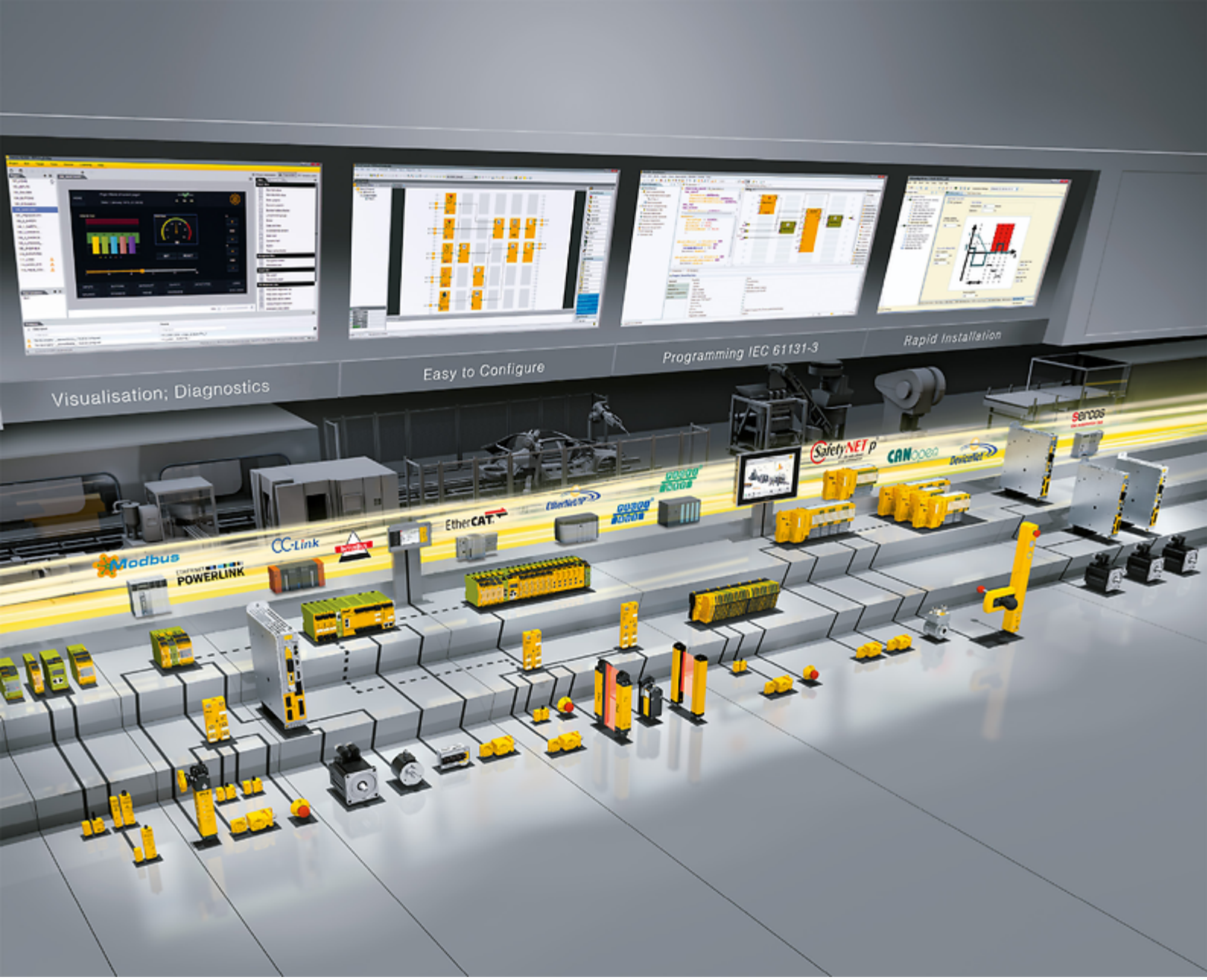



# PNOZ s60

PILZ
THE SPIRIT OF SAFETY

Safety relays

Operating Manual-1004492-EN-02

# Introduction

## Validity of documentation

This documentation is valid for the product PNOZ s60. It is valid until new documentation is published.

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product.

## Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

## Definition of symbols

Information that is particularly important is identified as follows:

**DANGER!**

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

**WARNING!**

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

**CAUTION!**

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

**NOTICE**

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

**INFORMATION**

This gives advice on applications and provides information on special features.

## Safety

### Intended use

The voltage monitoring relay operates as a device for the safe monitoring of 1-phase or 3-phase supplies with no voltage applied with neutral conductor. The three-phase network to be monitored must be earthed at the star point. It may be used in

- Safety circuits in accordance with EN 60204-1
- Standard for Safety – UL 6420 Chapter 5.4

The voltage monitoring relay prevents the safety contacts from closing until it is guaranteed that the plant has no voltage applied. As soon as a hazardous voltage is detected, the safety contacts are opened.

The following is deemed improper use in particular

- Any component, technical or electrical modification to the product,
- Use of the product outside the areas described in this manual,
- Use of the product outside the technical details (see Technical details [📖 18]).

**NOTICE**

**EMC-compliant electrical installation**

The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

### Safety regulations

### Safety assessment

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

### Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

- Are familiar with the basic regulations concerning health and safety / accident prevention,
- Have read and understood the information provided in the section entitled Safety
- Have a good knowledge of the generic and specialist standards applicable to the specific application.

### Warranty and liability

All claims to warranty and liability will be rendered invalid if

- The product was used contrary to the purpose for which it is intended,
- Damage can be attributed to not having followed the guidelines in the manual,
- Operating personnel are not suitably qualified,
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

### Disposal

- In safety-related applications, please comply with the mission time $T_M$ in the safety-related characteristic data.
- When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

### For your safety

The unit meets all the necessary conditions for safe operation. However, please note the following:

- Note for overvoltage category III: If on the device there are voltages higher than 300 V measured to the earth potential, connected control elements and sensors must have a rated insulation voltage of at least 600 V.

