




up to Category 4, EN 954-1 PNOZ s5



Safety relay for monitoring E-STOP pushbuttons, safety gates and light barriers.

Approvals

	PNOZ s5
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Unit features

- ▶ Positive-guided relay outputs:
 - 2 safety contacts (N/O), instantaneous
 - 2 safety contacts (N/O), delay-on de-energisation
- ▶ 1 semiconductor output
- ▶ Connection options for:
 - E-STOP pushbutton
 - Safety gate limit switch
 - Reset button
 - Light barriers
 - PSEN
- ▶ A connector can be used to connect 1 PNOZsigma contact expander module
- ▶ Delay-on de-energisation selectable
- ▶ Operating modes and delay times can be selected via rotary switches
- ▶ LED indicator for:
 - Supply voltage
 - Input status, channel 1
 - Input status, channel 2
 - Switch status channel 1/2
 - Reset circuit
 - Error

- ▶ Plug-in connection terminals (either cage clamp terminal or screw terminal)
- ▶ See order reference for unit types

Unit description

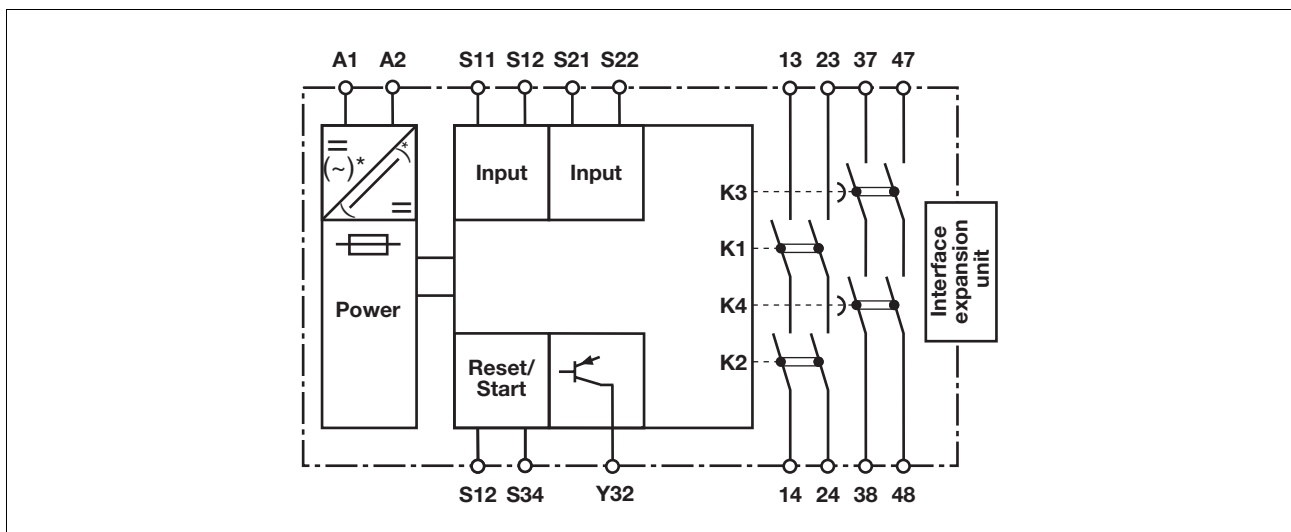
The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with

- ▶ E-STOP pushbuttons
- ▶ Safety gates
- ▶ Light barriers

Safety features

- The 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 correct opening and closing of the safety function relays is tested automatically in each on-off cycle.
 - ▶ The unit has an electronic fuse.

