

Up to PL c of EN ISO 13849-1 PNOZ s6.1



Two-hand control device for safety circuits

Approvals

PNOZ s6.1	
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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:
 - 2 control elements (pushbuttons)
 - E-STOP pushbutton
 - Safety gate limit switch
- ▶ A connector can be used to connect 1 PNOZsigma contact expansion module
- ▶ LED indicator for:
 - Supply voltage
 - Input status, channel 1
 - Input status, channel 2
 - Switch status, safety contacts
 - Feedback loop
 - Error
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

Unit description

The safety relay can be used as a two-hand control relay or for simultaneity monitoring.

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

The two-hand control relay meets the requirements of EN 574 Type IIIA. It forces the operator to keep his hands outside the danger zone area during the hazardous movement. It is designed for use in two-hand circuits.

CAUTION!

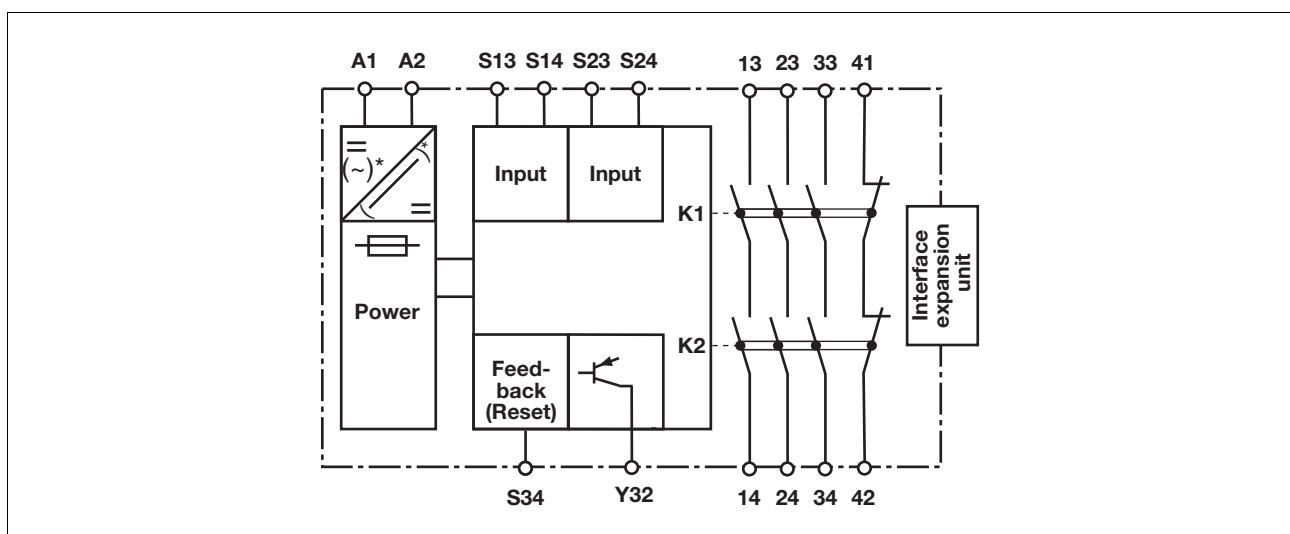
The two-hand control relay may **not** be used on **press controllers**. It is only suitable for use where the risk analysis has established a low level of risk (e.g. EN 954-1 Cat. 1 and EN ISO 13849-1 Cat. 1).

Safety features

The safety relay meets the following safety requirements:

- ▶ The safety relay prevents the plant from being enabled in the following cases:
 - Power supply failure
 - Component failure
 - Short circuit on an input circuit
 - Coil defect
 - Open circuit
 - Earth fault
- ▶ In each on-off cycle, the output relays on the safety device are tested to ensure they open and close correctly