## Unit features

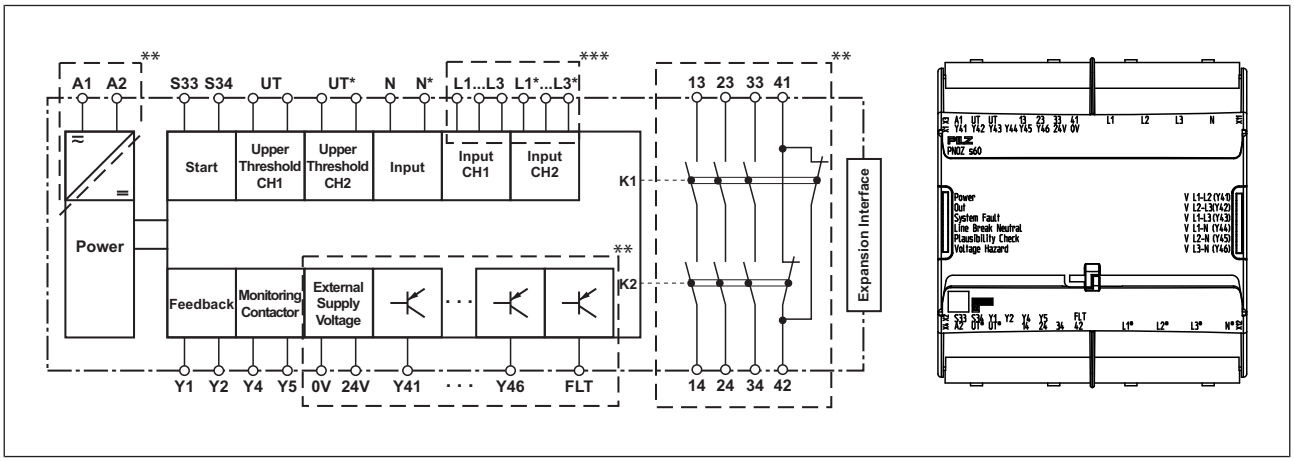
- Redundant measuring inputs for 3-phase AC circuits
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 7 semiconductor outputs
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - Diagnostics
  - State of measuring circuit
- Semiconductor outputs signal:
  - Status of measuring circuit
  - Error
- Input circuit (Y4-Y5) and feedback loop (Y1-Y2) to monitor external contactors or switch disconnectors
- Protective separation between the external voltage supply and the hazardous voltage circuits
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- A connector can be used to connect contact expansion module PNOZsigma:
  - PNOZ s7
  - PNOZ s7.1
  - PNOZ s7.2
  - PNOZ s8
  - PNOZ s9
  - PNOZ s10
  - PNOZ s11

## Safety features

The safety 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.

## Block diagram/terminal configuration




**Insulation against the non-marked area and between the relay contacts: Basic insulation (overvoltage category III) at 300 V, 4 kV. Insulation against the other areas marked with **: Protective separation (overvoltage category III) at 300 V, 6 kV.

***Insulation against all other areas and between the measuring connections L1(*), L2(*), L3(*): Protective separation (overvoltage category III) at 600 V, 8 kV

## Function description

The voltage monitoring relay PNOZ s60 operates as a threshold switch. It measures the three phase voltages L1, L2, L3. The switching threshold is selectable, 6 V or 12 V. The N/C contact of the monitored contactor or switch disconnector must be connected to input circuit Y4-Y5 and the measuring voltages must be connected to the measuring circuit (L1(*), L2(*), L3(*)). When the supply voltage is applied, the "POWER" LED will light.

- Input circuit Y4-Y5 is open (contactor active or switch disconnector switched on) or one of the measuring voltages is greater than the switching threshold
  - The safety contacts 13-14, 23-24 and 33-34 are open.
  - Auxiliary contact 41-42 is closed.
- Input circuit Y4-Y5 is closed (contactor inactive or switch disconnector switched off), feedback loop Y1-Y2 is closed (expansion contactor de-energised), start circuit S33-S34 is closed and all measuring voltages are lower than the switching threshold
  - The safety contacts 13-14, 23-24 and 33-34 are closed.
  - Auxiliary contact 41-42 is open.
- Self test: An internal self test is carried out during initial commissioning and each time the supply voltage is switched off and on. The process simulates switching all measuring voltages on and then off again. The unit is ready for operation once the self test has been completed successfully.
- Increase in the number of available instantaneous safety contacts by connecting contact expansion modules or expansion contactors;
  Connectors can be used to connect contact expansion modules PNOZsigma.

The state of the measuring circuits is displayed via the auxiliary outputs Y41 ... Y46 and the relevant LEDs:

| Measuring voltage | Semiconductor | LED | Description |
|---|---|---|---|
| L1 - L2 | Y41 | VL1-L2 (Y41) | LED lights when the measuring voltage > 110 V |
| L2 - L3 | Y42 | VL2-L3 (Y42) | LED lights when the measuring voltage > 110 V |
| L1 - L3 | Y43 | VL1-L3 (Y43) | LED lights when the measuring voltage > 110 V |
| L1 – N | Y44 | VL1-N (Y44) | LED lights when the measuring voltage > 64 V |
| L2 – N | Y45 | VL2-N (Y45) | LED lights when the measuring voltage > 64 V |
| L3 – N | Y46 | VL3-N (Y46) | LED lights when the measuring voltage > 64 V |

**Table of functions**

- Automatic start, start circuit S33-34 is closed
- The supply voltage is connected
- Base unit only, excluding expansion modules
- If the N/O contact of the safety contacts (13-14, 23-24 and 33-34) are closed, then the N/C contact (41-42) is open
- $U_{TH}$ = Switching threshold (see Technical details [18])

| Inputs | | | | | Outputs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | LEDs | | | | | |
| Measuring channel (L1-L3 and L1*-L3*) | Unit temperature | Open circuit | Input circuit (Y4-Y5) | Feedback loop (Y1-Y2) | Safety contacts (13-14, 23-24, 33-34) | Out | System Fault | Line Break Neutral | Plausibility Check | Voltage Hazard | Fault output (FLT) |
| < $U_{TH}$ | < 75 °C | No | open | open | open | ● | ● | ● | ● | ● | L |
| < $U_{TH}$ | < 75 °C | No | open | closed | open | ● | ● | ● | ☼ | ● | L |
| < $U_{TH}$ | < 75 °C | No | closed | open | open | ● | ☼ | ● | ● | ● | H |
| < $U_{TH}$ | < 75 °C | No | closed | closed | closed | ☼ | ● | ● | ● | ● | L |
| < $U_{TH}$ | < 75 °C | Yes | … | … | open | ● | ☼ | ☼ | … | ● | H |
| < $U_{TH}$ | 75 - 85 °C | No | closed | closed | closed | ☼ | ◐ | ● | ● | ● | L |