Block diagram



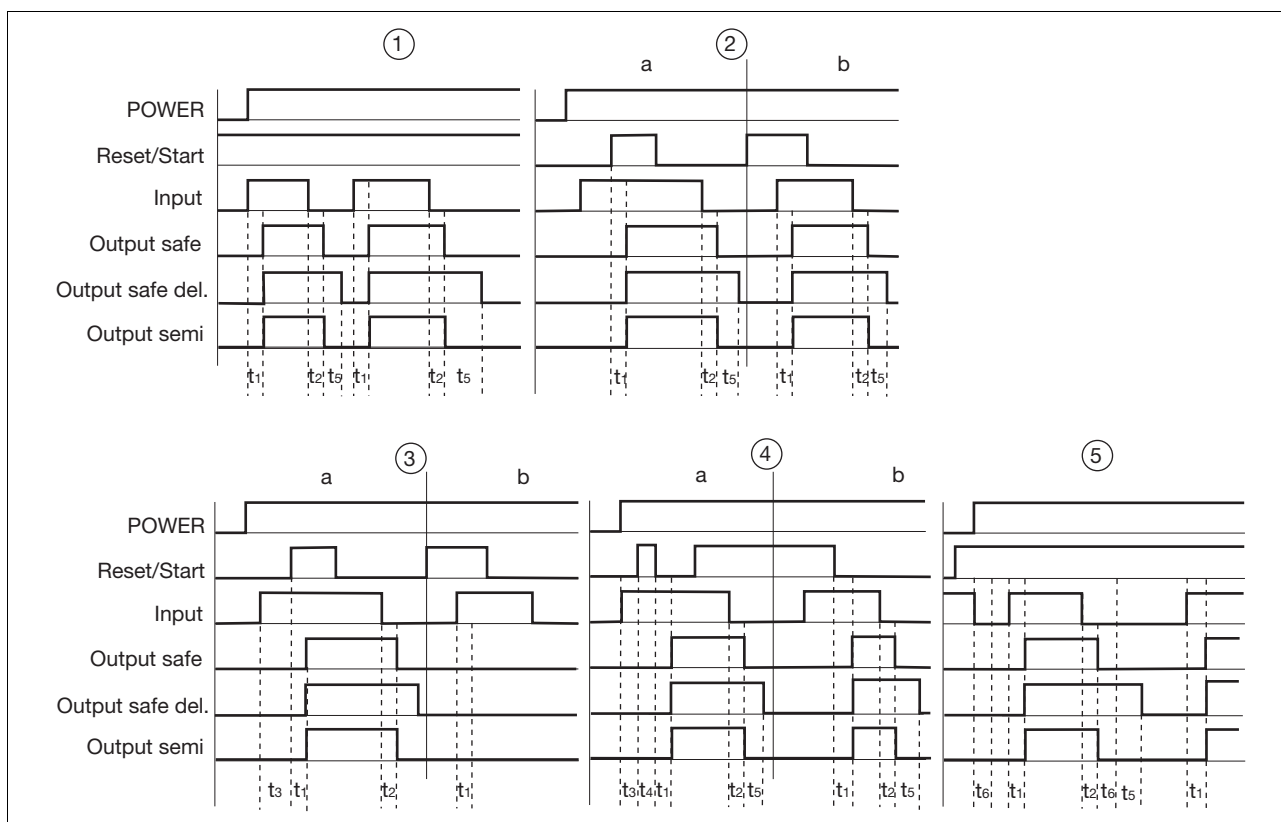
* only when $U_B = 48 - 240 \text{ VAC/DC}$

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Function description

- ▶ Single-channel operation: no redundancy in the input circuit, earth faults in the reset and input circuit are detected.
- ▶ Dual-channel operation without detection of shorts across contacts: redundant input circuit, detects
 - earth faults in the reset and input circuit,
 - short circuits in the input circuit and, with a monitored reset, in the reset circuit too.
- ▶ Dual-channel operation with detection of shorts across contacts: redundant input circuit, detects
 - earth faults in the reset and input circuit,
 - short circuits in the input circuit and, with a monitored reset, in the reset circuit too,
 - shorts between contacts in the input circuit.
- ▶ Automatic start: Unit is active once the input circuit has been closed.
- ▶ Manual reset: Unit is active once the input circuit is closed and then the reset circuit is closed.
- ▶ Monitored reset with falling edge: Unit is active once
 - the input circuit is closed and then the reset circuit is closed and opened again.
 - the reset circuit is closed and then opened again once the input circuit is closed.
- ▶ Monitored reset with rising edge: Unit is active once the input circuit is closed and once the reset circuit is closed after the waiting period has elapsed (see technical details).
- ▶ Reset with start-up test: The unit checks whether safety gates that are closed are opened and then closed again when supply voltage is applied.
- ▶ Increase in the number of available contacts by connecting contact expander modules or external contactors/relays; A connector can be used to connect 1 PNOZsigma contact expander module.