Block diagram



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

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Function description

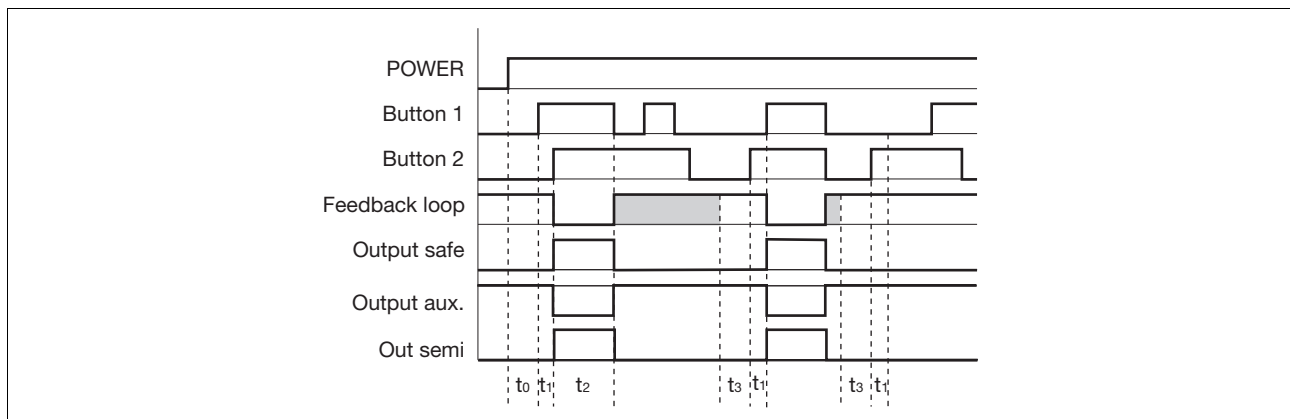
- ▶ The safety relay must be activated by simultaneously pressing two control elements (pushbuttons) within **0.5 s**. If one or both pushbut-

tons are released or the contacts open, the unit interrupts the control command for the hazardous movement.

- ▶ **Reactivation:** The output relays will not re-energise until both control el-

ements have been released and re-operated simultaneously or the contacts have opened and then closed.

Timing diagram



Key

- ▶ **POWER:** Supply voltage
 - ▶ **Button 1/Button 2:** Input circuits S13-S14, S23-S24
 - ▶ **Feedback loop:** Feedback loop S34
 - ▶ **Output safe:** Safety outputs 13-14, 23-24, 33-34
 - ▶ **Output aux:** Auxiliary contacts 41-42
 - ▶ **Out semi:** Semiconductor output switch status Y32
 - ▶ t_0 : Recovery time after power on
 - ▶ t_1 : Simultaneity, channel 1 and 2
 - ▶ t_2 : Operating cycle ended through button 1 or 2
 - ▶ t_3 : S34-S12 must be closed before before the button is operated (recovery time)
- Shaded area: Status irrelevant

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:

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

$R_{I_{max}}$ = 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.

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Preparing for operation

▶ Supply voltage

Supply voltage	AC	DC

▶ Input circuit

Input circuit	Single-channel	Dual-channel
Two-hand button with detection of shorts across contacts		
Simultaneity monitoring in safety gate applications with automatic reset after the safety gate is closed		

*The unit starts automatically when the E-STOP / safety gate device is released. Use external circuit measures to prevent an unexpected restart.

▶ Feedback loop

	Feedback loop
Contacts from external contactors	

▶ Semiconductor output

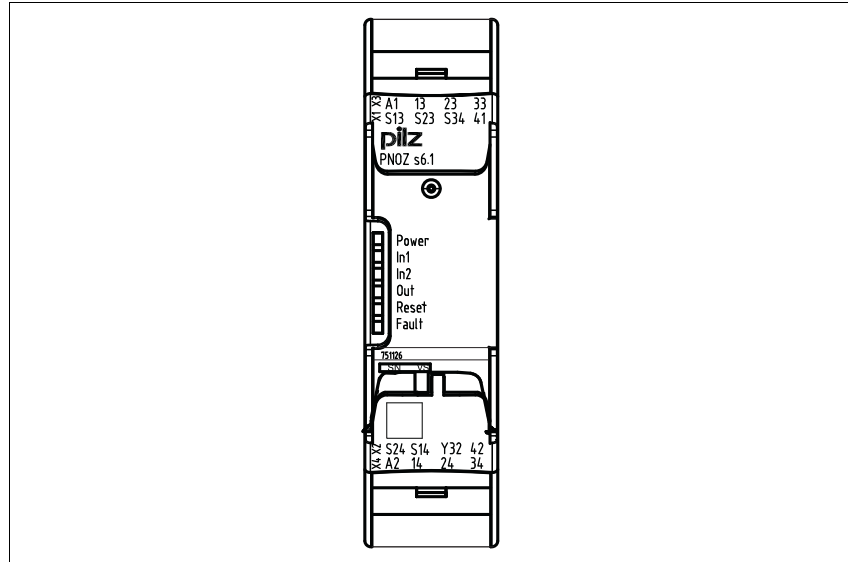
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▶ Key

S1/S2	Two-hand button
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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:

