



PNOZ s9

Safety relays

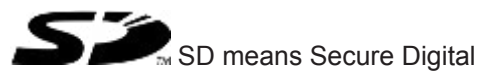


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Safety relay PNOZ s9

The unit meets the requirements of EN 60947-5-1, EN 60204-1 and VDE0113-1. In conjunction with a base unit the unit is used as a

- ▶ Contact expansion module to increase the number of contacts available on a base unit. Base units are all safety relays with feedback loop monitoring.
- ▶ Pulse relay
 - In accordance with EN ISO 12100-1 and EN ISO 12100-2 (inching circuit for limited movement of hazardous machine components during installation, set up and positioning)
 - in safety circuits in accordance with VDE 0113 and EN 60204-1 (e.g. on movable guards)
- ▶ Safe timer relays
 - in accordance with EN 1088 (release with delay through timer)
 - in safety circuits in accordance with VDE 0113-1 and EN 60204-1 (e.g. on movable guards)

The category that can be achieved in accordance with EN ISO 13849-1 depends on the category of the base unit. The contact expansion module may not exceed this.

- ▶ The unit can also be used without a base unit as a pulse relay or safe timer.

The unit is designed for use with

- ▶ Safety relays from the PNOZ X, PNOZsigma, PNOZelog, PNOZmulti series
- ▶ Safety gate monitors from the PST series
- ▶ Two-hand relays from the PNOZsigma, P2HZ series

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.

Unit features

- ▶ Positive-guided relay outputs, either instantaneous, delay-on de-energisation (also re-triggerable), pulsing or delay-on energisation:
 - 3 safety contacts
 - 1 auxiliary contact
- ▶ Safe separation of safety contacts 17-18, 27-28, 37-38 from all other circuits
- ▶ Switch-on time, pulse time or delay-on de-energisation selectable

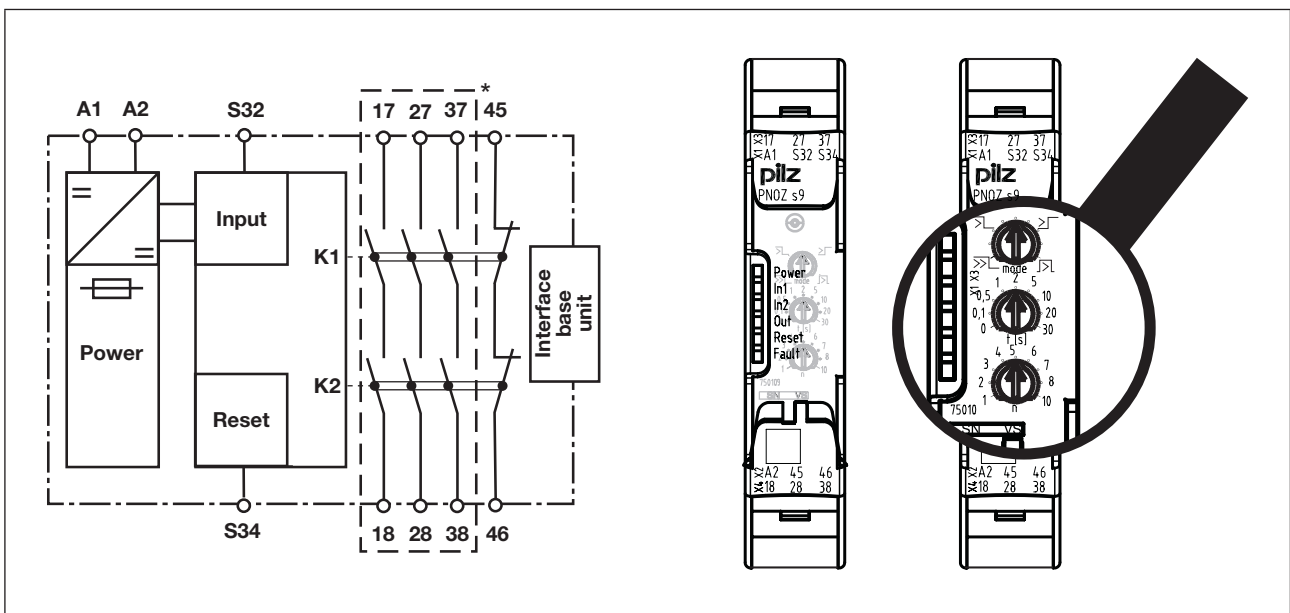
- ▶ LED indicator for:
 - Supply voltage
 - Input status, channel 1
 - Input status, channel 2
 - Switch status channel 1/2
 - Start circuit
 - Error
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)

