

## Up to PL e of EN ISO 13849-1 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 spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

### Unit description

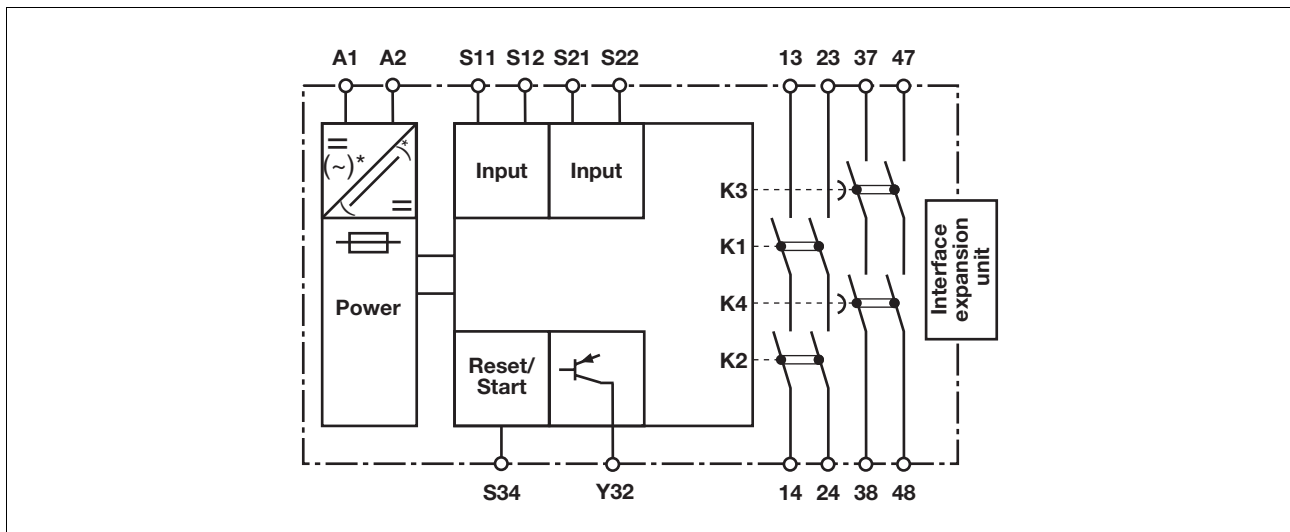
The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with

