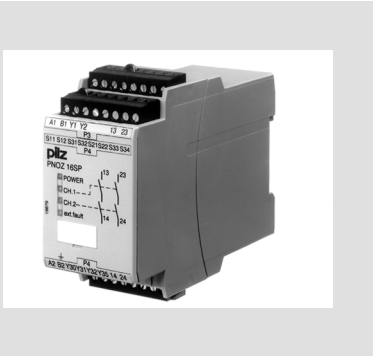
Up to Category 4, EN 954-1
PNOZ 16SP



Safety relay for monitoring emergency stop pushbuttons, safety gates, safety mats and safe edges

Approvals

	PNOZ 16SP
CE	◆
BG-PRÜFZERT	◆
c UL us LISTED	◆

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- 2 semiconductor outputs
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
  - Safe edges
  - Safety mats
- LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
  - Detection of shorts across contacts on safety mat "EXT. FAULT"
- Semiconductor outputs signal:
  - Switch status channel 1/2
  - Detection of shorts across contacts "EXT. FAULT"

Unit description

The safety relay meets the requirements of EN 60204-1, IEC 60204-1, EN 1760-1 and EN 1760-2 and may be used in applications with

- E-STOP pushbuttons
- Safety gates
- Safety mats
- Safe edges

The safety relay is not suitable for non-contact barriers because

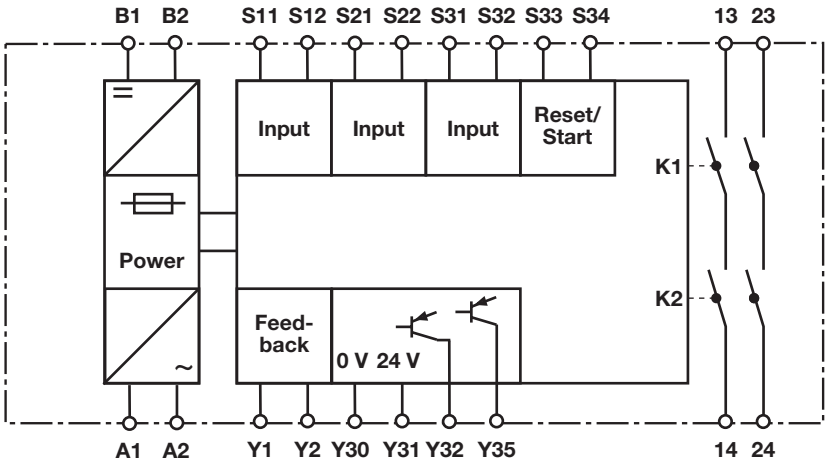
- a dynamic start is not possible
- the unit can be started during the delay-on de-energisation time.

Safety features

The relay conforms to the following safety criteria:

- 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 tranformer is short circuit-proof. An electronic fuse is used on a DC supply.

Block diagram



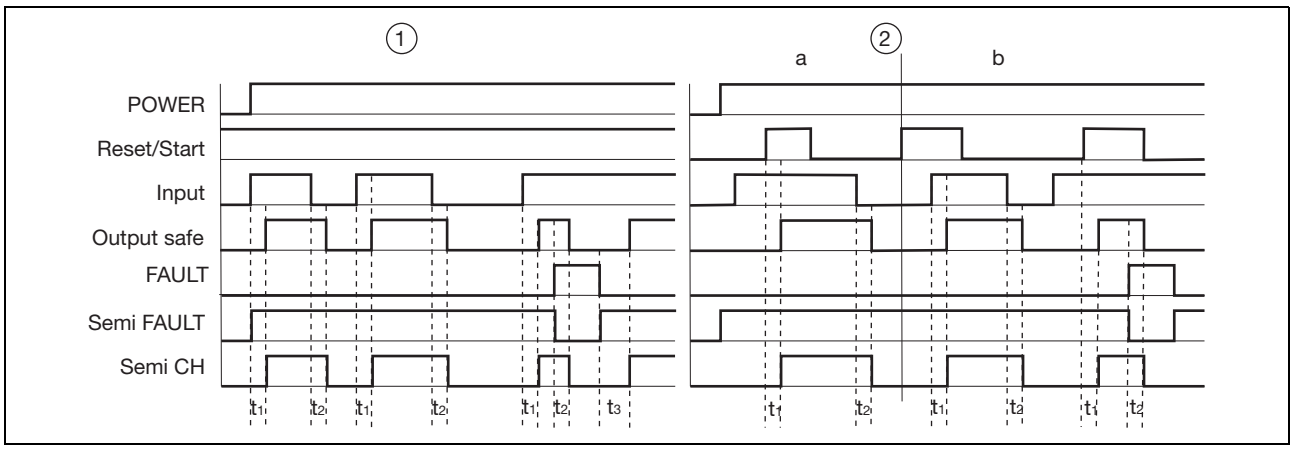
Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

