Up to PL e of EN ISO 13849-1
PNOZ s4.1

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

Approvals

	PNOZ s4.1
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	◆
	◆

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
  - Light barriers
  - PSEN
  - Safety valves for furnaces
- A connector can be used to connect 1 PNOZsigma contact expander module
  Operating modes can be set via rotary switch
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status, safety contacts
  - Reset circuit
  - Error
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)

Unit description

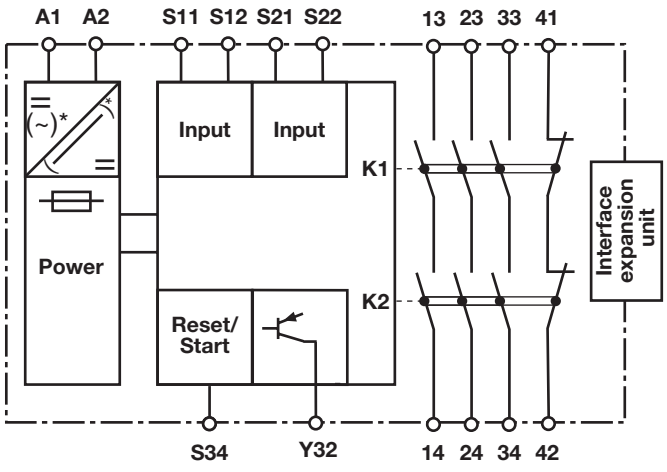
The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with
- E-STOP pushbuttons
- Safety gates
- Light barriers

It is designed for use in furnaces in accordance with EN 50156-1.

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 V AC/DC

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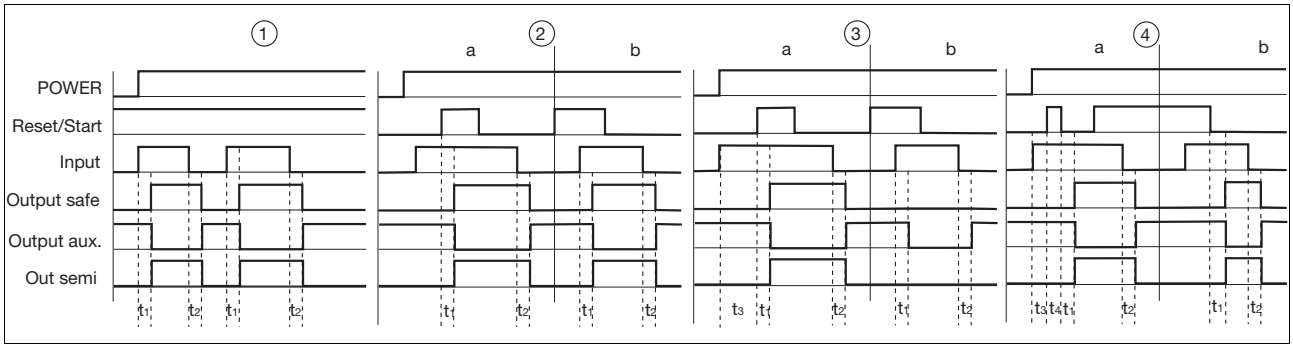
Function description

- 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 instantaneous safety 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 S34 S34
- Input: Input circuits S11-S12, S21-S22
- Output safe: Safety contacts 13-14, 23-24, 33-34
- Output aux: Auxiliary contacts 41-42
- Out semi: Semiconductor output Y32
- ①: Automatic reset
- ②: Manual reset
- ③: Monitored reset with rising edge
- ④: Monitored reset with falling edge
- 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

Wiring

Please note:

- Information given in the “Technical details” must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts, output 41-42 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 I_{max} in the input circuit:

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

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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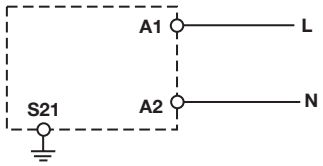
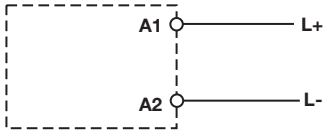
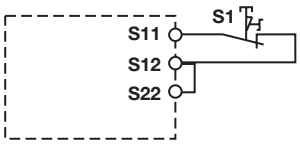
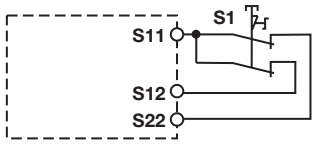
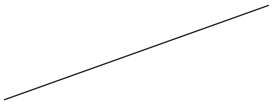
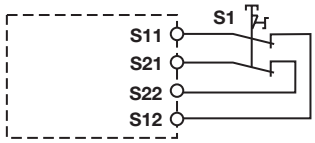
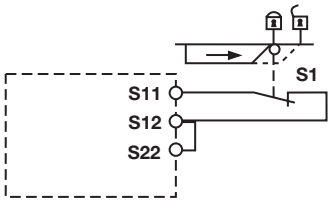
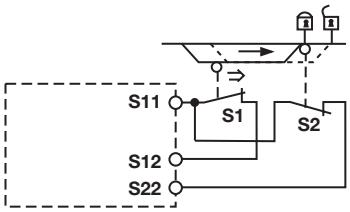
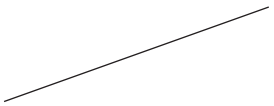
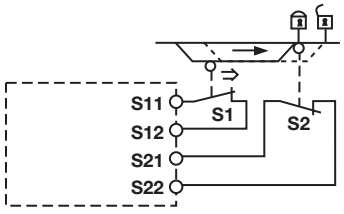
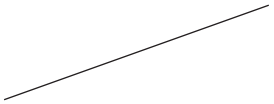
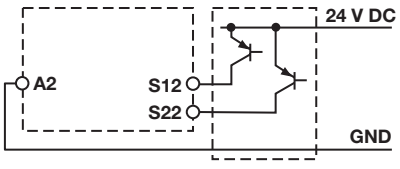
Preparing for operation

- Supply voltage

Supply voltage	AC	DC
		

- 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 beam device or safety switch **with** detection of shorts across contacts via ESPE (only when U_B = 24 VDC)		

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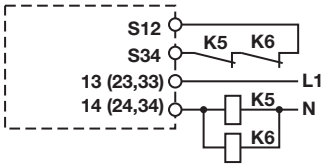
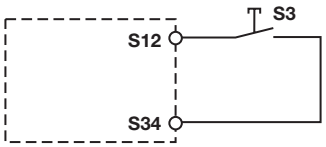
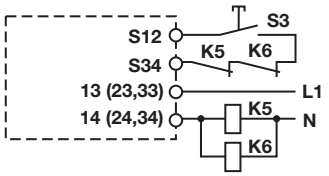
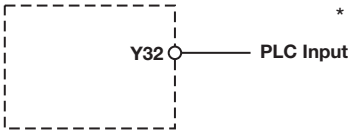
▸ Reset circuit/feedback loop

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

▸ Key

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

INFORMATION
If a base unit and a contact expansion module from the PNOZsigma range are linked via the connector, no additional wiring is necessary.

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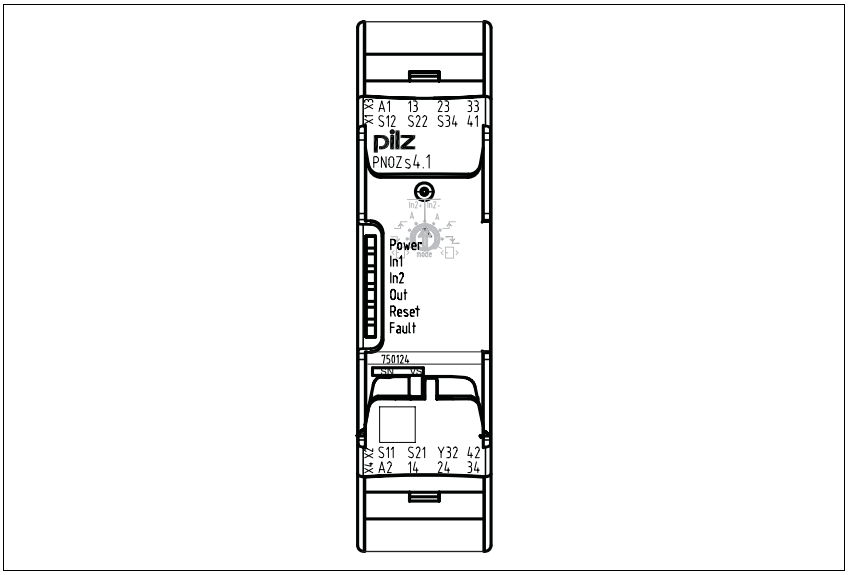
Terminal configuration