- ▶ 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



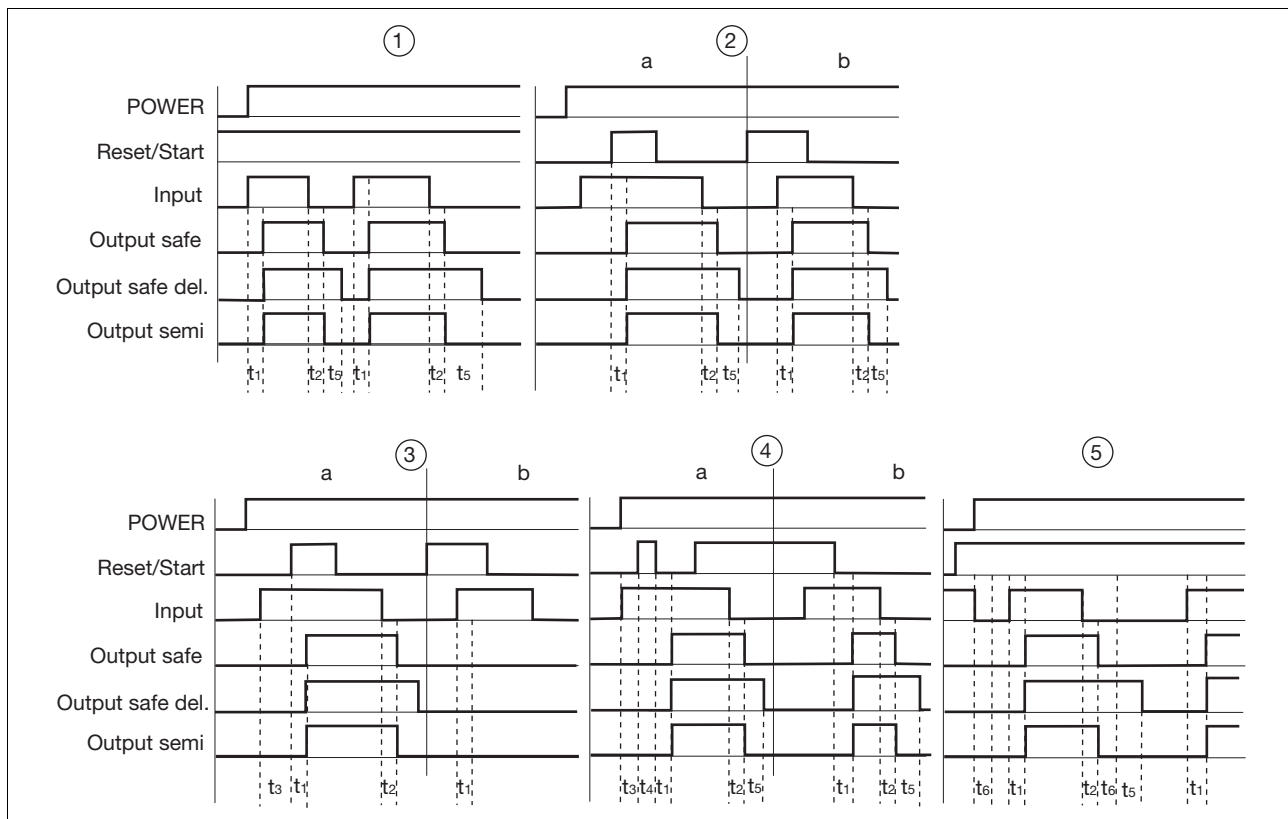
\* only when  $U_B = 48 - 240 \text{ VAC/DC}$

## Up to PL e of EN ISO 13849-1 PNOZ s5

### 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.
  - ▶ Ability to increase the number of contacts available on the
    - instantaneous safety contacts by using connectors to link to a PNOZsigma contact expansion module
    - delayed/instantaneous safety contacts by connecting contact expansion modules or external contactors

### 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 Y32
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ ③: Monitored reset with rising edge
- ▶ ④: Monitored reset with falling edge
- ▶ ⑤: Reset with start-up test

## Up to PL e of EN ISO 13849-1 PNOZ s5

- ▶ a: Input circuit closes before reset circuit
- ▶ b: Reset circuit closes before input circuit
- ▶ t<sub>1</sub>: Switch-on delay
- ▶ t<sub>2</sub>: Delay-on de-energisation
- ▶ t<sub>3</sub>: Waiting period
- ▶ t<sub>4</sub>: Waiting period reset circuit was closed
- ▶ t<sub>5</sub>: Delay time
- ▶ t<sub>6</sub>: 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 I<sub>max</sub> in the input circuit:

$$I_{\max} = \frac{R_{I_{\max}}}{R_1 / \text{km}}$$

R<sub>I<sub>max</sub></sub> = max. overall cable resistance (see technical details)

R<sub>1</sub> / 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<sub>B</sub> 48 – 240 VAC/DC: Connect S21 to the protective earth system

## Up to PL e of EN ISO 13849-1 PNOZ s5

### Preparing for operation

#### ► Supply voltage

Supply voltage	AC	DC

#### ► Input circuit

Input circuit	Single-channel	Dual-channel
E-STOP <b>without</b> detection of shorts across contacts		
E-STOP <b>with</b> detection of shorts across contacts		
Safety gate <b>without</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		
Light beam device or safety switch <b>with</b> detection of shorts across contacts via ESPE (only when $U_B = 24\text{ VDC}$ )		

