

up to PL e of EN ISO 13849-1 PNOZ s9



Contact expander module for increasing the number of available contacts, Pulse-on timer relay for step-by-step control of movement sequences, Delay-on energisation timer for unlocking an interlock with delay, Shutdown of application with delay-on de-energisation, controlled stop

Approvals

	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
- ▶ 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 for:
 - Supply voltage
 - Input status, channel 1
 - Input status, channel 2
 - Switch status channel 1/2
 - Reset circuit
 - Errors
- ▶ Plug-in connection terminals (either spring-loaded terminals or screw terminals)

Unit description

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 954-1 and 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

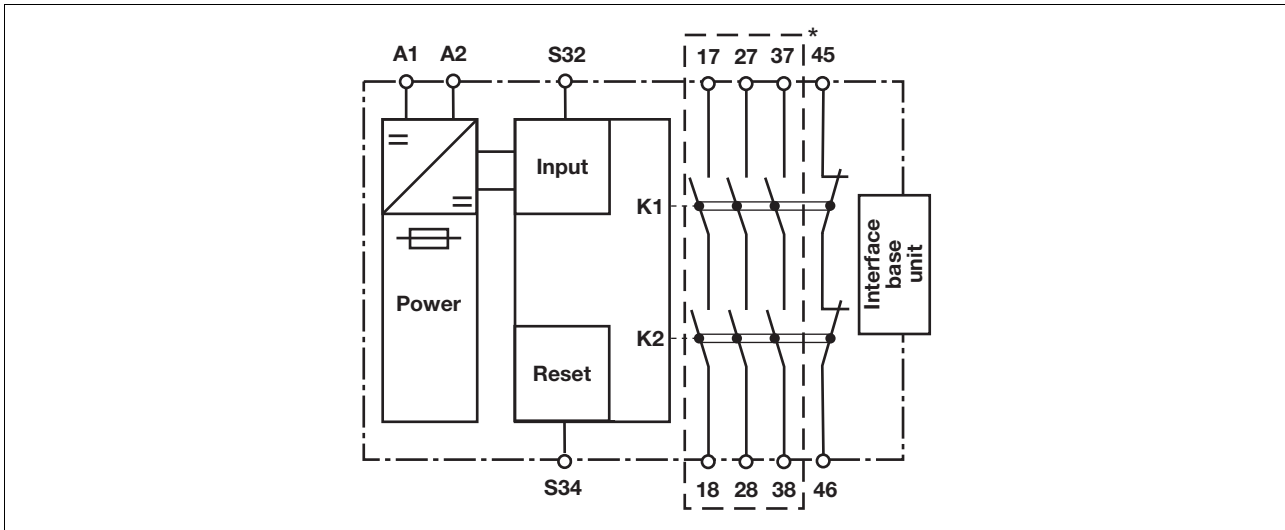
Safety features

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.

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Block diagram



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

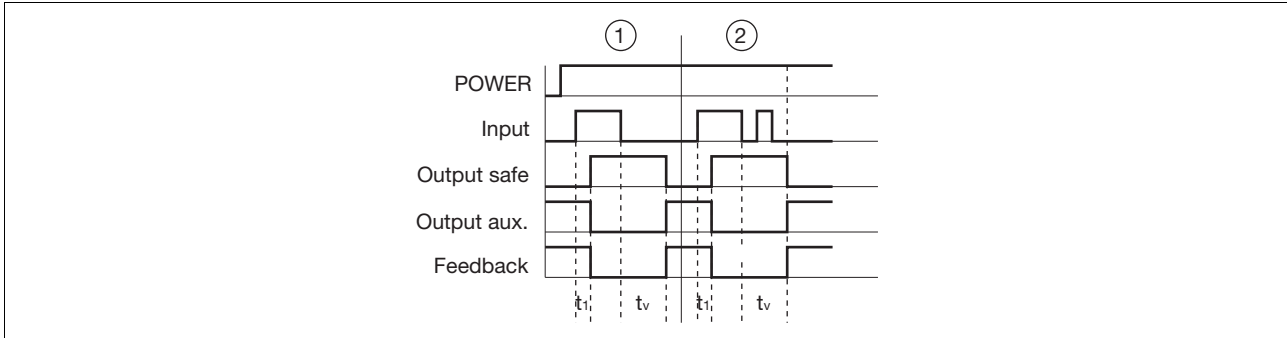
Function description

- ▶ Delay-on de-energisation, not re-triggerable
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