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:

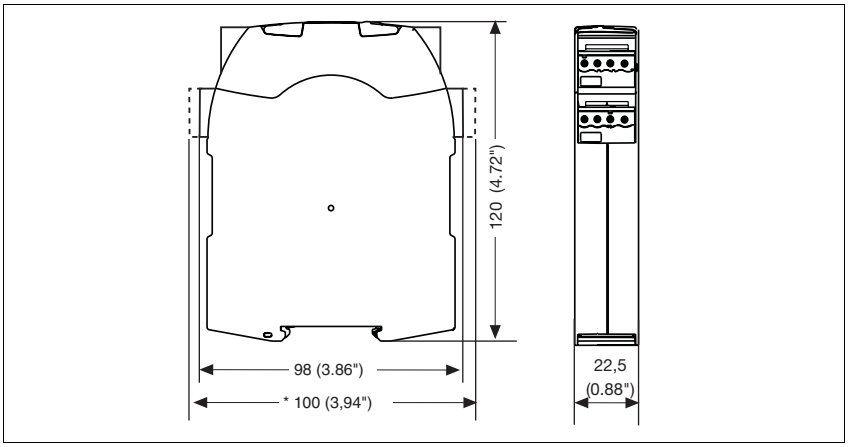
- Remove the plug terminator at the side of the base unit and at the contact expander module.
- Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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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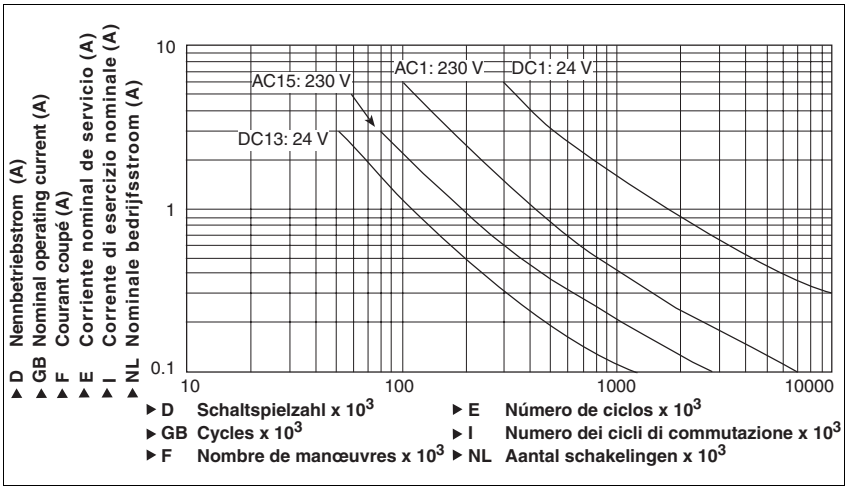
Notice

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	**5.0 VA** Order no.: 750154, 751154
Power consumption at U_B DC	**2.5 W**
Frequency range AC	**50 - 60 Hz**
Residual ripple DC	**20 %, 160 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**50.0 mA**
Reset circuit DC: **24.0 V**	**50.0 mA**
Feedback loop DC: **24.0 V**	**50.0 mA**
Number of output contacts	
Safety contacts (S) instantaneous:	**3**
Auxiliary contacts (N/C):	**1**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **1.5 A** P_{max}: **375 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}: **1.5 A** P_{max}: **375 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}: **0.6 A**
Safety contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **0.4 A**
Auxiliary contacts: AC15 at **230 V**	I_{max}: **0.6 A**
Auxiliary contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **0.4 A**
Contact material	**AgCuNi + 0.2 µm Au**