## Up to PL e of EN ISO 13849-1 PNOZ s5

### Reset circuit/feedback loop

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

### Semiconductor output

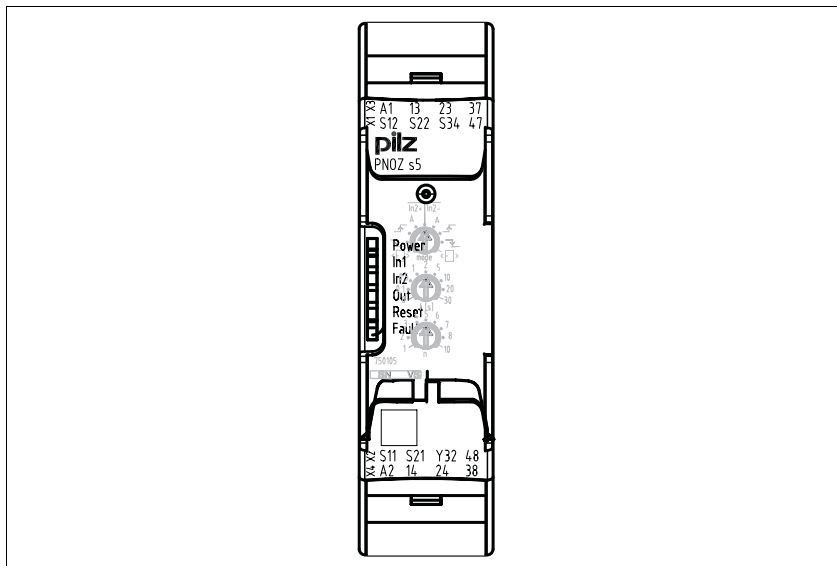
$U_B$ 24 VDC	$U_B$ 48 – 240 VAC/DC

### Key

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

## Up to PL e of EN ISO 13849-1 PNOZ s5

### 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:

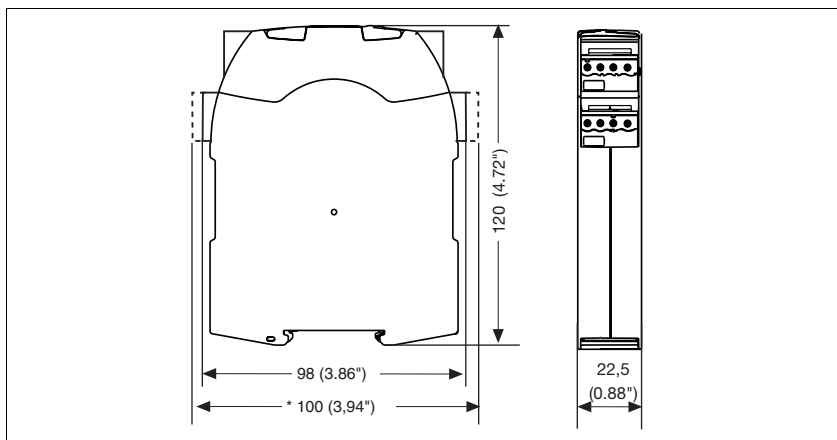
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module.
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