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Timing diagrams

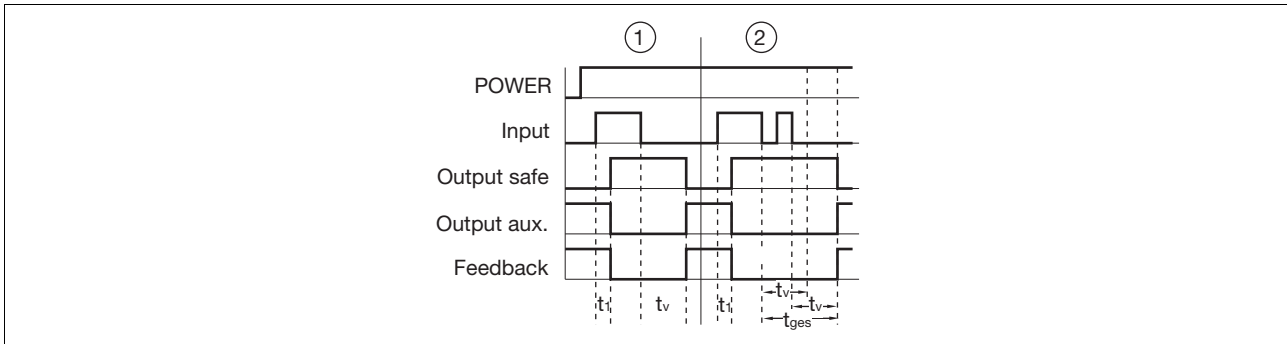
Delay-on de-energisation, not retriggerable



Key

- ▶ Power: Supply voltage
- ▶ Input: Input circuit S32
- ▶ Output safe: Safety contacts 17-18, 27-28, 37-38
- ▶ Output aux.: Auxiliary contact 45-46
- ▶ Feedback: Feedback loop S34
- ▶ t_1 : Switch-on delay
- ▶ t_v : Delay time
- ▶ ①: Delay-on de-energisation with the time t_v
- ▶ ②: No retriggering in the time t_v

Delay-on de-energisation, retriggerable

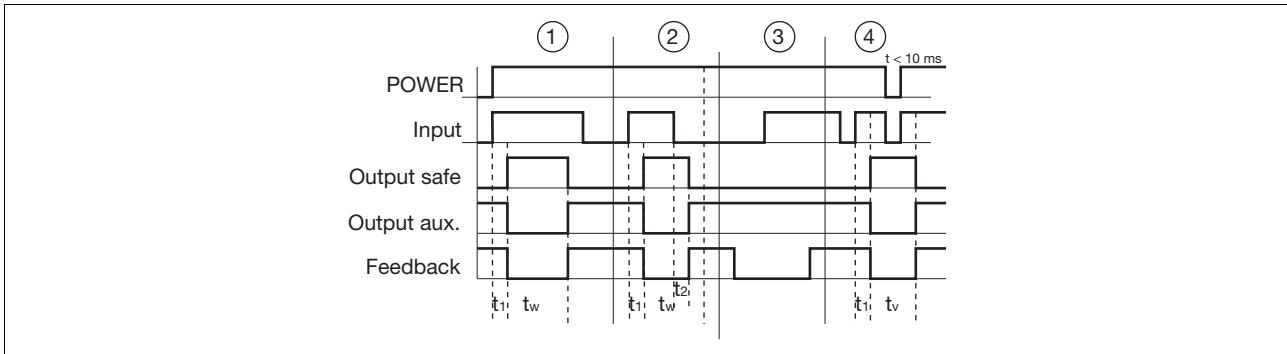


Key

- ▶ Power: Supply voltage
- ▶ Input: Input circuit S32
- ▶ Output safe: Safety contacts 17-18, 27-28, 37-38
- ▶ Output aux.: Auxiliary contact 45-46
- ▶ Feedback: Feedback loop S34
- ▶ t_1 : Switch-on delay
- ▶ t_v : Delay-on de-energisation
- ▶ 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}