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Electrical data	
External contact fuse protection (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**6 A**
Auxiliary contacts:	**6 A**
Blow-out fuse, slow	
Safety contacts:	**4 A**
Auxiliary contacts:	**4 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**4 A**
Auxiliary contacts:	**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.: 750154, 751154
dual-channel without detect. of shorts across contacts at U_B DC	**60 Ohm**
dual-channel without detect. of shorts across contacts at U_B AC	**60 Ohm** Order no.: 750154, 751154
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.: 750154, 751154
Safety-related characteristic data	
Performance level (PL) in accordance with **EN ISO 13849-1**	
Safety contacts, instantaneous	**e**
Category of output contacts in accordance with **EN 954-1**, **EN ISO 13849-1**	
Safety contacts (S) instantaneous:	**4**
SIL claim limit (SIL CL) in accordance with **EN IEC 62061**	
Safety contacts, instantaneous	**3**
Probability of dangerous failure per hour **(PFH_D)** in accordance with **EN IEC 62061**	
Safety contacts, instantaneous	**2.31E-09 1/h**
Mission time/Proof test interval in years	**20**
Times	
Switch-on delay	
with automatic reset typ.	**170 ms**
with automatic reset max.	**300 ms**
with automatic reset after power on typ.	**350 ms**
with automatic reset after power on max.	**600 ms**
with manual reset typ.	**40 ms**
with manual reset max.	**300 ms**
on monitored reset with rising edge typ.	**35 ms**
on monitored reset with rising edge max.	**50 ms**
on monitored reset with falling edge typ.	**55 ms**
on monitored reset with falling edge max.	**70 ms**
Delay-on de-energisation	
with E-STOP typ.	**10 ms**
with E-STOP max.	**20 ms**
with power failure typ.	**40 ms** Order no.: 750124, 751124 **75 ms** Order no.: 750154, 751154
with power failure max.	**110 ms** Order no.: 750154, 751154 **60 ms** Order no.: 750124, 751124
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms**
after power failure	**100 ms**
Waiting period with a monitored reset	
with rising edge	**120 ms**
with falling edge	**150 ms** Order no.: 750154, 751154 **250 ms** Order no.: 750124, 751124

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Times	
Min. start pulse duration with a monitored reset	
with rising edge	**30 ms**
with falling edge	**100 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 - 150 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 - 60 °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 mm² , 24 - 12 AWG** Order no.: 750124, 750154
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 750124, 750154
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 750124, 750154
Torque setting with screw terminals	**0.50 Nm** Order no.: 750124, 750154
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**0.20 - 2.50 mm² , 24 - 12 AWG** Order no.: 751124, 751154
Spring-loaded terminals: Terminal points per connection	**2** Order no.: 751124, 751154
Stripping length	**9 mm** Order no.: 751124, 751154
Dimensions	
Height	**102.0 mm** Order no.: 751124, 751154 **96.0 mm** Order no.: 750124, 750154
Width	**22.5 mm**
Depth	**120.0 mm**
Weight	**190 g** Order no.: 750124, 751124 **210 g** Order no.: 750154, 751154

The standards current on **2008-04** apply.

Conventional thermal current

Number of contacts	I_{th} (A) at U_B DC	I_{th} (A) at U_B AC
1	**6.00 A**	**6.00 A** Order no.: 750154, 751154
2	**6.00 A**	**6.00 A** Order no.: 750154, 751154
3	**4.50 A**	**4.50 A** Order no.: 750154, 751154

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Order reference

Type	Features		Terminals	Order no.
PNOZ s4.1		24 VDC	With spring-loaded terminals	751 124
PNOZ s4.1		24 VDC	With screw terminals	750 124
PNOZ s4.1	48 - 240 VAC/DC		With spring-loaded terminals	751 154
PNOZ s4.1	48 - 240 VAC/DC		With screw terminals	750 154