#### 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

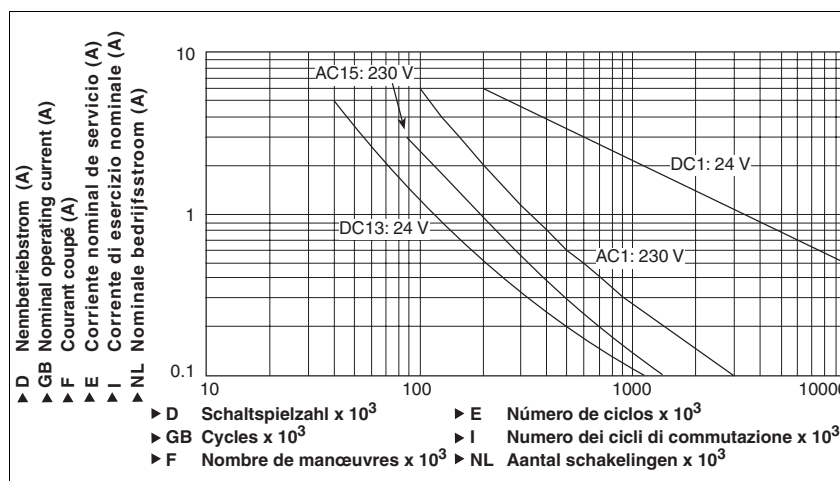


## Up to PL e of EN ISO 13849-1 PNOZ s5

### 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 <sub>B</sub> DC	<b>24 V</b>
Supply voltage U <sub>B</sub> AC/DC	<b>48 - 240 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at U <sub>B</sub> AC	<b>8.0 VA</b> Order no.: 750135, 751135
Power consumption at U <sub>B</sub> DC	<b>4.0 W</b>
Frequency range AC	<b>50 - 60 Hz</b>
Residual ripple DC	<b>20 %, 160 %</b>
Voltage and current at	
Input circuit DC: <b>24.0 V</b>	<b>40.0 mA</b>
Reset circuit DC: <b>24.0 V</b>	<b>40.0 mA</b>
Feedback loop DC: <b>24.0 V</b>	<b>40.0 mA</b>
Number of output contacts	
Safety contacts (S) instantaneous:	<b>2</b>
Safety contacts (N/O), delayed:	<b>2</b>
Utilisation category in accordance with <b>EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>6.0 A</b> P <sub>max</sub> : <b>1500 VA</b>
Safety contacts: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>6.0 A</b> P <sub>max</sub> : <b>150 W</b>
Safety contacts, delayed: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>6.0 A</b> P <sub>max</sub> : <b>1500 VA</b>
Safety contacts, delayed: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>6.0 A</b> P <sub>max</sub> : <b>150 W</b>
Utilisation category in accordance with <b>EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>3.0 A</b>
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>4.0 A</b>
Safety contacts, delayed: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>3.0 A</b>
Safety contacts, delayed: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>4.0 A</b>
Contact material	<b>AgCuNi + 0.2 µm Au</b>

