PNOZ s6.1

Safety relays

Safety relay PNOZ s6.1

The safety relay can be used as a two-hand control relay or for simultaneity monitoring.

The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with

▸ E-STOP pushbuttons

▸ Safety gates

The two-hand control relay meets the requirements of EN 574 Type IIIA. It forces the operator to keep his hands outside the danger zone area during the hazardous movement. It is designed for use in two-hand circuits.

> ⚠️ **ATTENTION!**
>
> The two-hand control relay may **not** be used on **press controllers**. It is only suitable for use where the risk analysis has established a low level of risk (e.g. EN 954-1 Cat. 1 and EN ISO 13849-1 Cat. 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 supply voltage for the two-hand relay must only be connected after the shutdown device in accordance with § 9 VBG 7n5.1/2.

▸ 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)

– 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)

Safety features

The safety relay meets the following safety requirements:

▸ The safety relay prevents the plant from being enabled in the following cases:
- – Power supply failure
- – Component failure
- – Short circuit on an input circuit
- – Coil defect
- – Open circuit
- – Earth fault
▸ In each on-off cycle, the output relays on the safety device are tested to ensure they open and close correctly
▸ The unit has an electronic fuse.

Block diagram/terminal configuration
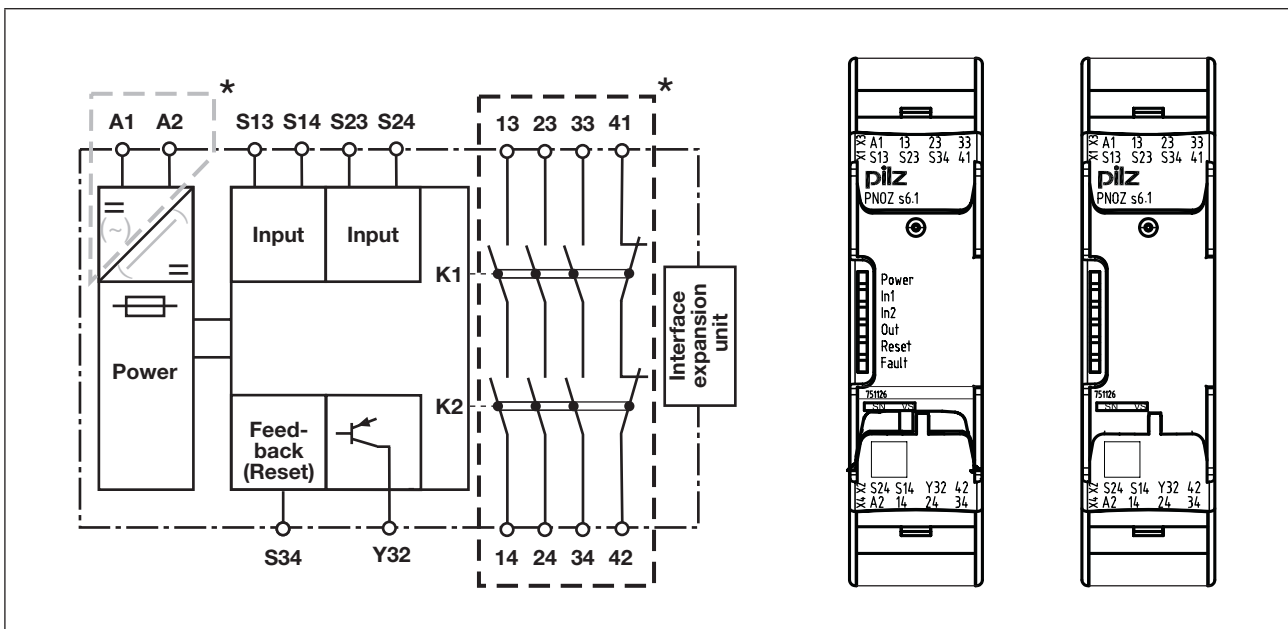
Centre: Front view with cover, right: Front view without cover

Grey highlighted area: Applies only with U_B = 48 – 240 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 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.

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:

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

R_{lmax} = max. overall cable resistance (see technical details)
R_l / km = cable resistance/km

▶ Use copper wire that can withstand 60/75 °C.

▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

Preparing for operation

▶ Supply voltage

Supply voltage	AC	DC
	A1 — L S14 A2 — N	A1 — L+ A2 — L-

▶ Input circuit

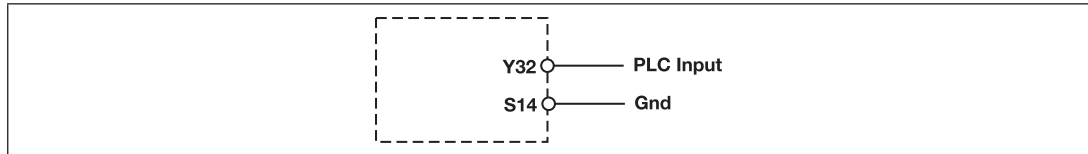| Input circuit	Single-channel	Dual-channel
Two-hand pushbuttons **with** detection of shorts across contacts		S13 S14 S1 S23 S24 S2
Simultaneity monitoring in safety gate applications with automatic start after the safety gate is closed		S13 S1 S14 S2 S23 S24 *

⚠️ **ATTENTION!**

*The unit starts automatically when the E-STOP / safety gate device is released. Use external circuit measures to prevent an unexpected restart.

▶ Feedback loop

	Feedback loop	
Contacts from external contactors	S24 S34 K5 K6 13 (23,33) — L1 14 (24,34) — N K5 K6	S24 S34

▶   Semiconductor output

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                              Y32 ○——— PLC Input
                              S14 ○——— Gnd
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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 S13 is operated.

⌖   **In2**
    Pushbutton at S23 is operated.

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

⌖   **Reset**
    24 V DC is present at S34.

Fault 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 S124 and S24 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 S13; input circuits not operated simultaneously

▶ Remedy: Open both input circuits, S14 and S24, simultaneously and then close again.

In2

Fault
Diagnostics: Simultaneity exceeded: Channel 2 too late or power-up blocked due to short-term interruption at S23; input circuits not operated simultaneously

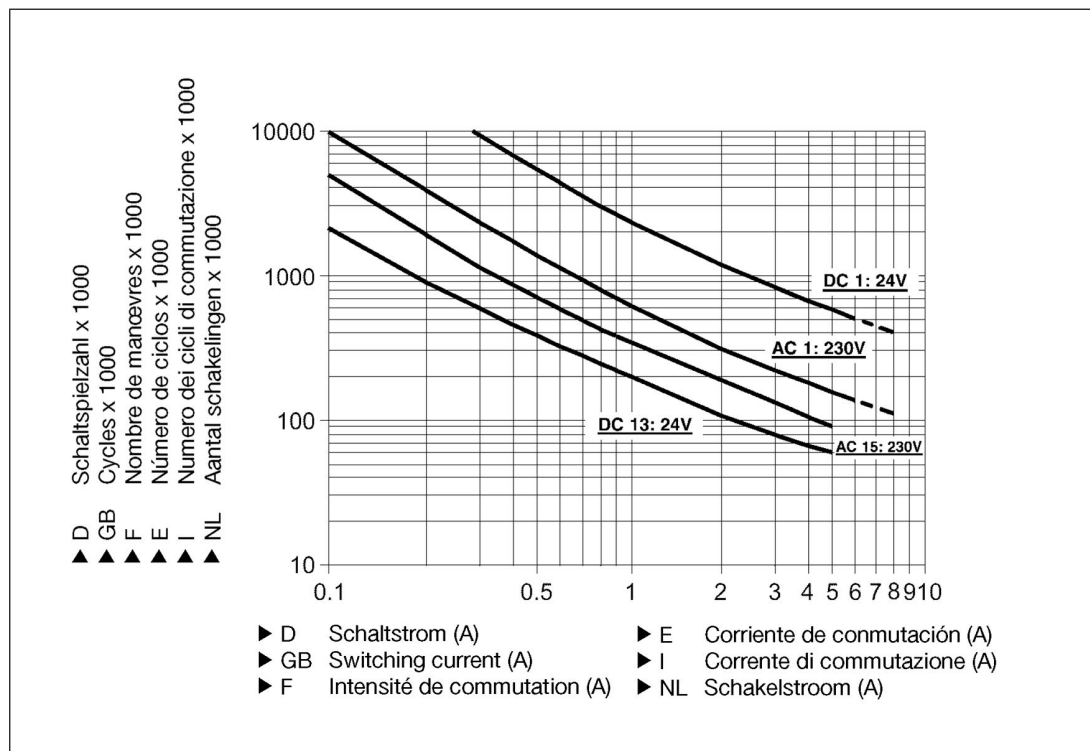▶ Remedy: Open both input circuits, S14 and S24, simultaneously and then close again.