Safety features

The unit meets the following safety requirements:

- ▶ The unit monitors its own output contacts.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ Earth fault in the feedback loop is detected.
- ▶ Earth fault in the input circuit:
 - The output relays de-energise and the safety contacts open.
- ▶ The unit has an electronic fuse.





Block diagram/terminal configuration



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

*Safe separation in accordance with EN 60947-1, 6 kV

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.
- ▶  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

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 expander module:

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

Control cabinet installation

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

Wiring

Please note:

- ▶ Information given in the "Technical details" 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).
- ▶ 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)


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

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.



CAUTION!

Do not adjust the rotary switch during operation, otherwise an error message will appear, the safety contacts will open and the unit will not be ready for operation until the supply voltage has been switched off and then on again.

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

Set delay time

Time selector switch "t[s]"

Factor selector switch "n"

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

Example:

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

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

Connection

- ▶ Supply voltage

Supply voltage	AC	DC
<p>Caution! The supply voltage may only be connected as shown in the examples listed below.</p>		

- ▶ 1-channel input circuit/feedback loop

Input circuit	Input circuit	Feedback loop
Without base unit (stand-alone)		
Base unit: Safety relay PNOZ X		<p>The inputs that evaluate the feedback loop will depend on the base unit and application.</p>
Base unit: Safety relay PNOZelog; driven via semiconductor outputs (24 VDC)		<p>The inputs that evaluate the feedback loop will depend on the base unit and application. * PNOZ e1p only; all other PNOZelog safety relays without delay-on de-energisation with PNOZ s9</p>

▶ 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

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**
Input circuit at S32 is closed.
-  **In2**
Input circuit at S32 is closed.
-  **Out**
Safety contacts are closed.
-  **Reset**
24 V DC is present at S34.
-  **Out**
Set delay time is running.


Fault indicators

All LEDs off
Unit switched off.


Fault
Diagnostics: Plug terminator not connected

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

With base unit PNOZsigma:
Diagnostics: Input circuit S32 is closed without authorisation


 **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.

 **Reset**

 **Fault**
Diagnostics: Position of rotary switch is not permitted or rotary switch was adjusted during operation.

- ▶ Remedy: Switch supply voltage off and then on again.



Power, In1, In2, Out, Reset, Fault

Diagnostics: The operating mode selector switch "mode" is in its start position (vertical position)

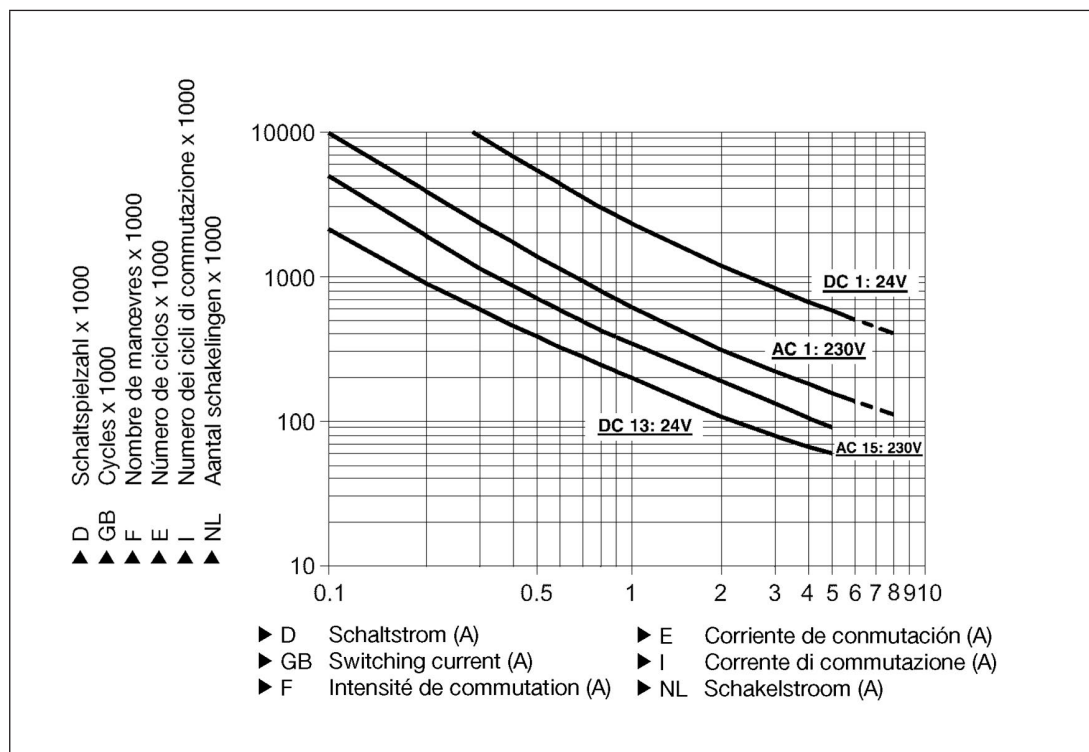
- ▶ Remedy: Switch off the supply voltage and set the required operating mode on operating mode selector switch "mode".