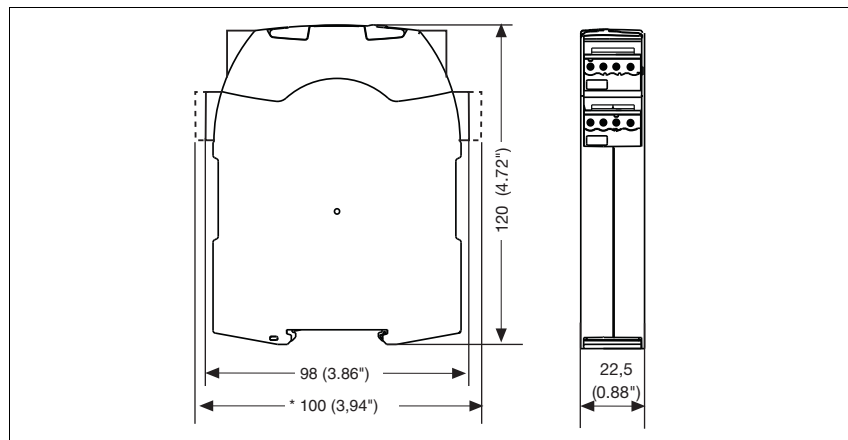
- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module.
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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 (35 mm).
- ▶ When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- ▶ Push the unit upwards or downwards before lifting it from the DIN rail.

Dimensions

*with spring-loaded terminals



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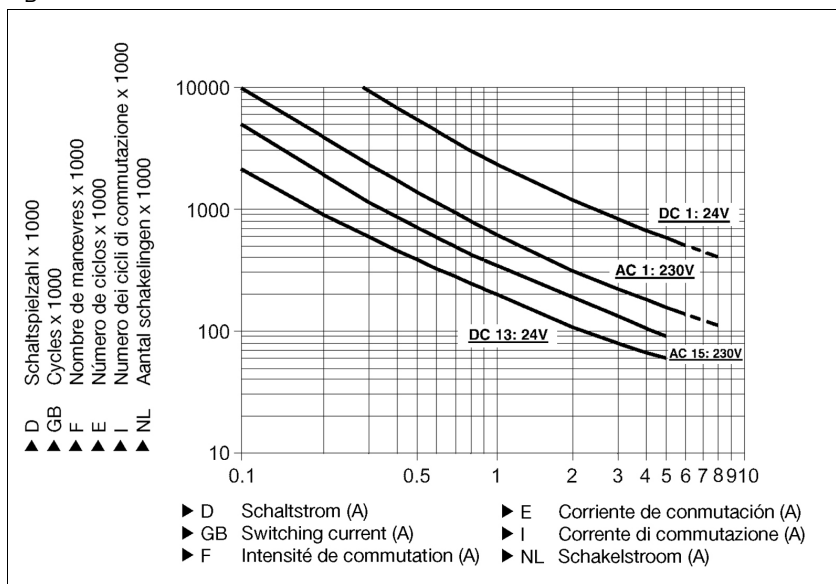
NOTICE

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

Service life graph

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.

U_B 24 V DC



Example

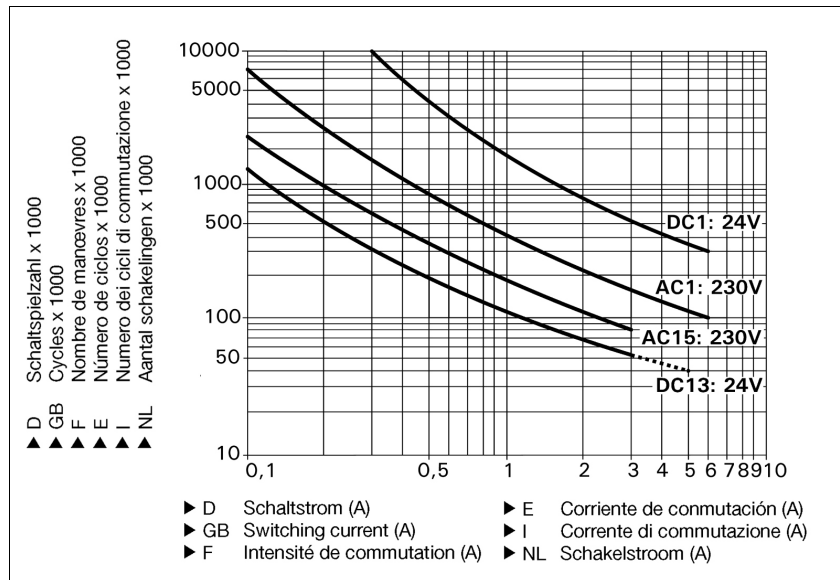
- ▶ Inductive load: 0,2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 2,000,000 cycles

Provided the application requires fewer than 2,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

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U_B 48-240 V AC/DC



Example

- ▶ Inductive load: 0,2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 1,000,000 cycles

Provided the application requires fewer than 1,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