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

	D	Schaltstrom (A)		E	Corriente de conmutación (A)
	GB	Switching current (A)		I	Corrente di commutazione (A)
	F	Intensité de commutation (A)		NL	Schakelstroom (A)

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_B 48-240 VAC/DC

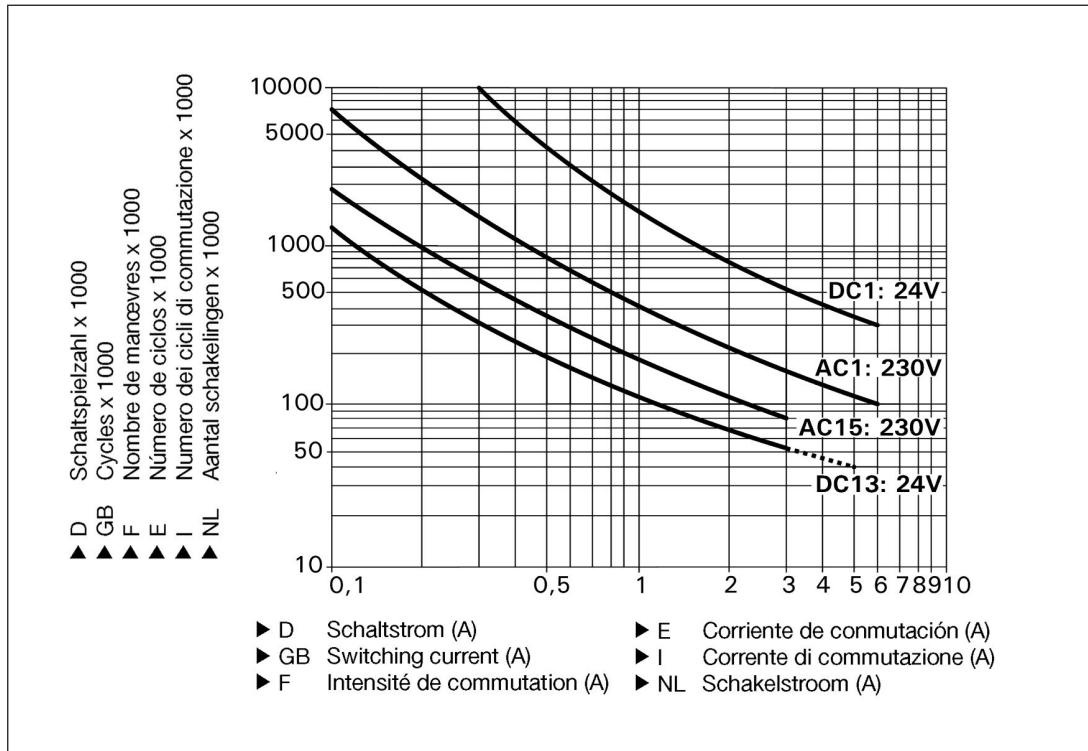**Example**

▸ 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	750126	750156	751126	751156
Approvals	CCC, CE, GOST, KOSHA, TÜV, cU-Lus Listed	CCC, CE, GOST, KOSHA, TÜV, cU-Lus Listed	CCC, CE, GOST, KOSHA, TÜV, cU-Lus Listed	CCC, CE, GOST, KOSHA, TÜV, cU-Lus Listed
Electrical data	**750126**	**750156**	**751126**	**751156**
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 Rlmax 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
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 A	III A	III A	III A
Inputs	**750126**	**750156**	**751126**	**751156**
Number	2	2	2	2