Up to Category 4, EN 954-1
PNOZ 16SP

Function description

- Single-channel operation: no redundancy in the input circuit, earth faults in the reset and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: redundant input circuit, detects
  – earth faults in the reset and input circuit,
  – short circuits and shorts between contacts in the input circuit.
- When the safety mat is actuated, a short is formed between the inputs and internal fault detection is energised. The safety contacts open and the LED EXT.FAULT is lit. If the safety mat is cleared and supply voltage is maintained, the unit is ready for operation again once the recovery time has elapsed.
- 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.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Key

- Power: Supply voltage
- Reset/start: Reset circuit S33-S34
- Input: Input circuits S11-S12, S21-S22, S31-S32
- Output safe: Safety contacts 13-14, 23-24
- Out semi FAULT: Semiconductor output supply voltage Y35
- Out semi CH: Semiconductor output switch status Y32
- FAULT: Short between contacts in the input circuit due to actuation of safety mat
- ①: Automatic reset
- ②: Manual reset
- 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: Recovery time after short across contacts

Wiring

Please note:

- Information given in the “Technical details” must be followed.
- Outputs 13-14, 23-24 are 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_{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

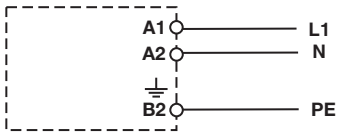
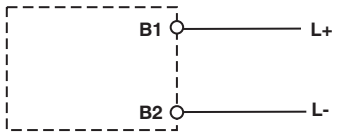
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

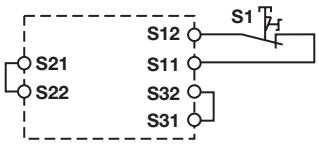
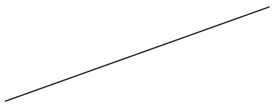
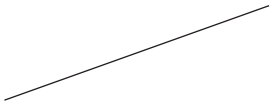
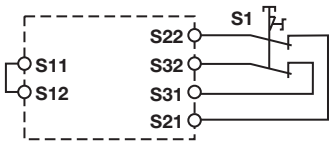
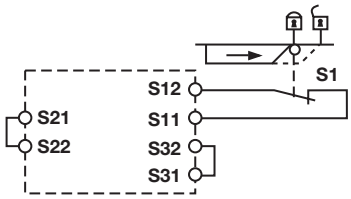
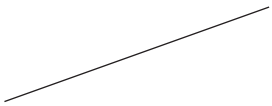
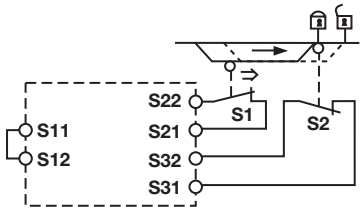
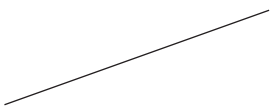
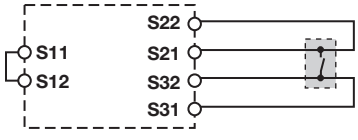
Up to Category 4, EN 954-1
PNOZ 16SP