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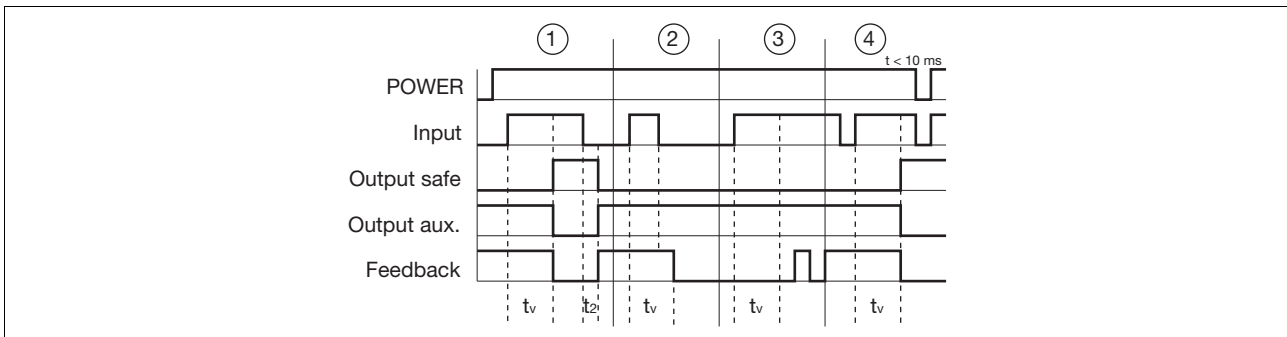
Pulse on switching on



Key

- ▶ Power: Supply voltage
- ▶ Input: Input circuit S32
- ▶ Output safe: Safety contacts 17-18, 27-28, 37-38
- ▶ Output aux.: Auxiliary contact 45-46
- ▶ Feedback: Feedback loop S34
- ▶ t_1 : Switch-on delay
- ▶ t_2 : Delay-on de-energisation
- ▶ t_w : 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

Delay-on energisation



Key

- ▶ Power: Supply voltage
- ▶ Input: Input circuit S32
- ▶ Output safe: Safety contacts 17-18, 27-28, 37-38
- ▶ Output aux.: Auxiliary contact 45-46
- ▶ Feedback: Feedback loop S34
- ▶ t_2 : Delay-on de-energisation
- ▶ t_v : Delay time
- ▶ ①: Normal operating cycle
- ▶ ②: Fault: Input circuit opened too early
- ▶ ③: Fault: Feedback loop closed too late after t_2 elapsed
- ▶ ④: Normal operating cycle with supply interruption < 10 ms

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).
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- ▶ Calculation of the max. cable runs l_{max} in the input circuit:

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

$$R_{lmax} = \text{max. overall cable resistance (see technical details)}$$

$$R_l / km = \text{cable resistance/km}$$
- ▶ Use copper wire that can withstand 60/75 °C.
- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

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Preparing for operation

► Supply voltage

Supply voltage	AC	DC

► 1-channel input circuit/feedback loop

Input circuit	Input circuit	Feedback circuit
Without base unit (standalone)		
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog; driven via semi-conductor outputs (24 VDC)		

The inputs that evaluate the feedback loop will depend on the base unit and application.

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

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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 unit PNOZ s6	Base unit: Two-hand control unit PNOZ s6.1
The input circuit is connected and evaluated via the connector.		

▶ Application

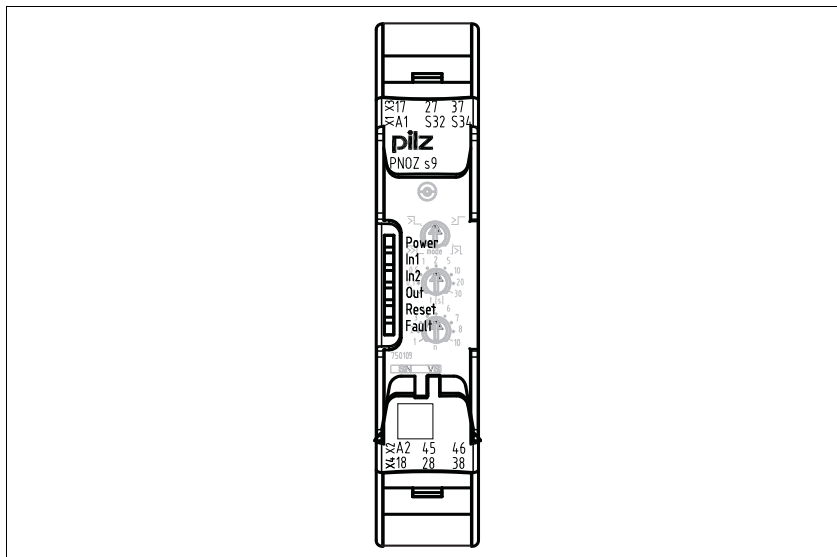
	without feedback loop	with feedback loop
without base unit		

