

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 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

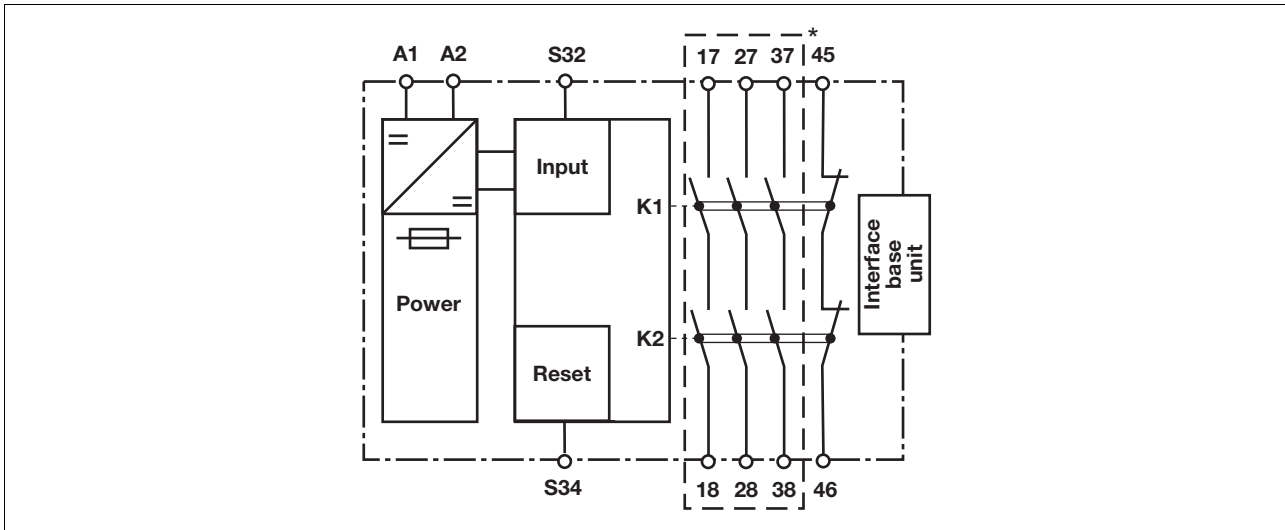
Safety features

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

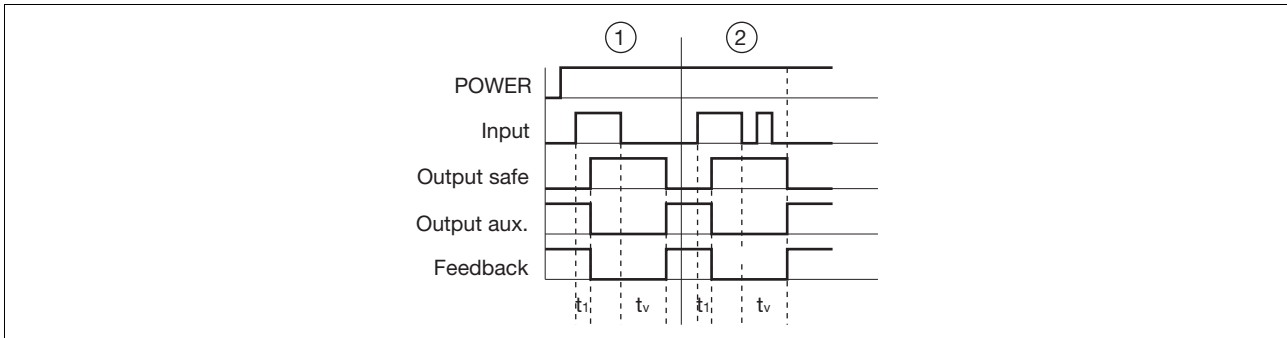
- ▶ Delay-on de-energisation, not retriggerable
If the supply voltage at the input circuit is interrupted, the safety contacts will open once the set release time has elapsed, even if the safety function is cancelled during the delay time. The unit cannot be reactivated until the delay time has elapsed.
- ▶ 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) and the reset button is operated, 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