Semiconductor outputs	750126	750156	751126	751156
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
Relay outputs	**750126**	**750156**	**751126**	**751156**
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

Relay outputs	750126	750156	751126	751156
Contact fuse protection, external safety contacts				
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**10 A**	**6 A**	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**	**6 A**	**4 A**
Circuit breaker, 24V AC/DC, characteristic B/C	**6 A**	**4 A**	**6 A**	**4 A**
Contact fuse protection, external auxiliary contacts				
Blow-out fuse, quick	**10 A**	**6 A**	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**	**6 A**	**4 A**
Circuit breaker, 24 V AC/DC, characteristic B/C	**6 A**	**4 A**	**6 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**
Conventional thermal current while loading several contacts	**750126**	**750156**	**751126**	**751156**
Ith per contact at UB AC				
Conv. therm. current with 1 contact	–	**6,00 A**	–	**6,00 A**
Conv. therm. current with 2 contacts	–	**6,00 A**	–	**6,00 A**
Conv. therm. current with 3 contacts	–	**4,50 A**	–	**4,50 A**
Ith per contact at UB DC				
Conv. therm. current with 1 contact	**6,00 A**	**6,00 A**	**6,00 A**	**6,00 A**
Conv. therm. current with 2 contacts	**6,00 A**	**6,00 A**	**6,00 A**	**6,00 A**
Conv. therm. current with 3 contacts	**6,00 A**	**4,50 A**	**6,00 A**	**4,50 A**

Times	750126	750156	751126	751156
Delay-on de-energisation (reaction time in accordance with EN 574)				
N/O contact	40 ms	40 ms	40 ms	40 ms
N/C contact	50 ms	50 ms	50 ms	50 ms
Recovery time	250 ms	250 ms	250 ms	250 ms
Supply interruption before de-energisation	20 ms	20 ms	20 ms	20 ms
Simultaneity, channel 1 and 2	0,5 s	0,5 s	0,5 s	0,5 s
Environmental data	**750126**	**750156**	**751126**	**751156**
Climatic suitability	EN 60068-2-78	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	-10 - 55 °C
Storage temperature				
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4
Vibration				
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10,0 - 55,0 Hz	10,0 - 55,0 Hz	10,0 - 55,0 Hz	10,0 - 55,0 Hz
Max. 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	4,00 kV	4,00 kV	4,00 kV	4,00 kV
Protection type				
Mounting (e.g. cabinet)	IP54	IP54	IP54	IP54
Housing	IP40	IP40	IP40	IP40
Terminals	IP20	IP20	IP20	IP20
Mechanical data	**750126**	**750156**	**751126**	**751156**
Mounting position	Any	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles

Mechanical data	750126	750156	751126	751156
Material				
Bottom	**PC**	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**	**PC**
Top	**PC**	**PC**	**PC**	**PC**
Cross section of external conductors with screw terminals				
1 core flexible	**0,25 - 2,50 mm², 24 - 12 AWG**	**0,25 - 2,50 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1,00 mm², 24 - 16 AWG**	**0,25 - 1,00 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,20 - 1,50 mm², 24 - 16 AWG**	**0,20 - 1,50 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,50 Nm**	**0,50 Nm**	–	–
Connection type	**Screw terminal**	**Screw terminal**	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug in**	**plug in**	**plug in**	**plug in**
Cross section of external conductors with spring-loaded terminals: flexible with/without crimp connector	–	–	**0,20 - 2,50 mm², 24 - 12 AWG**	**0,20 - 2,50 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	–	**2**	**2**
Stripping length	–	–	**9 mm**	**9 mm**
Dimensions				
Height	**98,0 mm**	**98,0 mm**	**100,0 mm**	**100,0 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**120,0 mm**	**120,0 mm**	**120,0 mm**	**120,0 mm**
Weight	**185 g**	**205 g**	**185 g**	**205 g**

The standards current on 2011-06 apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2006 PL	EN ISO 13849-1: 2006 Category	EN IEC 62061 SIL CL	EN IEC 62061 PFH$_D$ [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2006 T$_M$ [year]
Emergency 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.

> **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 s6.1		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

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

▶ …
In many countries we are
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