▶ Key

S3	Reset button
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Terminal configuration



Installation

Install contact expander 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:

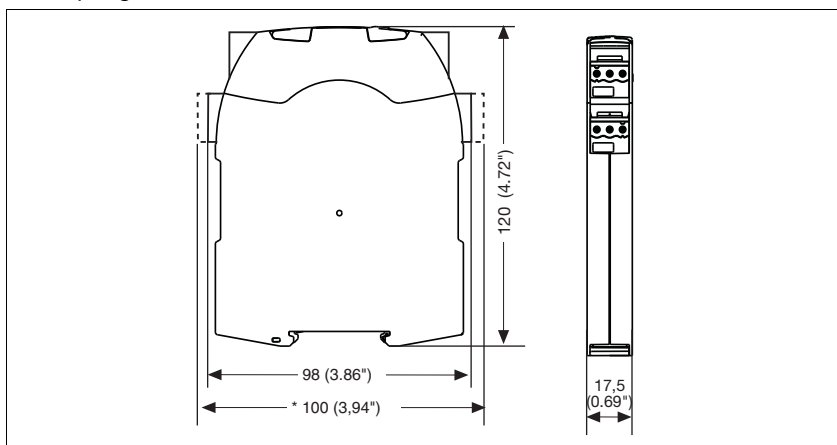
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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 unit upwards or downwards before lifting it from the DIN rail.

Dimensions

*with spring-loaded terminals



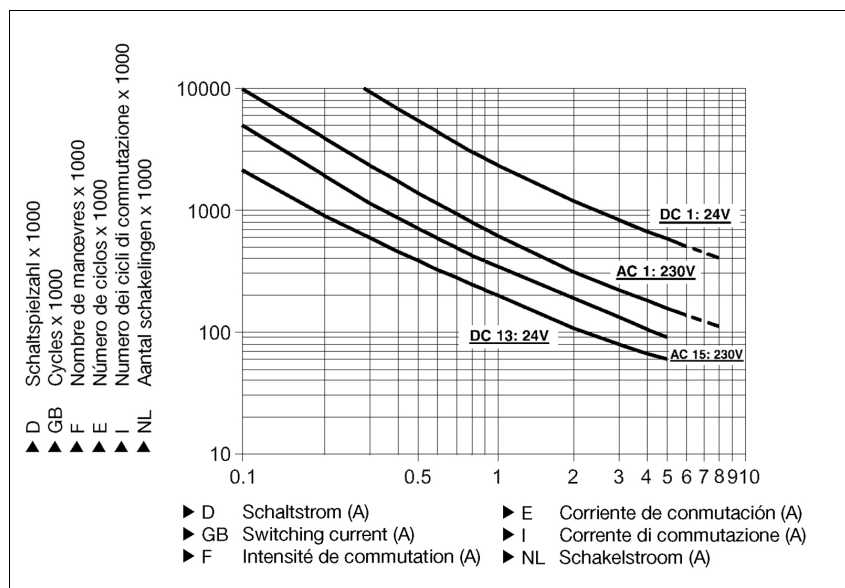
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NOTICE

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

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

Electrical data

Supply voltage	
Supply voltage U_B DC	24 V
Voltage tolerance	-20 %/+20 %
Power consumption at U_B DC	2.0 W
Residual ripple DC	20 %
Typ. supply current at A1	70 mA
Voltage and current at	
Input circuit DC:	15.0 mA
Feedback loop DC: 24.0 V	15.0 mA
Max. inrush current impulse	
A1	0.70 A
Input circuit	0.10 A
Feedback loop	0.10 A