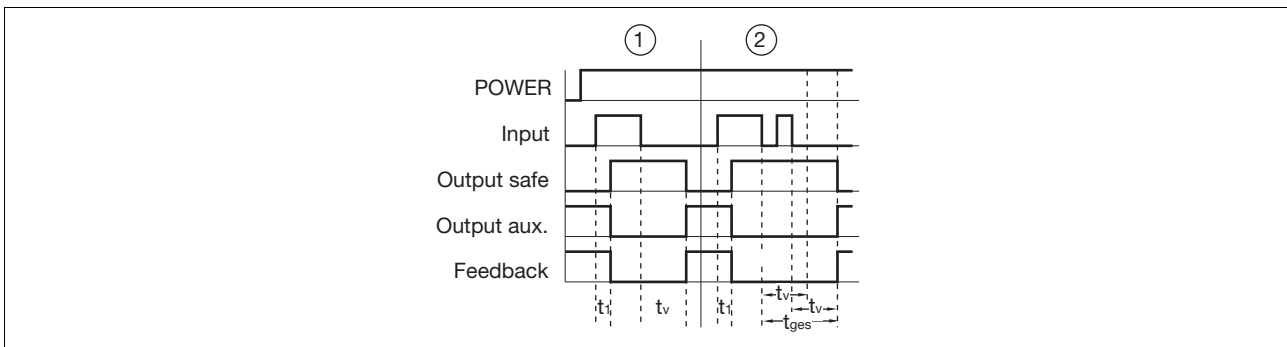
Delay-on de-energisation, not retriggerable



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

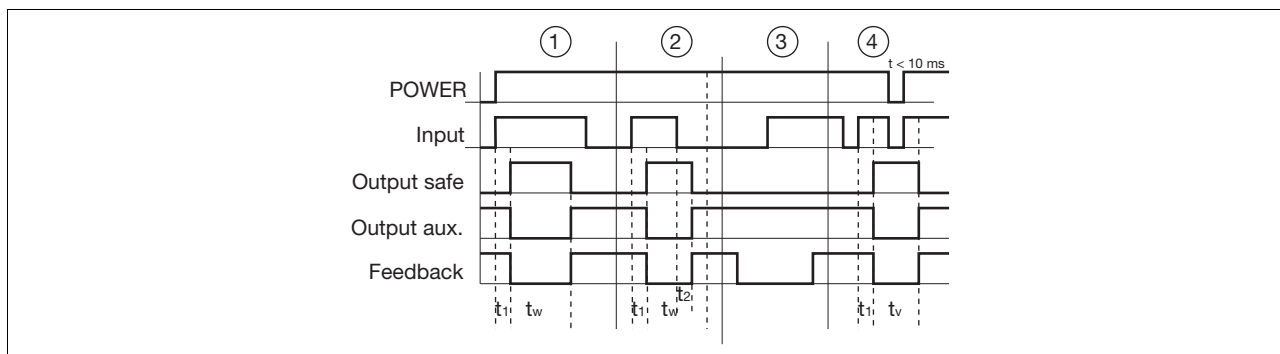


Key

- ▶ 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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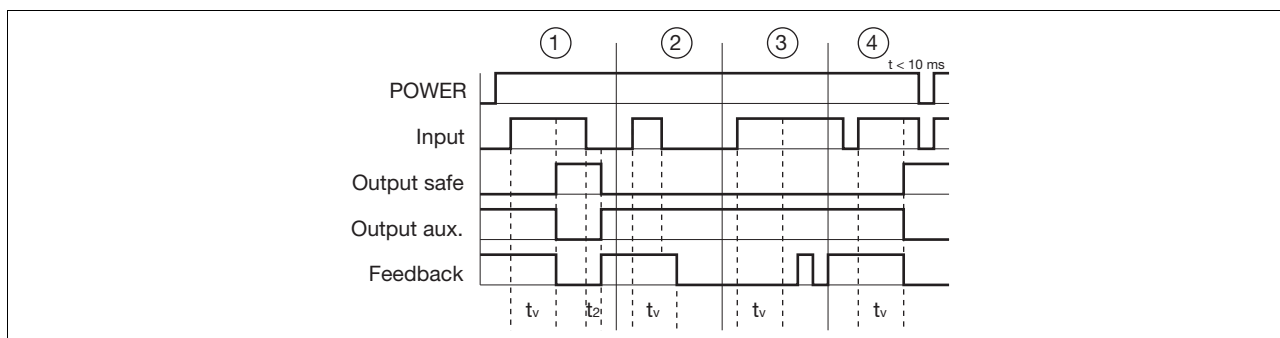
Pulse on switching on