| Inputs | | | | | Outputs | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | LEDs | | | | | |
| Measuring channel (L1-L3 and L1*-L3*) | Unit temperature | Open circuit | Input circuit (Y4-Y5) | Feedback loop (Y1-Y2) | Safety contacts (13-14, 23-24, 33-34) | Out | System Fault | Line Break Neutral | Plausibility Check | Voltage Hazard | Fault output (FLT) |
| < $U_{TH}$ | > 85 °C | No | closed | closed | closed | ☼ | ☼ | ● | ● | ● | H |
| > $U_{TH}$ | < 75 °C | No | open | closed | open | ● | ● | ● | ● | ● | L |
| > $U_{TH}$ | < 75 °C | No | closed | closed | open | ● | ● | ● | ● | ☼ | H |
| > $U_{TH}$ | < 75 °C | Yes | … | … | open | ● | ☼ | ☼ | … | … | H |
| > $U_{TH}$ | 75 - 85 °C | No | closed | closed | open | ● | ◐ | ● | ● | ☼ | H |
| > $U_{TH}$ | > 85 °C | No | open | closed | open | ● | ☼ | ● | ● | ● | L |

**Legend**

| | |
|---|---|
| ☼ | LED on |
| ◐ | LED flashes |
| ● | LED off |
| … | State irrelevant |
| H | High |
| L | Low |

## Installation

**Install base unit without contact expansion module:**

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

**Connect base unit and PNOZsigma contact expansion module:**

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

**Control cabinet installation**

- The safety relay should be installed in a control cabinet with a protection type of at least IP54.
- When installing, a distance must be maintained above and below the relay and to other heat-generating devices. We recommend the following distances:
  - Above and below: 30 mm
  - To other heat-generating devices: 20 mm

- The ambient temperature of the product in the control cabinet must not exceed the figure stated in the technical details, otherwise air conditioning may be required.
- 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 device upwards or downwards before lifting it from the DIN rail.

## Wiring

**NOTICE**

Connect the measuring voltages L1 and L1*, L2 and L2*, L3 and L3*, and N and N* each to separate terminals on the plant, so that at least one measuring voltage will be present if a terminal screw should come away unintentionally (single fault tolerance).

**NOTICE**

To meet the requirements of the safety circuits, separate wires in separate multicore cables must be used for the measuring voltages L1, L2, L3, N and the measuring voltages L1*, L2*, L3*, N*.

**NOTICE**

Ensure that there is sufficient fuse protection for the connection cables at terminals L1, L2, L3, L1*, L2*, L3*!

**NOTICE**

To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 18]).

Please note:

- Information given in the "Technical details [📖 18]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Outputs Y41-46 and FLT are auxiliary outputs, e.g. for communication with a PLC or display. Do not use auxiliary outputs Y41-Y46 and FLT for safety circuits!
- Semiconductor outputs should **not** be used for safety circuits!
- There is no bridging of the semiconductor supply in the event of supply interruptions! Ensure that there is sufficient voltage bridging on the semiconductor supply voltage.
- Do not connect undesignated terminals.

- Connect the neutral conductors N and N* to the earth connection or the neutral conductor of the three phase supply.
- Calculation of the max. cable length $l_{max}$ for the N-cable:

$$l = \frac{R * A}{\rho_{Cu}}$$

$R_{lmax}$ = max. overall cable resistance (see Technical details [18])

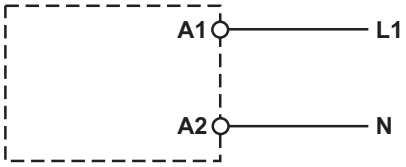
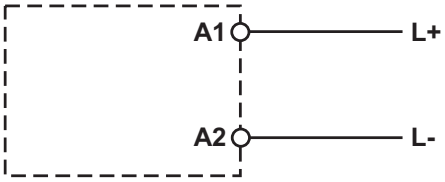
A = Cross-sectional area of a round conductor

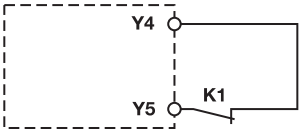
$\rho_{cu}$ = Specific resistance:

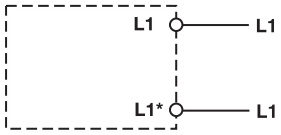
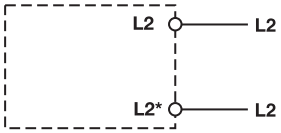
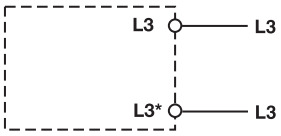
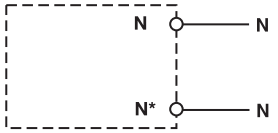
$\rho_{Cu} = 1{,}7 * 10^{-2} \frac{\Omega mm^2}{m}$

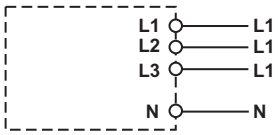
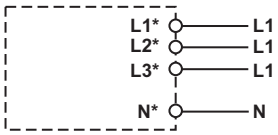
- Use copper wiring with a temperature stability of 75 °C.
- To prevent EMC interferences (particularly common-mode interferences) the measures described in EN 60204-1 must be executed. This includes the separate routing of cables of the control circuits (input, start and feedback loop) from other cables for energy transmission or the shielding of cables, for example.
- Cables that have to be laid outside the control cabinet must be protected from mechanical damage, e.g. by installing them in a conduit.
- A SELV/PELV voltage source can be connected to 24 VDC (external supply voltage). Ensure that there is sufficient fuse protection for the SELV-PELV voltage sources.
- Ensure that there is adequate protection on all output contacts with capacitive and inductive loads (see Technical details [18]).
- Do not switch low currents using contacts that have been used previously with high currents.
- The three-phase network must be earthed in the star point.