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	7.0 VA No. 750156, 751156
Power consumption at U _B DC	3.5 W
Frequency range AC	50 - 60 Hz
Residual ripple DC	20 %
Voltage and current at	
Input circuit DC: 24.0 V	
N/O contact	20 mA
Feedback loop DC: 24.0 V	15.0 mA
Number of output contacts	
Safety contacts (S) instantaneous:	3
Auxiliary contacts (N/C):	1
Type in accordance with EN 574	III A

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Electrical data	
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
Auxiliary contacts: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 6.0 A P_{\max} : 1500 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} : 3.0 A No. 750156, 751156 5.0 A No. 750126, 751126
Safety contacts: DC13 at 24 V (6 cycles/min)	I_{\max} : 4.0 A No. 750156, 751156 5.0 A No. 750126, 751126
Auxiliary contacts: AC15 at 230 V	I_{\max} : 3.0 A No. 750156, 751156 5.0 A No. 750126, 751126
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	I_{\max} : 4.0 A No. 750156, 751156 5.0 A No. 750126, 751126
Contact material	AgCuNi + 0.2 µm Au
External contact fuse protection ($I_k = 1$ kA) to EN 60947-5-1	
Blow-out fuse, quick	
Safety contacts:	10 A No. 750126, 751126 6 A No. 750156, 751156
Auxiliary contacts:	10 A No. 750126, 751126 6 A No. 750156, 751156
Blow-out fuse, slow	
Safety contacts:	4 A No. 750156, 751156 6 A No. 750126, 751126
Auxiliary contacts:	4 A No. 750156, 751156 6 A No. 750126, 751126
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	4 A No. 750156, 751156 6 A No. 750126, 751126
Auxiliary contacts:	4 A No. 750156, 751156 6 A No. 750126, 751126
Semiconductor outputs (short circuit proof)	24.0 V DC, 20 mA
Max. overall cable resistance $R_{l\max}$ per input circuit	30 Ohm
Safety-related characteristic data	
PL in accordance with EN ISO 13849-1: 2006	
E-STOP/safety gate function	PL e (Cat. 4)
Two-hand function	PL c (Cat. 1)
Category in accordance with EN 954-1	
E-STOP/safety gate function	Cat. 4
Two-hand function	Cat. 1
SIL CL in accordance with EN IEC 62061	
E-STOP/safety gate function	SIL CL 3
Two-hand function	SIL CL 1
PFH in accordance with EN IEC 62061	
E-STOP/safety gate function	2.62E-09
Two-hand function	5.99E-08
SIL in accordance with IEC 61511	
E-STOP/safety gate function	SIL 3
Two-hand function	SIL 1
PFD in accordance with IEC 61511	
E-STOP/safety gate function	3.32E-05
Two-hand function	5.10E-03
T_M [year] in accordance with EN ISO 13849-1: 2006	20

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Times	
Delay-on de-energisation (reaction time in accordance with EN 574)	
N/O contact	40 ms
N/C contact	50 ms
Recovery time	250 ms
Simultaneity, channel 1 and 2	0.5 s
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
Overvoltage category	III / II
Rated insulation voltage	250 V
Rated impulse withstand voltage	4.00 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 ² , 24 - 12 AWG No. 750126, 750156
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm ² , 24 - 16 AWG No. 750126, 750156
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG No. 750126, 750156
Torque setting with screw terminals	0.50 Nm No. 750126, 750156
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	
Spring-loaded terminals: Terminal points per connection	2 No. 751126, 751156
Stripping length	9 mm No. 751126, 751156
Dimensions	
Height	
	100.0 mm No. 751126, 751156
	98.0 mm No. 750126, 750156
Width	
	22.5 mm
Depth	
	120.0 mm
Weight	
	190 g No. 750126, 751126
	210 g No. 750156, 751156

No. stands for order number.

It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.

The PFH value depends on the switching frequency and the load on the relay output.
If the service life graphs are not accessible, the stated PFH value can be

used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

All the units used within a safety function must be considered when calculating the safety characteristic data.

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INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAscal software tool to calculate the safety function's SIL/PL values.

The standards current on **2011-06** apply.

Conventional thermal current while loading several contacts

Number of contacts	I_{th} per contact at U_B DC	I_{th} at U_B AC
1	6.00 A	6.00 A No. 750156, 751156
2	6.00 A	6.00 A No. 750156, 751156
3	4.50 A No. 750156, 751156 6.00 A No. 750126, 751126	4.50 A No. 750156, 751156

Order reference

Type	Features	Terminals	Order no.
PNOZ s6.1	24 VDC	With screw terminals	750 126
PNOZ s6.1 C	24 VDC	With spring-loaded terminals	751 126
PNOZ s6.1	48 – 240 VAC/DC	With screw terminals	750 156
PNOZ s6.1 C	48 – 240 VAC/DC	With spring-loaded terminals	751 156