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.



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.

Technical details

General	750109	751109	751189
Approvals	CCC, CE, GOST, KOS-HA, TÜV, cULus Listed	CCC, CE, GOST, KOS-HA, TÜV, cULus Listed	CCC, CE, GOST, KOS-HA, TÜV, cULus Listed
Electrical data	750109	751109	751189
Supply voltage			
Voltage	24 V	24 V	24 V
Type	DC	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2,0 W	2,0 W	2,0 W
Residual ripple DC	20 %	20 %	20 %
Continuous duty	100 %	100 %	100 %
Max. inrush current impulse			
A1	0,70 A	0,70 A	0,70 A
Pulse duration	10,0000 ms	10,0000 ms	10,0000 ms
Feedback loop	0,10 A	0,10 A	0,10 A
Max. overall cable resistance R _{lmax}			
Single-channel at UB DC	30 Ohm	30 Ohm	30 Ohm
Feedback loop	30 Ohm	30 Ohm	30 Ohm
A1/A2	20 Ohm	20 Ohm	20 Ohm
Voltage at			
Feedback loop DC	24,0 V	24,0 V	24,0 V
Current at			
Input circuit DC	15,0 mA	15,0 mA	15,0 mA
Feedback loop	15,0 mA	15,0 mA	15,0 mA
Number of output contacts			
Safety contacts (N/O), delayed	3	3	3
Auxiliary contacts (N/C), delayed	1	1	1
Relay outputs	750109	751109	751189
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
Auxiliary contacts, AC1 at	240 V	240 V	240 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	6,0 A	6,0 A	6,0 A
Max. power	1500 VA	1500 VA	1500 VA
Auxiliary contacts, DC1 at	24 V	24 V	24 V
Min. current	0,01 A	0,01 A	0,01 A