Preparing for operation

- Supply voltage

Supply voltage	AC	DC
		

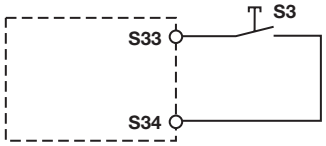
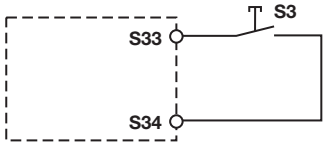
- Input circuit

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		
Safety mat, safe edge **with** detection of shorts across contacts		

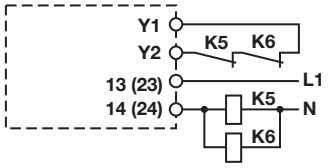
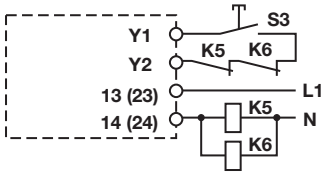
Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

Up to Category 4, EN 954-1
PNOZ 16SP

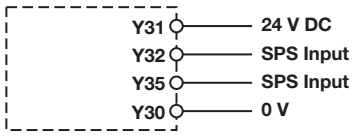
Reset circuit

Reset circuit	E-STOP wiring (single-channel) Safety gate (single-channel)	E-STOP wiring (dual-channel) Safety gate (dual-channel)
Automatic reset		
Manual reset		

Feedback loop

Feedback loop	Automatic reset	Manual reset
Contacts from external contactors		

Semiconductor output



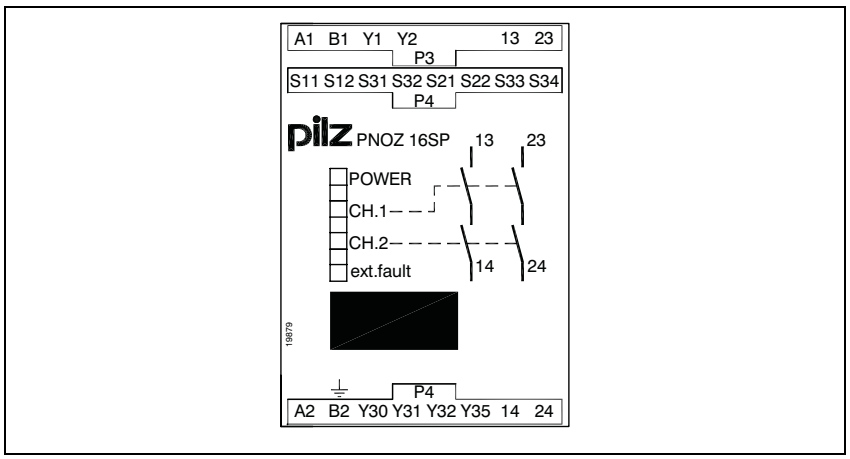
Key

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

Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

Up to Category 4, EN 954-1
PNOZ 16SP

Terminal configuration

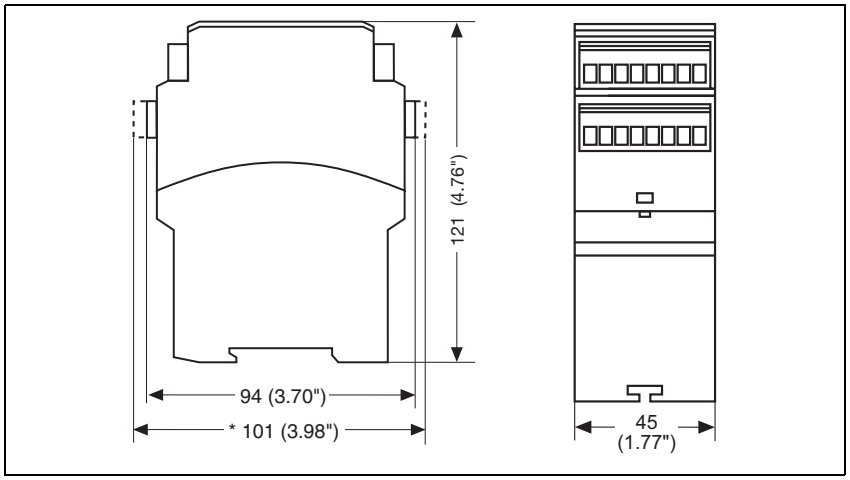


Installation

- 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).