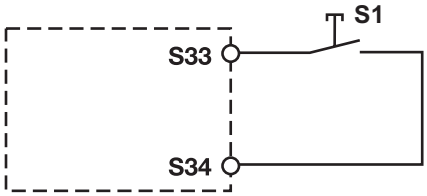
## Preparing for operation

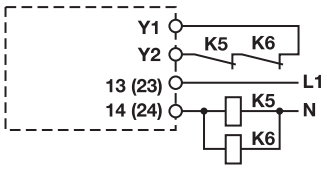
| Supply voltage | AC | DC |
|---|---|---|
| |  |  |

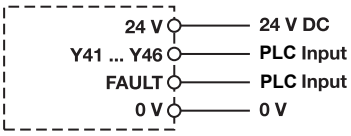
| Input circuit | |
|---|---|
| Contactor to be monitored |  |

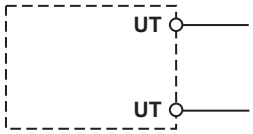
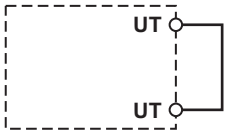
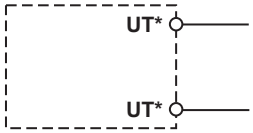
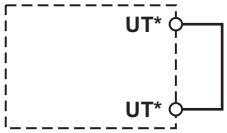
| Measuring circuit, three-phase measurement | |
|---|---|
| Measuring voltage L1 |  |
| Measuring voltage L2 |  |
| Measuring voltage L3 |  |
| Measuring voltage N |  |

| Measuring circuit, single-phase measurement | | |
|---|---|---|
| Measuring voltage L1 |  |  |

| Start circuit | Automatic start | Manual start |
|---|---|---|
| |  |  |

| Feedback loop | with feedback loop monitoring | without feedback loop monitoring |
|---|---|---|
| Contacts from external contactors or bridge |  |  |

| Semiconductor output | |
|---|---|
| The semiconductor outputs require an external 24 VDC supply. |  |

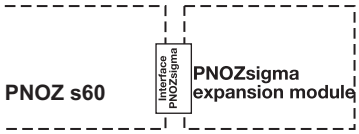
| Switchable switching threshold | Switching threshold 6 V (no bridge) | Switching threshold 12 V |
|---|---|---|
| Upper Threshold CH1 |  |  |
| Upper Threshold CH2 |  |  |

**NOTICE**

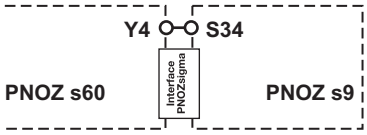
If UT or UT* is not bridged, the 6 V switching threshold will apply automatically.

**NOTICE**

**No** switch contacts may be connected to UT or UT*.

| Connection to PNOZsigma contact expansion modules PNOZ s7, PNOZ s7.1, PNOZ s7.2, PNOZ s8, PNOZ s10, PNOZ s11 | |
|---|---|
| The input circuit is connected and evaluated via the connector |  |

The wiring will differ if you are using the contact expansion module PNOZ s9. Please note the following:

| 2-channel input circuit | |
|---|---|
| The input circuit is connected and evaluated via the connector |  |

**INFORMATION**

If a base unit and a contact expansion module are linked via the connector, no additional wiring is necessary.
Do not connect A1/A2 to the contact expansion module!

**Legend**

- S1: Start button

## Operation

When the relay outputs are switched on, the mechanical contact on the relay cannot be tested automatically. Depending on the operational environment, measures to detect the non-opening of switching elements may be required under some circumstances.

When the product is used in accordance with the European Machinery Directive, a check must be carried out to ensure that the safety contacts on the relay outputs open correctly. Start the device again or open the safety contacts (switch off output), so that the internal diagnostics can check the correct opening of the safety contacts

- for SIL CL 3/PL e at least 1x per month
- for SIL CL 2/PL d at least 1x per year

**NOTICE**

The safety function should be checked after initial commissioning and each time the plant/machine is changed. The safety functions may only be checked by qualified personnel.

**NOTICE**

If the measuring voltages are below the set switching threshold for longer than 24 hours, the PNOZ s60 must be restarted (switch the supply voltage off and on).

### Status indicators

**INFORMATION**

Several status indicators and error indicators may occur simultaneously.

The unit is ready for operation when the Power LED is permanently lit.

LEDs indicate the status and errors during operation:

 LED on

 LED flashes

 LED off

**POWER**

Supply voltage is present.

**OUT**
Safety contacts are closed.

**SYSTEM FAULT**

see Faults - malfunctions [📖 16]

**SYSTEM FAULT**

Internal housing temperature is between 75 … 85 °C.

**LINE BREAK NEUTRAL**

Open circuit between N and N*.

**PLAUSIBILITY CHECK**

Input circuit (Y4-Y5) open and measuring voltage is lower than the set switching threshold.

**VOLTAGE HAZARD**

Input circuit (Y4-Y5) closed and measuring voltage is higher than the set switching threshold.

**VL1-L2(Y41) … VL3-N(Y46)**

State of measuring voltage (see Function description [📖 8])

## Faults - malfunctions

- The "PLAUSIBILITY CHECK" LED lights: Measuring voltage is lower than the switching threshold, although input circuit Y4-Y5 is open.
- The "SYSTEM FAULT" LED lights:
  - Open circuit on at least one measuring cable
  - Time difference between the two measuring channels is too great
  - Internal fault
  - Internal housing temperature above 85 °C
  - Fault on the expansion module/terminator not connected
- The "VOLTAGE HAZARD" LED lights: At least one measuring voltage is higher than the switching threshold, although input circuit Y4-Y5 is closed.
- Malfunctions of the safety contacts (13-14, 23-24, 33-34): If the contacts have welded, re-activation will not be possible after the input circuit has opened.