## Up to PL e of EN ISO 13849-1 PNOZ s5

Electrical data	
External contact fuse protection ( $I_k = 1 \text{ kA}$ ) to <b>EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>6 A</b>
Safety contacts, delayed:	<b>6 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>4 A</b>
Safety contacts, delayed:	<b>4 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>4 A</b>
Safety contacts, delayed:	<b>4 A</b>
Semiconductor outputs (short circuit proof)	<b>24.0 V DC, 20 mA</b>
Max. overall cable resistance $R_{lmax}$ input circuits, reset circuits	
single-channel at $U_B$ DC	<b>30 Ohm</b>
single-channel at $U_B$ AC	<b>30 Ohm</b> Order no.: 750135, 751135
dual-channel without detect. of shorts across contacts at $U_B$ DC	<b>30 Ohm</b>
dual-channel without detect. of shorts across contacts at $U_B$ AC	<b>30 Ohm</b> Order no.: 750135, 751135
dual-channel with detect. of shorts across contacts at $U_B$ DC	<b>30 Ohm</b>
dual-channel with detect. of shorts across contacts at $U_B$ AC	<b>30 Ohm</b> Order no.: 750135, 751135
Safety-related characteristic data	
<b>Performance level (PL)</b> in accordance with <b>EN ISO 13849-1</b>	
Safety contacts, instantaneous	<b>e</b>
Safety contacts, delayed <30 s	<b>e</b>
Safety contacts, delayed $\geq 30$ s	<b>e</b>
<b>Category</b> of output contacts in accordance with <b>EN 954-1</b> , <b>EN ISO 13849-1</b>	
Safety contacts (S) instantaneous:	<b>4</b>
Delay time <30 s	<b>4</b>
Delay time $\geq 30$ s	<b>4</b>
<b>SIL claim limit (SIL CL)</b> in accordance with <b>EN IEC 62061</b>	
Safety contacts, instantaneous	<b>3</b>
Safety contacts, delayed <30 s	<b>3</b>
Safety contacts, delayed $\geq 30$ s	<b>3</b>
Probability of dangerous failure per hour ( <b>PFH<sub>D</sub></b> ) in accordance with <b>EN IEC 62061</b>	
Safety contacts, instantaneous	<b>2.31E-09 1/h</b>
Safety contacts, delayed <30 s	<b>2.34E-09 1/h</b>
Safety contacts, delayed $\geq 30$ s	<b>2.34E-09 1/h</b>
Mission time/Proof test interval in years	<b>20</b>
Times	
Switch-on delay	
with automatic reset typ.	<b>180 ms</b>
with automatic reset max.	<b>400 ms</b>
with automatic reset after power on typ.	<b>1,430 ms</b>
with automatic reset after power on max.	<b>2,000 ms</b>
with manual reset typ.	<b>45 ms</b>
with manual reset max.	<b>85 ms</b>
on monitored reset with rising edge typ.	<b>45 ms</b>
on monitored reset with rising edge max.	<b>130 ms</b>
on monitored reset with falling edge typ.	<b>60 ms</b>
on monitored reset with falling edge max.	<b>150 ms</b>
Delay-on de-energisation	
with E-STOP typ.	<b>15 ms</b>
with E-STOP max.	<b>20 ms</b>
with power failure typ.	<b>75 ms</b>
with power failure max.	<b>110 ms</b>



## Up to PL e of EN ISO 13849-1 PNOZ s5

Times	
Recovery time at max. switching frequency 1/s after E-STOP	150 ms +tv
after power failure	200 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
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 in accordance with EN 60947-1	
Pollution degree	2
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
Cross section of external conductors with screw terminals	
1 core flexible	0.25 - 2.50 mm <sup>2</sup> , 24 - 12 AWG Order no.: 750105, 750135
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm <sup>2</sup> , 24 - 16 AWG Order no.: 750105, 750135
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm <sup>2</sup> , 24 - 16 AWG Order no.: 750105, 750135
Torque setting with screw terminals	0.50 Nm Order no.: 750105, 750135
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	0.20 - 2.50 mm <sup>2</sup> , 24 - 12 AWG Order no.: 751105, 751135, 751185
Spring-loaded terminals: Terminal points per connection	2 Order no.: 751105, 751135, 751185
Stripping length	9 mm Order no.: 751105, 751135, 751185
Dimensions	
Height	102.0 mm Order no.: 751105, 751135, 751185 96.0 mm Order no.: 750105, 750135
Width	22.5 mm
Depth	120.0 mm
Weight	235 g Order no.: 750105, 751105, 751185 280 g Order no.: 750135, 751135

## Up to PL e of EN ISO 13849-1 PNOZ s5

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

### Conventional thermal current

$I_{th}$  (A) at  $U_B$  DC

1 contact	<b>6.00 A</b>
2 contacts	<b>6.00 A</b>
3 contacts	<b>6.00 A</b>
4 contacts	<b>6.00 A</b>

### Order reference

Type	Features		Terminals	Order no.
PNOZ s5		24 VDC	With screw terminals	750 105
PNOZ s5 C		24 VDC	With spring-loaded terminals	751 105
PNOZ s5 C (coated version)		24 VDC	With spring-loaded terminals	751 185
PNOZ s5	48 – 240 VAC	48 – 240 VDC	With screw terminals	750 135
PNOZ s5 C	48 – 240 VAC	48 – 240 VDC	With spring-loaded terminals	751 135