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} = 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.

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Preparing for operation

- Supply voltage

Supply voltage	AC	DC

- 1-channel input circuit/feedback loop

Input circuit	Input circuit	Feedback loop
Without base unit (standalone)		
Base unit: PNOZ X safety relay		
Base unit: PNOZelog safety relay; driven via semiconductor outputs (24 VDC)		

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

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* 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

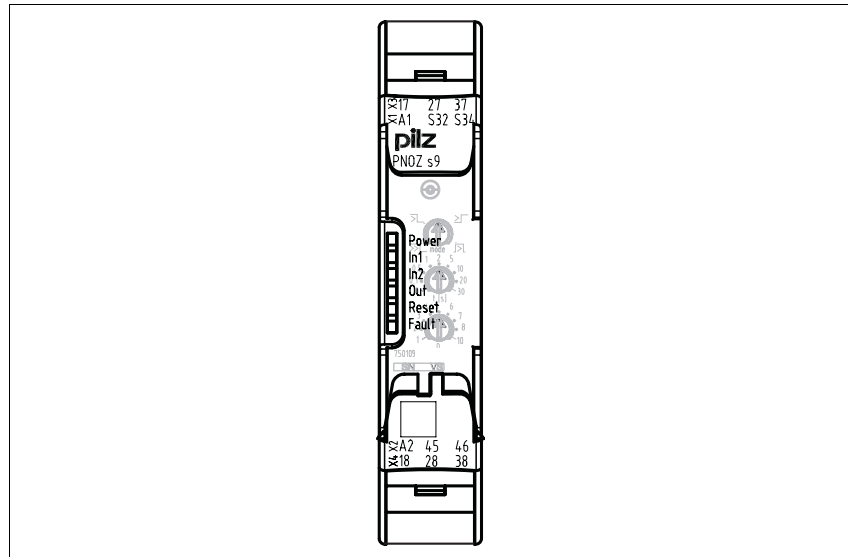
	without feedback loop	with feedback loop
without base unit		

▶ Key

S3	Reset button
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Terminal configuration



Installation

Install safety relay without PNOZsigma base unit:

- ▶ Ensure that the plug terminator is inserted at the side of the unit.

Connect PNOZsigma base unit and PNOZsigma contact expansion module:

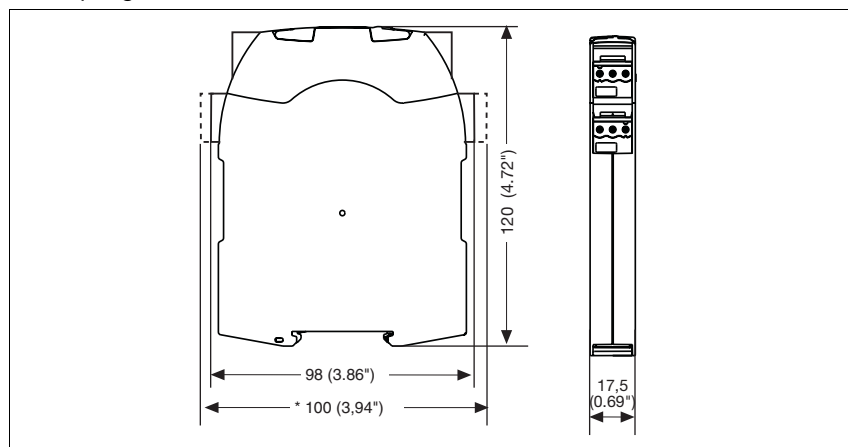
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module
- ▶ Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

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.
- ▶ 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.