## Dimensions

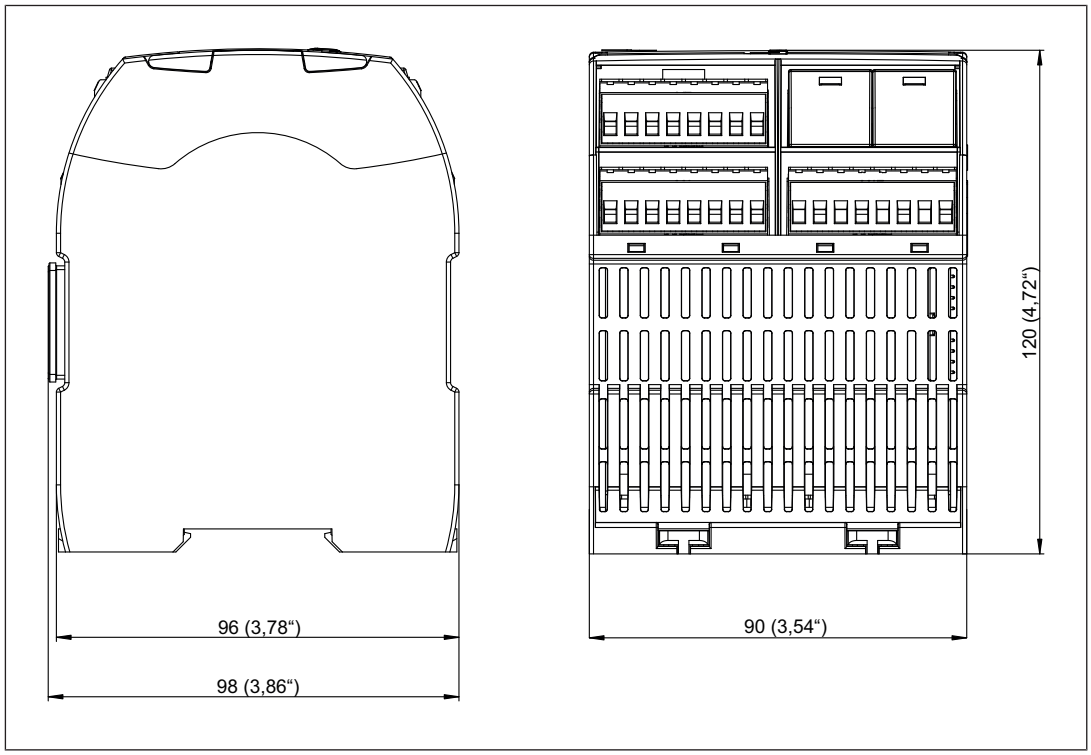



Fig.: Dimensions in mm (")

## Technical details

| General | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Certifications | CCC, CE, EAC (Eurasian), TÜV, cULus Listed | CCC, CE, EAC (Eurasian), TÜV, cULus Listed | CCC, CE, EAC (Eurasian), TÜV, cULus Listed | CCC, CE, EAC (Eurasian), TÜV, cULus Listed |
| **Electrical data** | **750600** | **750601** | **751600** | **751601** |
| Supply voltage | | | | |
| for | Device supply | Device supply | Device supply | Device supply |
| Voltage | 24 - 48 V | 100 - 240 V | 24 - 48 V | 100 - 240 V |
| Kind | AC/DC | AC/DC | AC/DC | AC/DC |
| Voltage tolerance | -15 %/+10 % | -15 %/+10 % | -15 %/+10 % | -15 %/+10 % |
| Output of external power supply (AC) | 10,2 VA | 10,5 VA | 10,2 VA | 10,5 VA |
| Output of external power supply (DC) | 7,5 W | 8 W | 7,5 W | 8 W |
| Frequency range AC | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz |
| Duty cycle | 100 % | 100 % | 100 % | 100 % |
| **Measuring circuit** | **750600** | **750601** | **751600** | **751601** |
| Min. measuring voltage | 110 V | 110 V | 110 V | 110 V |
| Max. measuring voltage | 600 V | 600 V | 600 V | 600 V |
| Min. measuring voltage against N (N*) | 64 V | 64 V | 64 V | 64 V |
| Max. measuring voltage against N (N*) | 346 V | 346 V | 346 V | 346 V |
| Tolerance, measuring voltage | 85 - 110 % | 85 - 110 % | 85 - 110 % | 85 - 110 % |
| Frequency range | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz |
| Frequency range against N | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz | 50 - 60 Hz |
| Upper switching threshold Ur | 12 V | 12 V | 12 V | 12 V |
| Lower switching threshold Uf | 10 V | 10 V | 10 V | 10 V |
| Input resistance | 1.000 kOhm | 1.000 kOhm | 1.000 kOhm | 1.000 kOhm |
| Max. neutral conductor impedance | 120 Ohm | 120 Ohm | 120 Ohm | 120 Ohm |
| **Inputs** | **750600** | **750601** | **751600** | **751601** |
| Number | 6 | 6 | 6 | 6 |

| Inputs | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Voltage at | | | | |
| Input circuit DC | **24 V** | **24 V** | **24 V** | **24 V** |
| Start circuit DC | **24 V** | **24 V** | **24 V** | **24 V** |
| Feedback loop DC | **24 V** | **24 V** | **24 V** | **24 V** |
| Current at | | | | |
| Input circuit DC | **80 mA** | **80 mA** | **80 mA** | **80 mA** |
| Start circuit DC | **40 mA** | **40 mA** | **40 mA** | **40 mA** |
| Feedback loop DC | **0,5 mA** | **0,5 mA** | **0,5 mA** | **0,5 mA** |
| Max. inrush current impulse | | | | |
| Current pulse, input circuit | **0,1 A** | **0,1 A** | **0,1 A** | **0,1 A** |
| Pulse duration, input circuit | **200 ms** | **200 ms** | **200 ms** | **200 ms** |
| Current pulse, feedback loop | **0,1 A** | **0,1 A** | **0,1 A** | **0,1 A** |
| Pulse duration, feedback loop | **150 ms** | **150 ms** | **150 ms** | **150 ms** |
| **Semiconductor outputs** | **750600** | **750601** | **751600** | **751601** |
| Number | **6** | **6** | **6** | **6** |
| Voltage | **24 V** | **24 V** | **24 V** | **24 V** |
| Current | **50 mA** | **50 mA** | **50 mA** | **50 mA** |
| External supply voltage | **24 V** | **24 V** | **24 V** | **24 V** |
| Voltage tolerance | **-20 %/+20 %** | **-20 %/+20 %** | **-20 %/+20 %** | **-20 %/+20 %** |
| **Semiconductor outputs (standard)** | **750600** | **750601** | **751600** | **751601** |
| Switching capability | | | | |
| Voltage | **24 V** | **24 V** | **24 V** | **24 V** |
| Current | **0,05 A** | **0,05 A** | **0,05 A** | **0,05 A** |
| Power | **1,2 W** | **1,2 W** | **1,2 W** | **1,2 W** |
| Galvanic isolation | **yes** | **yes** | **yes** | **yes** |
| Short circuit-proof | **yes** | **yes** | **yes** | **yes** |
| Residual current at "0" | **0,1 mA** | **0,1 mA** | **0,1 mA** | **0,1 mA** |
| Signal level at "1" | **UB - 2.5 V DC at 0.05 A** | **UB - 2.5 V DC at 0.05 A** | **UB - 2.5 V DC at 0.05 A** | **UB - 2.5 V DC at 0.05 A** |