Dimensions

* with cage clamp terminals



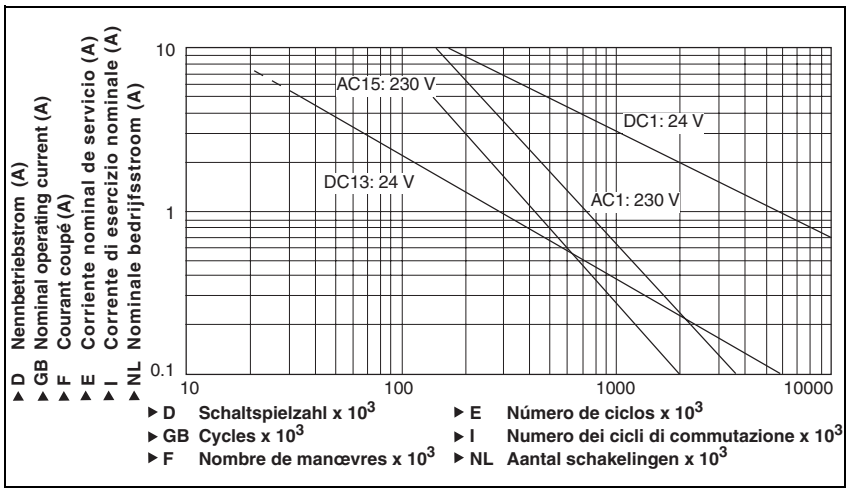
Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

Up to Category 4, EN 954-1
PNOZ 16SP

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 AC	**24 V**, **42 V**, **48 V**, **110 V**, **115 V**, **120 V**, **230 V**, **240 V**
Supply voltage U_B DC	**24 V**
Voltage tolerance	**-15% / +10%**
Power consumption at U_B AC	**3.5 VA**
Power consumption at U_B DC	**2.0 W**
Frequency range AC	**50 - 60 Hz**
Residual ripple DC	**20 %**
Voltage and current at	
input circuit DC: **24.0 V**	**25.0 mA**
reset circuit DC: **24.0 V**	**25.0 mA**
feedback loop DC: **24.0 V**	**25.0 mA**
Output contacts in accordance with **EN 954-1** Category **4**	Safety contacts (N/O): **2**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **8.00 A** P_{max}: **2,000 VA**
Safety 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}: **5.0 A**
Safety contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **6.0 A**
Contact material	**AgSnO2 + 0.2 µm Au**
External contact fuse protection to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**10 A**
Blow-out fuse, slow	
Safety contacts:	**6 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**6 A**