Timing diagram



Key

- ▶ Power: Supply voltage
- ▶ Reset/start: Reset circuit S12-S34
- ▶ Input: Input circuits S11-S12, S21-S22
- ▶ Output safe: Safety contacts 13-14, 23-24
- ▶ Out semi: Semiconductor output
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ ③: Monitored reset with rising edge
- ▶ ④: Monitored reset with falling edge
- ▶ ⑤: Reset with start-up test
- ▶ a: Input circuit closes before reset circuit
- ▶ b: Reset circuit closes before input circuit
- ▶ t_1 : Switch-on delay
- ▶ t_2 : Delay-on de-energisation
- ▶ t_3 : Waiting period
- ▶ t_4 : Waiting period reset circuit was closed

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- ▶ t_5 : Delay time
- ▶ t_6 : Minimum time safety gates open

Wiring

Please note:

- ▶ Information given in the “Technical details” must be followed.
- ▶ Outputs 13-14, 23-24 are instantaneous safety contacts, outputs 37-38, 47-48 are delay-on de-energisation safety contacts.
- ▶ 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:

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

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


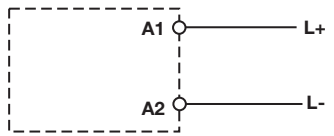
R_l / km = cable resistance/km

- ▶ Use copper wire that can withstand 60/75 °C.
- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- ▶ With U_B 48 – 240 VAC/DC: Connect S21 to the protective earth system

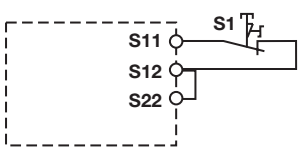
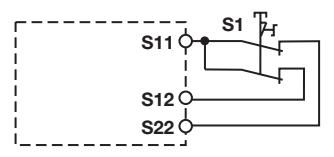

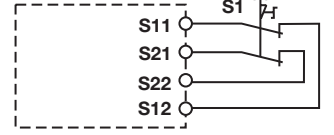
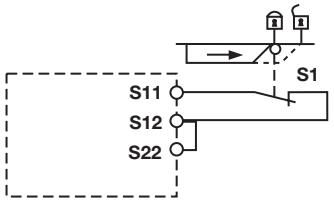
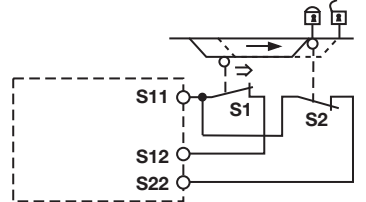

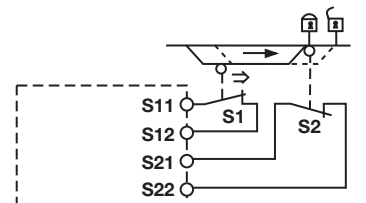

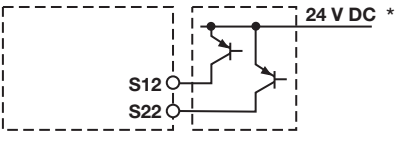
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Preparing for operation

▶ Supply voltage


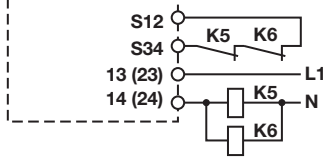
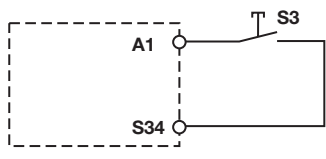
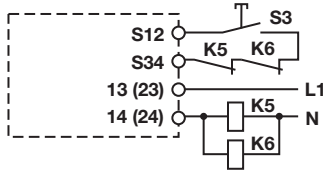
Supply voltage	AC	DC
		