| Relay outputs | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Number of output contacts | | | | |
| Safety contacts (N/O), instantaneous | 3 | 3 | 3 | 3 |
| Auxiliary contacts (N/C) | 1 | 1 | 1 | 1 |
| Max. short circuit current IK | 1 kA | 1 kA | 1 kA | 1 kA |
| Utilisation category | | | | |
| In accordance with the standard | EN 60947-4-1 | EN 60947-4-1 | EN 60947-4-1 | EN 60947-4-1 |
| Utilisation category of safety contacts | | | | |
| AC1 at | 250 V | 250 V | 250 V | 250 V |
| Min. current | 5 mA | 5 mA | 5 mA | 5 mA |
| Max. current | 6 A | 6 A | 6 A | 6 A |
| Max. power | 1500 VA | 1500 VA | 1500 VA | 1500 VA |
| DC1 at | 24 V | 24 V | 24 V | 24 V |
| Min. current | 5 mA | 5 mA | 5 mA | 5 mA |
| Max. current | 6 A | 6 A | 6 A | 6 A |
| Max. power | 144 W | 144 W | 144 W | 144 W |
| Utilisation category of auxiliary contacts | | | | |
| AC1 at | 250 V | 250 V | 250 V | 250 V |
| Min. current | 5 mA | 5 mA | 5 mA | 5 mA |
| Max. current | 6 A | 6 A | 6 A | 6 A |
| Max. power | 1500 VA | 1500 VA | 1500 VA | 1500 VA |
| DC1 at | 24 V | 24 V | 24 V | 24 V |
| Min. current | 5 mA | 5 mA | 5 mA | 5 mA |
| Max. current | 6 A | 6 A | 6 A | 6 A |
| Max. power | 144 W | 144 W | 144 W | 144 W |
| Utilisation category | | | | |
| In accordance with the standard | EN 60947-5-1 | EN 60947-5-1 | EN 60947-5-1 | EN 60947-5-1 |
| Utilisation category of safety contacts | | | | |
| AC15 at | 230 V | 230 V | 230 V | 230 V |
| Max. current | 3 A | 3 A | 3 A | 3 A |
| DC13 (6 cycles/min) at | 24 V | 24 V | 24 V | 24 V |
| Max. current | 5 A | 5 A | 5 A | 5 A |

| Relay outputs | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Utilisation category of auxiliary contacts | | | | |
| AC15 at | **230 V** | **230 V** | **230 V** | **230 V** |
| Max. current | **3 A** | **3 A** | **3 A** | **3 A** |
| DC13 (6 cycles/ min) at | **24 V** | **24 V** | **24 V** | **24 V** |
| Max. current | **5 A** | **5 A** | **5 A** | **5 A** |
| Utilisation category in accordance with UL | | | | |
| With current | **6 A** | **6 A** | **6 A** | **6 A** |
| With current | **6 A** | **6 A** | **6 A** | **6 A** |
| External contact fuse protection, safety contacts | | | | |
| In accordance with the standard | **EN 60947-5-1** | **EN 60947-5-1** | **EN 60947-5-1** | **EN 60947-5-1** |
| Max. melting integral | **66 A²s** | **66 A²s** | **66 A²s** | **66 A²s** |
| Blow-out fuse, quick | **6 A** | **6 A** | **6 A** | **6 A** |
| Blow-out fuse, slow | **4 A** | **4 A** | **4 A** | **4 A** |
| Blow-out fuse, gG | **6 A** | **6 A** | **6 A** | **6 A** |
| Circuit breaker 24V AC/DC, characteristic B/C | **4 A** | **4 A** | **4 A** | **4 A** |
| External contact fuse protection, auxiliary contacts | | | | |
| Max. melting integral | **66 A²s** | **66 A²s** | **66 A²s** | **66 A²s** |
| Blow-out fuse, quick | **6 A** | **6 A** | **6 A** | **6 A** |
| Blow-out fuse, slow | **4 A** | **4 A** | **4 A** | **4 A** |
| Blow-out fuse, gG | **6 A** | **6 A** | **6 A** | **6 A** |
| Circuit breaker 24 V AC/DC, characteristic B/C | **4 A** | **4 A** | **4 A** | **4 A** |
| Contact material | **AgCuNi + 0,2 µm Au** | **AgCuNi + 0,2 µm Au** | **AgCuNi + 0,2 µm Au** | **AgCuNi + 0,2 µm Au** |

| Conventional thermal current while loading several contacts | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Ith per contact at UB AC;<br>AC1: 240 V, DC1: 24 V | | | | |
| Conv. therm. current with 1 contact | **6 A** | **6 A** | **6 A** | **6 A** |
| Conv. therm. current with 2 contacts | **6 A** | **6 A** | **6 A** | **6 A** |
| Conv. therm. current with 3 contacts | **4 A** | **4 A** | **4 A** | **4 A** |
| Ith per contact at UB DC;<br>AC1: 240 V, DC1: 24 V | | | | |
| Conv. therm. current with 1 contact | **6 A** | **6 A** | **6 A** | **6 A** |
| Conv. therm. current with 2 contacts | **6 A** | **6 A** | **6 A** | **6 A** |
| Conv. therm. current with 3 contacts | **4 A** | **4 A** | **4 A** | **4 A** |
| **Times** | **750600** | **750601** | **751600** | **751601** |
| Switch-on delay | | | | |
| With automatic start typ. | **20 ms** | **20 ms** | **20 ms** | **20 ms** |
| With automatic start max. | **30 ms** | **30 ms** | **30 ms** | **30 ms** |
| With automatic start after power on typ. | **700 ms** | **700 ms** | **700 ms** | **700 ms** |
| With automatic start after power on max. | **800 ms** | **800 ms** | **800 ms** | **800 ms** |
| With manual start typ. | **20 ms** | **20 ms** | **20 ms** | **20 ms** |
| With manual start max. | **30 ms** | **30 ms** | **30 ms** | **30 ms** |