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Electrical data	
Number of output contacts	
Safety contacts (N/O), delayed:	3
Auxiliary contacts (N/C), delayed:	1
Utilisation category in accordance with EN 60947-4-1	
Safety contacts: AC1 at 240 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 1500 VA$
Safety contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 150 W$
Auxiliary contacts: AC1 at 240 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 1500 VA$
Auxiliary contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 150 W$
Utilisation category in accordance with EN 60947-5-1	
Safety contacts: AC15 at 230 V	$I_{max}: 5.0 A$
Safety contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 5.0 A$
Auxiliary contacts: AC15 at 230 V	$I_{max}: 5.0 A$
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 5.0 A$
Conventional thermal current	6.0 A
Contact material	AgCuNi + 0.2 µm Au
External contact fuse protection ($I_K = 1 kA$) to EN 60947-5-1	
Blow-out fuse, quick	
Safety contacts:	10 A
Auxiliary contacts:	10 A
Blow-out fuse, slow	
Safety contacts:	6 A
Auxiliary contacts:	6 A
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	6 A
Auxiliary contacts:	6 A
Max. overall cable resistance R_{lmax}	
A1/A2	20 Ohm
Input circuit	30 Ohm
Feedback loop	30 Ohm
Safety-related characteristic data	
PL in accordance with EN ISO 13849-1: 2006	PL e (Cat. 4)
Category in accordance with EN 954-1	Cat. 4
SIL CL in accordance with EN IEC 62061	SIL CL 3
PFH in accordance with EN IEC 62061	2.34E-09
SIL in accordance with IEC 61511	SIL 3
PFD in accordance with IEC 61511	2.75E-05
T_M [year] in accordance with EN ISO 13849-1: 2006	20
Times	
Switch-on delay	
with manual reset typ.	60 ms
with manual reset max.	80 ms
Delay-on de-energisation	
with E-STOP typ.	40 ms
with E-STOP max.	50 ms
Recovery time at max. switching frequency 1/s after power failure	
	800 ms

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Times	
Delay time t_V : selectable	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; 2,00 s; 2,50 s; 3,00 s; 3,50 s; 4,00 s; 5,00 s; 6,00 s; 7,00 s; 8,00 s; 10,00 s; 12,00 s; 14,00 s; 15,00 s; 16,00 s; 20,00 s; 25,00 s; 30,00 s; 35,00 s; 40,00 s; 50,00 s; 60,00 s; 70,00 s; 80,00 s; 90,00 s; 100,00 s; 120,00 s; 140,00 s; 150,00 s; 160,00 s; 180,00 s; 200,00 s; 210,00 s; 240,00 s; 300,00 s
Repetition accuracy	+/-1 % + +/-20 ms
Repetition accuracy in the case of a fault	+/-15 % + +/-20 ms
Time accuracy	+/-1 % + +/-20 ms
Supply interruption before de-energisation	10 ms
Supply interruption before de-energisation in the input circuit	10.0 ms
Environmental data	
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4
Vibration to EN 60068-2-6	
Frequency	10 - 55 Hz
Amplitude	0.35 mm
Climatic suitability	EN 60068-2-78
Airgap creepage in accordance with EN 60947-1	
Pollution degree	2
Overvoltage category	III
Rated insulation voltage	250 V
Rated impulse withstand voltage	6.00 kV
Ambient temperature	-15 - 55 °C
Storage temperature	-40 - 85 °C
Protection type	
Mounting (e.g. cabinet)	IP54
Housing	IP40
Terminals	IP 20
Mechanical data	
Housing material	
Housing	PC
Front	PC
Cross section of external conductors with screw terminals	
1 core flexible	0.25 - 2.50 mm ² , 24 - 12 AWG No. 750109
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm ² , 24 - 16 AWG No. 750109
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG No. 750109
Torque setting with screw terminals	0.50 Nm No. 750109
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	0.20 - 2.50 mm ² , 24 - 12 AWG No. 751109, 751189
Spring-loaded terminals: Terminal points per connection	2 No. 751109, 751189
Stripping length	9 mm No. 751109, 751189
Dimensions	
Height	100.0 mm No. 751109, 751189 96.0 mm No. 750109
Width	17.5 mm
Depth	120.0 mm
Weight	175 g No. 751189 176 g No. 751109 177 g No. 750109

No. stands for order number.

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.

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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.

The standards current on **2007-02** apply.

Order reference

Type	Features	Terminals	Order no.
PNOZ s9	24 VDC	With screw terminals	750 109
PNOZ s9 C	24 VDC	With spring-loaded terminals	751 109
PNOZ s9 C (coated version)	24 VDC	With spring-loaded terminals	751 189

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