▶ Input circuit

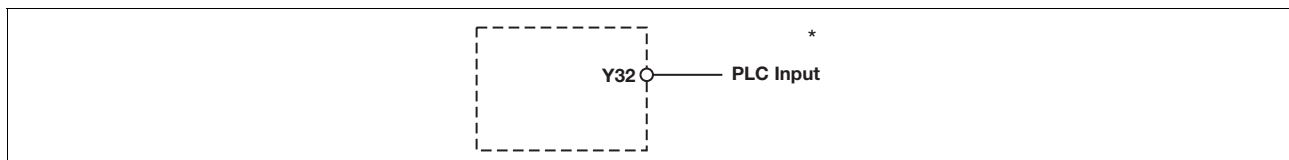
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		
Safety gate with detection of shorts across contacts		
Light barrier or safety switch with detection of shorts across contacts via ESPE		

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▶ Reset circuit/feedback loop

Reset circuit/feedback loop	Reset circuit	Feedback loop
Automatic reset		
Manual/monitored reset		

▶ Semiconductor output






*Connect together the 0V connections on all the external power supplies

INFORMATION

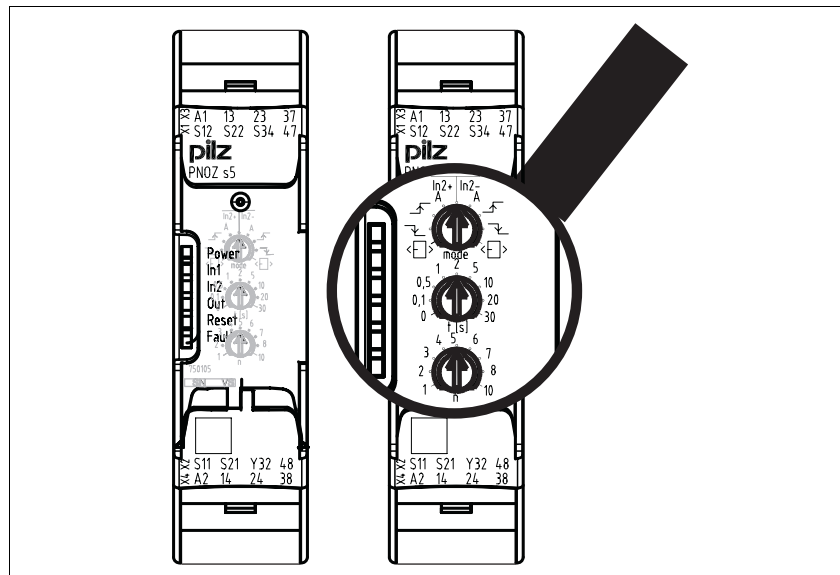
The wiring between a base unit and a PNOZsigma expander module occurs exclusively via the connector.

▶ Key

S1/S2	E-STOP/safety gate switch
S3	Reset button
	Switch operated
	Gate open
	Gate closed

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Terminal configuration



Installation

Install base unit without contact expander module:

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

Connect base unit and PNOZsigma contact expander module:

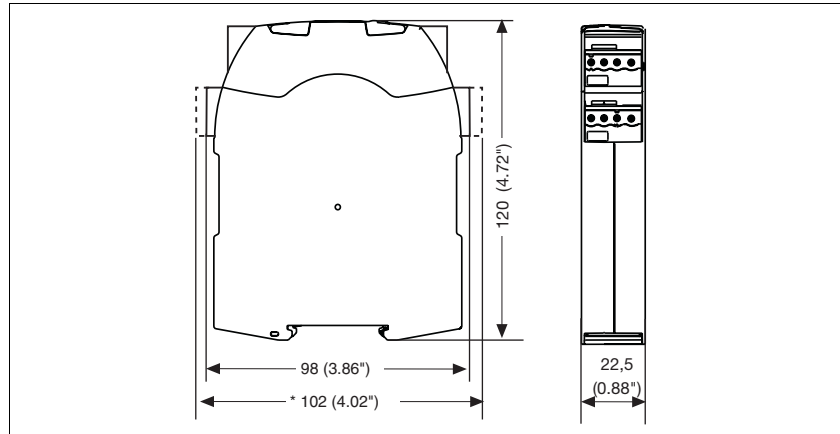
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module.
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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.
- ▶ 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