more than automation
safe automation

Up to Category 4, EN 954-1
PNOZ 16SP

Electrical data	
Semiconductor outputs (short circuit proof)	**24.0 V** DC, **20 mA**
External supply voltage	**24.0 V** DC
Voltage tolerance	**-15 %/+10 %** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077 **-15% / +10%** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077
Safety mat resistance + overall cable resistance	**80 Ohm**
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**40 Ohm**
single-channel at U_B AC	**40 Ohm**
dual-channel with detect. of shorts across contacts at U_B DC	**80 Ohm**
dual-channel with detect. of shorts across contacts at U_B AC	**80 Ohm**
Times	
Switch-on delay	
with automatic reset typ.	**230 ms**
with automatic reset max.	**350 ms**
with automatic reset after power on typ.	**310 ms**
with automatic reset after power on max.	**450 ms**
with manual reset typ.	**230 ms**
with manual reset max.	**350 ms**
Delay-on de-energisation	
with E-STOP typ.	**18 ms**
with E-STOP max.	**30 ms**
with power failure typ.	**50 ms**
with power failure max.	**80 ms**
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms**
after power failure	**100 ms**
Recovery time after short across contacts	
at U_B DC - Tol.	**650 ms**
at U_B DC nom.	**400 ms**
at U_B DC + Tol.	**320 ms**
at U_B AC - Tol.	**400 ms**
at U_B AC nom.	**300 ms**
at U_B AC + Tol.	**280 ms**
Simultaneity, channel 1 and 2	∞
Supply interruption before de-energisation	**20 ms**
Environmental data	
EMC	**EN 60947-5-1**, **EN 61000-6-2**
Vibration in accordance with **EN 60068-2-6**	
Frequency	**10 - 55 Hz**
Amplitude	**0.35 mm**
Climatic suitability	**EN 60068-2-78**
Airgap creepage	**VDE 0110-1**
Ambient temperature	**-10 - 55 °C**
Storage temperature	**-40 - 85 °C**
Protection type	
Mounting (e.g. control cabinet)	**IP54**
Housing	**IP40**
Terminals	**IP20**
Mechanical data	
Housing material	
Housing	**PPO UL 94 V0**
Front	**ABS UL 94 V0**

Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

Up to Category 4, EN 954-1
PNOZ 16SP

Mechanical data	
Max. cross section of external conductors with screw terminals	
1 core flexible	1 core flexible
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077
Torque setting with screw terminals	**0.50 Nm** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077
Max. cross section of external conductors with cage clamp terminals: flexible without crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077
Cage clamp terminals: terminal points per connection	**2** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077
Stripping length	**8 mm** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077
Dimensions	
Height	**101.0 mm** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077 **94.0 mm** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077
Width	**45.0 mm**
Depth	**121.0 mm**
Weight	**335 g** Order no.: 787070, 787071, 787072, 787073, 787074, 787075, 787076, 787077 **340 g** Order no.: 777070, 777071, 777072, 777073, 777074, 777075, 777076, 777077

The standards current on **05/01** apply.

Max. continuous current

Number of contacts	I_{max} (A) at U_B DC	I_{max} (A) at U_B AC
1	**8.00 A**	**8.00 A**
2	**6.00 A**	**6.00 A**

Order reference

Type	Features		Terminals	Order no.
PNOZ 16SP	24 VAC/DC		Screw terminals	777 070
PNOZ 16SP C	24 VAC/DC		Cage clamp terminals	787 070
PNOZ 16SP	42 VAC	24 VDC	Screw terminals	777 071
PNOZ 16SP C	42 VAC	24 VDC	Cage clamp terminals	787 071
PNOZ 16SP	48 VAC	24 VDC	Screw terminals	777 072
PNOZ 16SP C	48 VAC	24 VDC	Cage clamp terminals	787 072
PNOZ 16SP	110 VAC	24 VDC	Screw terminals	777 073
PNOZ 16SP C	110 VAC	24 VDC	Cage clamp terminals	787 073
PNOZ 16SP	115 VAC	24 VDC	Screw terminals	777 074
PNOZ 16SP C	115 VAC	24 VDC	Cage clamp terminals	787 074
PNOZ 16SP	120 VAC	24 VDC	Screw terminals	777 075
PNOZ 16SP C	120 VAC	24 VDC	Cage clamp terminals	787 075
PNOZ 16SP	230 VAC	24 VDC	Screw terminals	777 076
PNOZ 16SP C	230 VAC	24 VDC	Cage clamp terminals	787 076
PNOZ 16SP	240 VAC	24 VDC	Screw terminals	777 077
PNOZ 16SP C	240 VAC	24 VDC	Cage clamp terminals	787 077

Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de