| Times | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Delay-on de-energisation | | | | |
| With power failure typ. UB 240 V | – | **140 ms** | – | **140 ms** |
| With power failure max. UB 240 V | – | **155 ms** | – | **155 ms** |
| With power failure typ. UB 120 V | – | **35 ms** | – | **35 ms** |
| With power failure max. UB 120 V | – | **40 ms** | – | **40 ms** |
| After safety function is triggered typ. | **20 ms** | **20 ms** | **20 ms** | **20 ms** |
| After safety function is triggered max. | **30 ms** | **30 ms** | **30 ms** | **30 ms** |
| Recovery time at max. switching frequency 1/s | | | | |
| After power failure | **1500 ms** | **1500 ms** | **1500 ms** | **1500 ms** |
| After safety function is triggered | **1000 ms** | **1000 ms** | **1000 ms** | **1000 ms** |
| Supply interruption before de-energisation | **20 ms** | **10 ms** | **20 ms** | **10 ms** |
| Simultaneity, channel 1 and 2 max. | **3-8 s** | **3-8 s** | **3-8 s** | **3-8 s** |
| **Environmental data** | **750600** | **750601** | **751600** | **751601** |
| Climatic suitability | **EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78** | **EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78** | **EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78** | **EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78** |
| Ambient temperature | | | | |
| Temperature range | **-10 - 55 °C** | **-10 - 55 °C** | **-10 - 55 °C** | **-10 - 55 °C** |
| Storage temperature | | | | |
| Temperature range | **-40 - 85 °C** | **-40 - 85 °C** | **-40 - 85 °C** | **-40 - 85 °C** |
| Climatic suitability | | | | |
| Humidity | **93 % r. h. at 40 °C** | **93 % r. h. at 40 °C** | **93 % r. h. at 40 °C** | **93 % r. h. at 40 °C** |
| Condensation during operation | **Not permitted** | **Not permitted** | **Not permitted** | **Not permitted** |
| EMC | **EN 60255-26, EN 61326-3-1** | **EN 60255-26, EN 61326-3-1** | **EN 60255-26, EN 61326-3-1** | **EN 60255-26, EN 61326-3-1** |

| Environmental data | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Vibration | | | | |
| In accordance with the standard | **EN 60255-21-1** | **EN 60068-2-6** | **EN 60255-21-1** | **EN 60255-21-1** |
| Test severity class | **Class 1** | **Class 1** | **Class 1** | **Class 1** |
| Shock stress | | | | |
| In accordance with the standard | **EN 60255-21-2** | **EN 60255-21-2** | **EN 60255-21-2** | **EN 60255-21-2** |
| Test severity class | **Class 1** | **Class 1** | **Class 1** | **Class 1** |
| Earthquake | | | | |
| In accordance with the standard | **EN 60255-21-3** | **EN 60255-21-3** | **EN 60255-21-3** | **EN 60255-21-3** |
| Test severity class | **Class 0** | **Class 0** | **Class 0** | **Class 0** |
| Continuous shock | | | | |
| Test severity class | **Class 1** | **Class 1** | **Class 1** | **Class 1** |
| Airgap creepage | | | | |
| In accordance with the standard | **EN 60255-27** | **EN 60255-27** | **EN 60255-27** | **EN 60255-27** |
| Overvoltage category | **III** | **III** | **III** | **III** |
| Pollution degree | **2** | **2** | **2** | **2** |
| Rated insulation voltage | **600 V** | **600 V** | **600 V** | **600 V** |
| Rated impulse withstand voltage | **6 kV** | **6 kV** | **6 kV** | **6 kV** |
| Protection type | | | | |
| Housing | **IP20** | **IP20** | **IP20** | **IP20** |
| Terminals | **IP20** | **IP20** | **IP20** | **IP20** |
| Mounting area (e.g. control cabinet) | **IP54** | **IP54** | **IP54** | **IP54** |
| **Mechanical data** | **750600** | **750601** | **751600** | **751601** |
| Mounting position | **Any** | **Any** | **Any** | **Any** |
| Mechanical life | **10,000,000 cycles** | **10,000,000 cycles** | **10,000,000 cycles** | **10,000,000 cycles** |
| Material | | | | |
| Bottom | **PC** | **PC** | **PC** | **PC** |
| Front | **PC** | **PC** | **PC** | **PC** |
| Top | **PC** | **PC** | **PC** | **PC** |
| Connection type | **Screw terminal** | **Screw terminal** | **Spring-loaded terminal** | **Spring-loaded terminal** |
| Mounting type | **plug-in** | **plug-in** | **plug-in** | **plug-in** |

| Mechanical data | 750600 | 750601 | 751600 | 751601 |
|---|---|---|---|---|
| Conductor cross section with screw terminals | | | | |
| 1 core flexible | **0,25 - 2,5 mm², 24 - 12 AWG** | **0,25 - 2,5 mm², 24 - 12 AWG** | – | – |
| 2 core with the same cross section, flexible with crimp connectors, no plastic sleeve | **0,25 - 1 mm², 24 - 16 AWG** | **0,25 - 1 mm², 24 - 16 AWG** | – | – |
| 2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors | **0,2 - 1,5 mm², 24 - 16 AWG** | **0,2 - 1,5 mm², 24 - 16 AWG** | – | – |
| Torque setting with screw terminals | **0,5 Nm** | **0,5 Nm** | – | – |
| Stripping length with screw terminals | **8 mm** | **8 mm** | – | – |
| Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector | – | – | **0,2 - 2,5 mm², 24 - 12 AWG** | **0,2 - 2,5 mm², 24 - 12 AWG** |
| Spring-loaded terminals: Terminal points per connection | – | – | **2** | **2** |
| Stripping length with spring-loaded terminals | – | – | **9 mm** | **9 mm** |
| Dimensions | | | | |
| Height | **98 mm** | **98 mm** | **98 mm** | **98 mm** |
| Width | **90 mm** | **90 mm** | **90 mm** | **90 mm** |
| Depth | **120 mm** | **120 mm** | **120 mm** | **120 mm** |
| Weight | **669 g** | **655 g** | **667 g** | **652 g** |

Where standards are undated, the 2020-07 latest editions shall apply.