Relay outputs	750109	751109	751189
Max. current	6,0 A	6,0 A	6,0 A
Max. power	150 W	150 W	150 W
Safety contacts, AC1 at	240 V	240 V	240 V
Max. current	6,0 A	6,0 A	6,0 A
Min. current	0,01 A	0,01 A	0,01 A
Max. power	1500 VA	1500 VA	1500 VA
Safety contacts, DC1 at	24 V	24 V	24 V
Max. current	6,0 A	6,0 A	6,0 A
Min. current	0,01 A	0,01 A	0,01 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
Auxiliary contacts, AC15 at	230 V	230 V	230 V
Max. current	5,0 A	5,0 A	5,0 A
Auxiliary contacts, DC13 (6 cycles/min) at	24 V	24 V	24 V
Max. current	5,0 A	5,0 A	5,0 A
Safety contacts, AC15 at	230 V	230 V	230 V
Max. current	5,0 A	5,0 A	5,0 A
Safety contacts, DC13 (6 cycles/min) at	24 V	24 V	24 V
Max. current	5,0 A	5,0 A	5,0 A
Contact fuse protection, external safety contacts			
In accordance with the standard	EN 60947-5-1	EN 60947-5-1	EN 60947-5-1
Blow-out fuse, quick	10 A	10 A	10 A
Blow-out fuse, slow	6 A	6 A	6 A
Circuit breaker, 24V AC/DC, characteristic B/C	6 A	6 A	6 A
Contact fuse protection, external auxiliary contacts			
Blow-out fuse, quick	10 A	10 A	10 A
Blow-out fuse, slow	6 A	6 A	6 A
Circuit breaker, 24 V AC/DC, characteristic B/C	6 A	6 A	6 A
Conventional thermal current	6,0 A	6,0 A	6,0 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 reset typ.	60 ms	60 ms	60 ms
With manual reset 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
Recovery time at max. switching frequency 1/s			
After power failure	800 ms	800 ms	800 ms
Delay time tv	0,00 s, 0,10 s, 0,20 s, 0,30 s, 0,40 s, 0,50 s, 0,60 s, 0,70 s, 0,80 s, 1,00 s, 1,50 s, 10,00 s, 100,00 s, 12,00 s, 120,00 s, 14,00 s, 140,00 s, 15,00 s, 150,00 s, 16,00 s, 160,00 s, 180,00 s, 2,00 s, 2,50 s, 20,00 s, 200,00 s, 210,00 s, 240,00 s, 25,00 s, 3,00 s, 3,50 s, 30,00 s, 300,00 s, 35,00 s, 4,00 s, 40,00 s, 5,00 s, 50,00 s, 6,00 s, 60,00 s, 7,00 s, 70,00 s, 8,00 s, 80,00 s, 90,00 s	0,00 s, 0,10 s, 0,20 s, 0,30 s, 0,40 s, 0,50 s, 0,60 s, 0,70 s, 0,80 s, 1,00 s, 1,50 s, 10,00 s, 100,00 s, 12,00 s, 120,00 s, 14,00 s, 140,00 s, 15,00 s, 150,00 s, 16,00 s, 160,00 s, 180,00 s, 2,00 s, 2,50 s, 20,00 s, 200,00 s, 210,00 s, 240,00 s, 25,00 s, 3,00 s, 3,50 s, 30,00 s, 300,00 s, 35,00 s, 4,00 s, 40,00 s, 5,00 s, 50,00 s, 6,00 s, 60,00 s, 7,00 s, 70,00 s, 8,00 s, 80,00 s, 90,00 s	0,00 s, 0,10 s, 0,20 s, 0,30 s, 0,40 s, 0,50 s, 0,60 s, 0,70 s, 0,80 s, 1,00 s, 1,50 s, 10,00 s, 100,00 s, 12,00 s, 120,00 s, 14,00 s, 140,00 s, 15,00 s, 150,00 s, 16,00 s, 160,00 s, 180,00 s, 2,00 s, 2,50 s, 20,00 s, 200,00 s, 210,00 s, 240,00 s, 25,00 s, 3,00 s, 3,50 s, 30,00 s, 300,00 s, 35,00 s, 4,00 s, 40,00 s, 5,00 s, 50,00 s, 6,00 s, 60,00 s, 7,00 s, 70,00 s, 8,00 s, 80,00 s, 90,00 s
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
Time accuracy	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms
Supply interruption before de-energisation in the input circuit	10,0 ms	10,0 ms	10,0 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
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
Vibration			
In accordance with the standard	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
Max. amplitude	0,35 mm	0,35 mm	0,35 mm

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	6,00 kV	6,00 kV	6,00 kV
Protection type			
Mounting (e.g. 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
Cross section of external conductors with screw terminals			
1 core flexible	0,25 - 2,50 mm², 24 - 12 AWG	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1,00 mm², 24 - 16 AWG	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,20 - 1,50 mm², 24 - 16 AWG	–	–
Torque setting with screw terminals	0,50 Nm	–	–
Connection type	Screw terminal	Spring-loaded terminal, plug in	Spring-loaded terminal, plug in
Mounting type	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

Mechanical data	750109	751109	751189
Dimensions			
Height	98,0 mm	100,0 mm	100,0 mm
Width	17,5 mm	17,5 mm	17,5 mm
Depth	120,0 mm	120,0 mm	120,0 mm
Weight	175 g	175 g	175 g

The standards current on 2009-12 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]
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.



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 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

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 represented by our subsidiaries and sales partners.

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

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