG</b>	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	<b>0,25 - 1,00 mm<sup>2</sup>, 24 - 16 AWG</b>	<b>0,25 - 1,00 mm<sup>2</sup>, 24 - 16 AWG</b>	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	<b>0,20 - 1,50 mm<sup>2</sup>, 24 - 16 AWG</b>	<b>0,20 - 1,50 mm<sup>2</sup>, 24 - 16 AWG</b>	–	–
Torque setting with screw terminals	<b>0,50 Nm</b>	<b>0,50 Nm</b>	–	–
Connection type	<b>Screw terminal</b>	<b>Screw terminal</b>	<b>Spring-loaded terminal</b>	<b>Spring-loaded terminal</b>
Mounting type	<b>plug in</b>	<b>plug in</b>	<b>plug in</b>	<b>plug in</b>
Cross section of external conductors with spring-loaded terminals: flexible with/without crimp connector	–	–	<b>0,20 - 2,50 mm<sup>2</sup>, 24 - 12 AWG</b>	<b>0,20 - 2,50 mm<sup>2</sup>, 24 - 12 AWG</b>
Spring-loaded terminals: Terminal points per connection	–	–	<b>2</b>	<b>2</b>
Stripping length	–	–	<b>9 mm</b>	<b>9 mm</b>
Dimensions				
Height	<b>98,0 mm</b>	<b>98,0 mm</b>	<b>100,0 mm</b>	<b>100,0 mm</b>
Width	<b>22,5 mm</b>	<b>22,5 mm</b>	<b>22,5 mm</b>	<b>22,5 mm</b>
Depth	<b>120,0 mm</b>	<b>120,0 mm</b>	<b>120,0 mm</b>	<b>120,0 mm</b>
Weight	<b>185 g</b>	<b>205 g</b>	<b>185 g</b>	<b>205 g</b>

The standards current on 2011-06 apply.

#### Safety characteristic data

<b>Operating mode</b>	<b>EN ISO 13849-1: 2006</b>	<b>EN ISO 13849-1: 2006</b>	<b>EN IEC 62061</b>	<b>EN IEC 62061</b>	<b>IEC 61511</b>	<b>IEC 61511</b>	<b>EN ISO 13849-1: 2006</b>
	<b>PL</b>	<b>Category</b>	<b>SIL CL</b>	<b>PFH<sub>D</sub> [1/h]</b>	<b>SIL</b>	<b>PFD</b>	<b>T<sub>M</sub> [year]</b>
Two-hand function	<b>PL e</b>	<b>Cat. 4</b>	<b>SIL CL 3</b>	<b>2,62E-09</b>	<b>SIL 3</b>	<b>3,32E-05</b>	<b>20</b>

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



### Information

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



### ATTENTION!

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

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

## Order reference

Order reference					
Product type	Features			Terminals	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

## EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC for machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at [www.pilz.com/downloads](http://www.pilz.com/downloads).

Representative: Norbert Fröhlich, Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany





► ...  
In many countries we are represented by our subsidiaries and sales partners.

Please refer to our homepage for further details or contact our headquarters.

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# pilz