### Safety characteristic data

**NOTICE**

You must comply with the safety characteristic data in order to achieve the required safety level for your plant/machine.

| Operating mode | EN ISO 13849-1: 2015 PL | EN ISO 13849-1: 2015 Category | EN 62061 SIL CL | EN 62061 $PFH_D$ [1/h] | IEC 61511 SIL | IEC 61511 PFD | EN ISO 13849-1: 2015 $T_M$ [year] |
|---|---|---|---|---|---|---|---|
| – | PL e | Cat. 4 | SIL CL 3 | 4,91E-10 | SIL 3 | 3,56E-05 | 20 |

Explanatory notes for the safety-related characteristic data:

- The SIL CL value in accordance with EN 62061 corresponds to the SIL value in accordance with EN 61508.
- $T_M$ is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN 61508-6 and IEC 61511 and as the proof test interval and mission time in accordance with EN 62061.

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

**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.

**CAUTION!**

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 switch frequency and the load of the relay output.
If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switch 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.

## Supplementary data

### 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.

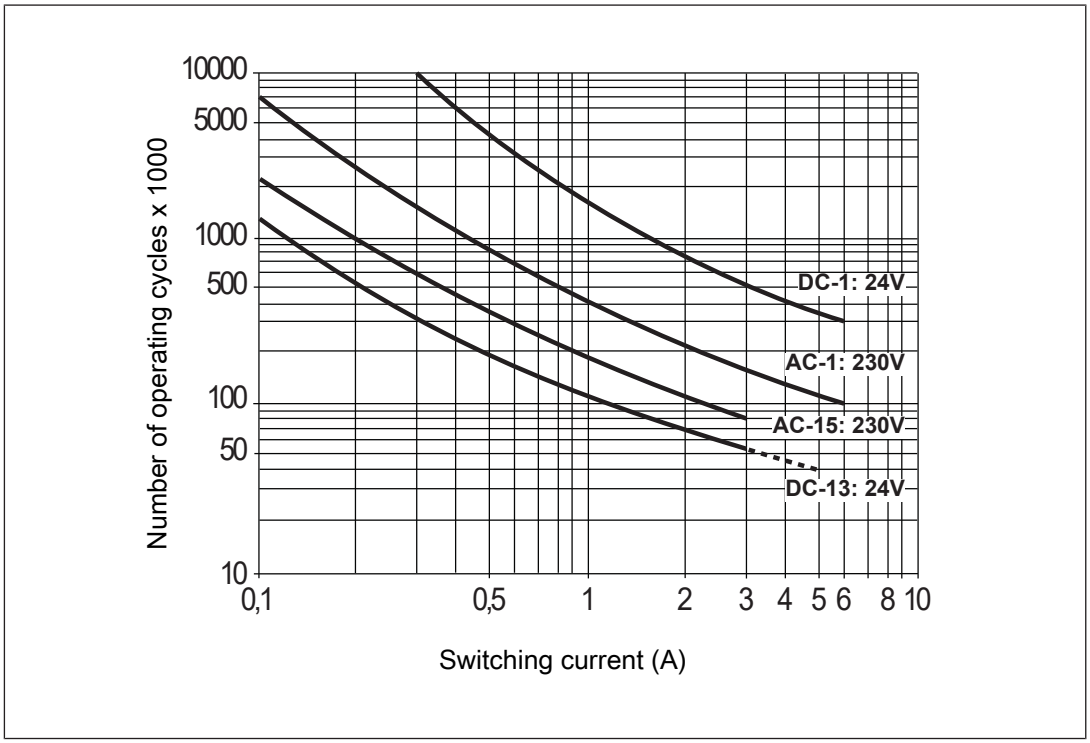



Fig.: Service life graphs at 24 VDC and 230 VAC

### Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 18]) can be used in the calculation.

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

**Permitted operating height**

The values stated in the technical details apply to the use of the device in operating heights up to max. 2000 m above sea level. When used in greater heights, constraints have to be taken into account:

- Permitted maximum operating height 5000 m
- Reduction of the max. measuring voltage, the max. operating voltage and the max. voltage at the output relays for applications with protective separation:

| Max. operating height | Max. measuring voltage<br>Phase - Phase<br>Phase - Neutral | Max. operating voltage | Max. voltage at the output relays |
|---|---|---|---|
| 3000 m | 300 V | 150 V | 150 V |
| 4000 m | 300 V | 150 V | 150 V |
| 5000 m | 150 V | 150 V | 150 V |

- Reduction of the max. measuring voltage, the max. operating voltage and the max. voltage at the output relays for applications with basic insulation:

| Max. operating height | Max. measuring voltage<br>Phase - Phase<br>Phase - Neutral | Max. operating voltage | Max. voltage at the output relays |
|---|---|---|---|
| 3000 m | 600 V | 150 V | 150 V |
| 4000 m | 600 V | 150 V | 150 V |
| 5000 m | 300 V | 150 V | 150 V |

- From an operating height of 2000 m the max. permitted ambient temperature is reduced by 0.5 °C/100 m

| Operating height | Permitted ambient temperature |
|---|---|
| 3000 m | 50 °C |
| 4000 m | 45 °C |
| 5000 m | 40 °C |

## Order reference

### Product

| Product type | Features | Connection type | Order no. |
|---|---|---|---|
| PNOZ s60 | 24 - 48 VAC/DC | Screw terminals | 750600 |
| PNOZ s60 | 100 – 240 VAC/DC | Screw terminals | 750601 |
| PNOZ s60 | 24 - 48 VAC/DC | Spring-loaded terminals | 751600 |
| PNOZ s60 | 100 – 240 VAC/DC | Spring-loaded terminals | 751601 |

### Accessories

### Connector

| Product type | Features | Order no. |
|---|---|---|
| PNOZ s terminator plug (10 pieces) | Connector for terminating a PNOZsigma base unit or PNOZsigma expansion module, 10 pieces | 750010 |
| PNOZ s connector (10 pieces) | Connector for connecting a PNOZsigma base unit to a PNOZsigma expansion module, 10 pieces | 750020 |

## EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC for machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.
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1004492-EN-02, 2020-11 Printed in Germany




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PILZ
THE SPIRIT OF SAFETY