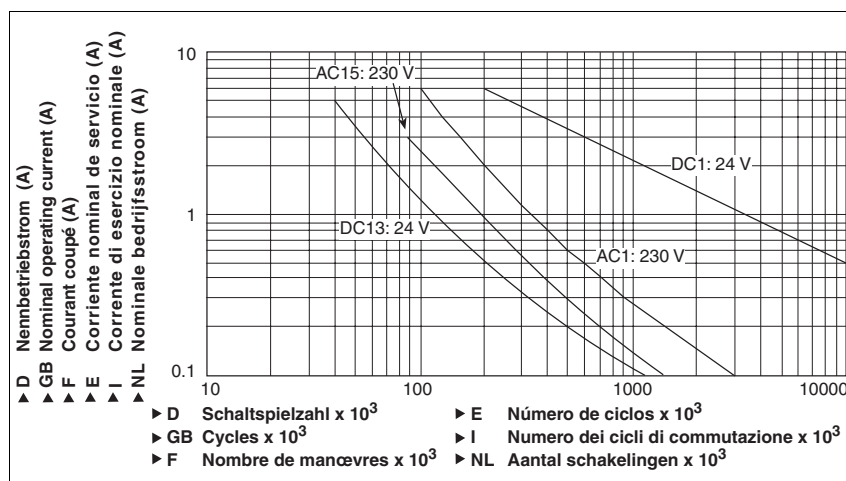


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Notice

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
Supply voltage U _B AC/DC	48 - 240 V
Voltage tolerance	-15 %/+10 %
Power consumption at U _B AC	8.0 VA Order no.: 750135, 751135
Power consumption at U _B DC	4.0 W
Frequency range AC	50 - 60 Hz
Residual ripple DC	20 %, 160 %
Voltage and current at	
Input circuit DC: 24.0 V	40.0 mA
Reset circuit DC: 24.0 V	40.0 mA
Feedback loop DC: 24.0 V	40.0 mA
Number of output contacts	
Safety contacts (S) instantaneous:	2
Safety contacts (N/O), delayed:	2
Category of output contacts in accordance with EN 954-1	
Safety contacts (S) instantaneous:	4
Delay time <30 s	4
Delay time >30 s	4
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
Safety contacts, delayed: AC1 at 240 V	I _{min} : 0.01 A , I _{max} : 6.0 A P _{max} : 1500 VA
Safety contacts, delayed: 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} : 3.0 A
Safety contacts: DC13 at 24 V (6 cycles/min)	I _{max} : 4.0 A
Safety contacts, delayed: AC15 at 230 V	I _{max} : 3.0 A
Safety contacts, delayed: DC13 at 24 V (6 cycles/min)	I _{max} : 4.0 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:	6 A
Safety contacts, delayed:	6 A
Blow-out fuse, slow	
Safety contacts:	4 A
Safety contacts, delayed:	4 A
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	4 A
Safety contacts, delayed:	4 A
Semiconductor outputs (short circuit proof)	24.0 V DC, 20 mA
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	30 Ohm
single-channel at U_B AC	30 Ohm Order no.: 750135, 751135
dual-channel without detect. of shorts across contacts at U_B DC	30 Ohm
dual-channel without detect. of shorts across contacts at U_B AC	30 Ohm Order no.: 750135, 751135
dual-channel with detect. of shorts across contacts at U_B DC	30 Ohm
dual-channel with detect. of shorts across contacts at U_B AC	30 Ohm Order no.: 750135, 751135
Safety-related characteristic data	
Probability of dangerous failure per hour (PFH _D)	
Safety contacts, instantaneous	2.31E-09 1/h Order no.: 750135, 751135
Safety contacts, delayed <30 s	2.14E-09 1/h Order no.: 750135, 751135
Safety contacts, delayed >30 s	2.14E-09 1/h Order no.: 750135, 751135
SIL claim limit (SIL CL)	
Safety contacts, instantaneous	3
Safety contacts, delayed <30 s	3
Safety contacts, delayed >30 s	3
Performance level (PL)	
Safety contacts, instantaneous	e
Safety contacts, delayed <30 s	e
Safety contacts, delayed >30 s	e
Proof test interval in years	20
Times	
Switch-on delay	
with automatic reset typ.	180 ms
with automatic reset max.	400 ms
with automatic reset after power on typ.	1,430 ms
with automatic reset after power on max.	2,000 ms