Dimensions

*with spring-loaded terminals

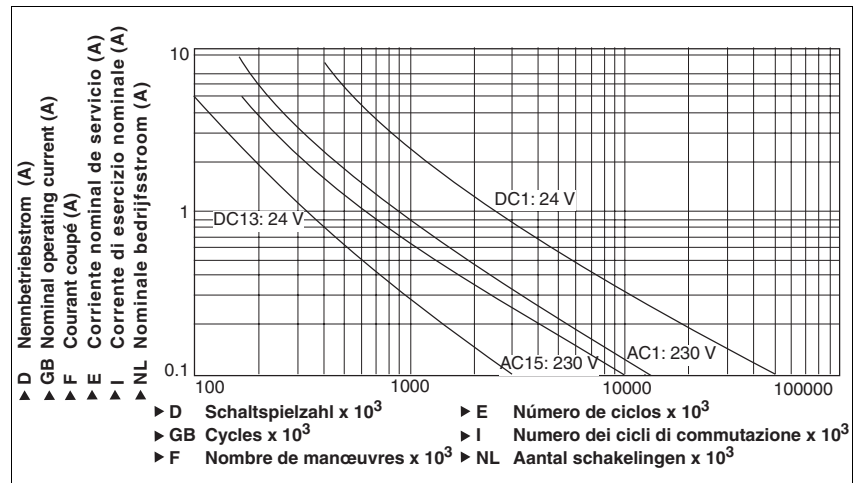


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NOTICE

This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

Service life graph



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. current pulse	
A1	0.70 A
Input circuit	0.10 A
Feedback loop	0.10 A
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	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 2000 VA$
Safety contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 200 W$
Auxiliary contacts: AC1 at 240 V	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 2000 VA$
Auxiliary contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 200 W$
Utilisation category in accordance with EN 60947-5-1	
Safety contacts: AC15 at 230 V	$I_{max}: 6.0 A$
Safety contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 5.0 A$
Auxiliary contacts: AC15 at 230 V	$I_{max}: 6.0 A$
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 5.0 A$
Contact material	AgCuNi + 0.2 μm Au

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Electrical data	
External contact fuse protection ($I_K = 1 \text{ kA}$) 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	
Performance level (PL) in accordance with EN ISO 13849-1	
Safety contacts, delayed <30 s	e
Safety contacts, delayed ≥ 30 s	e
Category of output contacts in accordance with EN 954-1, EN ISO 13849-1	
Delay time <30 s	4
Delay time ≥ 30 s	4
SIL claim limit (SIL CL) in accordance with EN IEC 62061	
Safety contacts, delayed <30 s	3
Safety contacts, delayed ≥ 30 s	3
Probability of dangerous failure per hour (PFH _D) in accordance with EN IEC 62061	
Safety contacts, delayed <30 s	2.34E-09 1/h
Safety contacts, delayed ≥ 30 s	2.34E-09 1/h
Mission time/Proof test interval in years	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
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 %/+1 %, -20 ms/+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
Rated insulation voltage	250 V
Rated impulse withstand voltage	6.0 kV

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Environmental data	
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 Order no.: 750109
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm ² , 24 - 16 AWG Order no.: 750109
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG Order no.: 750109
Torque setting with screw terminals	0.50 Nm Order 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 Order no.: 751109
Spring-loaded terminals: Terminal points per connection	2 Order no.: 751109
Stripping length	9 mm Order no.: 751109
Dimensions	
Height	100.0 mm Order no.: 751109 96.0 mm Order no.: 750109
Width	17.5 mm
Depth	120.0 mm
Weight	175 g

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

Conventional thermal current	
I_{th} (A) at U_B DC	
1 contact	8.00 A
2 contacts	7.00 A
3 contacts	6.00 A

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