with manual reset typ.	45 ms
with manual reset max.	85 ms
on monitored reset with rising edge typ.	45 ms
on monitored reset with rising edge max.	130 ms
on monitored reset with falling edge typ.	60 ms
on monitored reset with falling edge max.	150 ms
Delay-on de-energisation	
with E-STOP typ.	15 ms
with E-STOP max.	20 ms
with power failure typ.	75 ms
with power failure max.	110 ms
Recovery time at max. switching frequency 1/s	
after E-STOP	150 ms +tv
after power failure	200 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 %/+1 %, -20 ms/+20 ms
Repetition accuracy in the case of a fault	-15 %/+15 %, -20 ms/+20 ms
Time accuracy	-1 %/+1 %, -20 ms/+20 ms
Waiting period with a monitored reset	
with rising edge	150 ms
with falling edge	240 ms
Min. start pulse duration with a monitored reset	
with rising edge	30 ms
with falling edge	70 ms
Simultaneity, channel 1 and 2	∞
Supply interruption before de-energisation	20 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	EN 60947-1
Rated insulation voltage	250 V
Rated impulse withstand voltage	4.0 kV
Ambient temperature	-10 - 55 °C
Storage temperature	-40 - 85 °C
Protection type	
Mounting (e.g. cabinet)	IP54
Housing	IP40
Terminals	IP20
Mechanical data	
Housing material	
Housing	PC
Front	PC
Max. cross section of external conductors with screw terminals	
1 core flexible	0.25 - 2.50 mm ² , 24 - 12 AWG Order no.: 750105, 750135
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm ² , 24 - 16 AWG Order no.: 750105, 750135
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG Order no.: 750105, 750135
Torque setting with screw terminals	0.50 Nm Order no.: 750105, 750135
Max. cross section of external conductors with cage clamp terminals/spring-loaded terminals: Flexible without crimp connectors	0.20 - 2.50 mm ² , 24 - 12 AWG Order no.: 751105, 751135
Cage clamp terminals/spring-loaded terminals: Terminal points per connection	2 Order no.: 751105, 751135
Stripping length	9 mm Order no.: 751105, 751135
Dimensions	
Height	102.0 mm Order no.: 751105, 751135 96.0 mm Order no.: 750105, 750135
Width	22.5 mm
Depth	120.0 mm
Weight	235 g Order no.: 750105, 751105 280 g Order no.: 750135, 751135

The standards current on **2006-04** apply.

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Conventional thermal current

I_{th} (A) at U_B DC

1 contact	6.00 A
2 contacts	6.00 A
3 contacts	6.00 A
4 contacts	6.00 A

Order reference

Type	Features	Terminals	Order no.	
PNOZ s5	24 V DC	With screw terminals	750 105	
PNOZ s5 C	24 V DC	With spring-loaded terminals	751 105	
PNOZ s5	48 – 240 V AC	48 – 240 V DC	With screw terminals	750 135
PNOZ s5 C	48 – 240 V AC	48 – 240 V DC	With spring-loaded terminals	751 135