



► PNOZ s22

PILZ
THE SPIRIT OF SAFETY

Operating Manual-22170-EN-09
- Safety relays



This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

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SD means Secure Digital

Introduction	5
Validity of documentation	5
Using the documentation	5
Definition of symbols	5
Safety	6
Intended use	6
Safety regulations	7
Safety assessment	7
Use of qualified personnel	7
Warranty and liability	7
Disposal	7
For your safety	8
Unit features	8
Safety features	8
Block diagram/terminal configuration	9
Function description	9
Installation	9
Wiring	10
Preparing for operation	10
Operation	11
Status indicators	11
Faults - malfunctions	11
Dimensions in mm	12
Technical details	12
Safety characteristic data	17
Supplementary data	18
Service life graph	18

Operating height in accordance with EN 60664-120

Remove plug-in terminals21

Order reference21

EC declaration of conformity21

UKCA-Declaration of Conformity21

Introduction

Validity of documentation

This documentation is valid for the product PNOZ s22. 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 unit meets the requirements of EN 60947-5-1 and EN 60204-1. The contact expansion module is used to increase the number of instantaneous safety contacts available on a base unit. Base units are

- ▶ Speed monitor PNOZ s30
- ▶ PNOZmulti Mini base units PNOZ mm0.1p, PNOZ mm0.2p

The max. achievable safety level depends on the base unit. The expansion module may not exceed this. The safety-related characteristic values stated under [safety-related characteristic data](#) [ 17] can only be achieved if the base unit also exhibits these safety characteristic values.

Improper use

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 operating manual,
- ▶ Use of the product outside the technical details (see chapter entitled [Technical Details](#) [ 12]).

**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 IEC 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, decommissioned and maintained 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. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with 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 stated 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 voltages higher than low voltage (>50 VAC or >120 VDC) are present on the unit, connected control elements and sensors must have a rated insulation voltage of at least 250 V.

Unit features

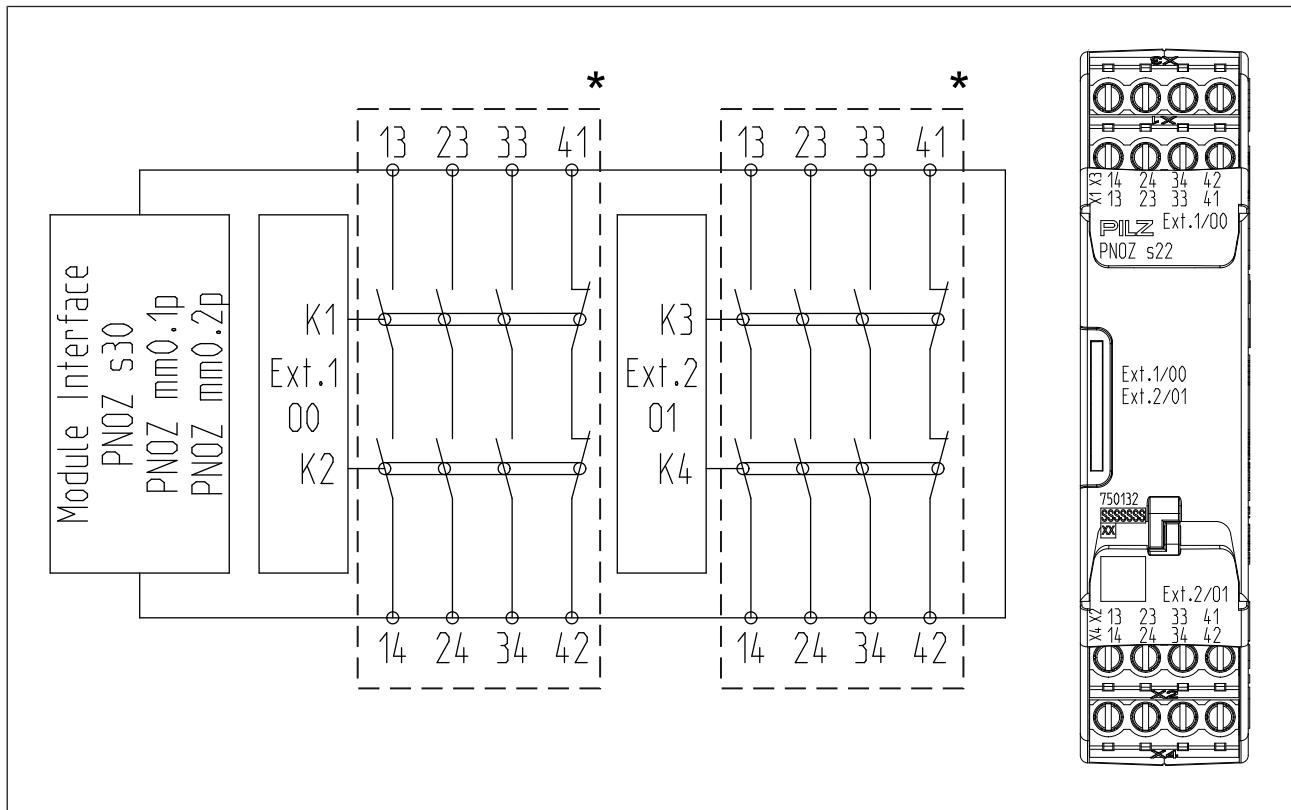
- ▶ Positive-guided relay outputs:
 - 6 safety contacts (N/O), instantaneous
 - 2 auxiliary contacts (N/C), instantaneous
- ▶ 3 safety contacts and 1 auxiliary contact each; these can be controlled separately
- ▶ LED indicator for:
 - Input state of channel Ext.1/O0
 - Input state of channel Ext.2/O1
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

Safety features

The unit meets the following safety requirements:

- ▶ The contact expansion module expands an existing circuit. As the output relays are monitored via the base unit's feedback loop, the safety functions on the existing circuit are transferred to the contact expansion module.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ Earth fault in the feedback loop:
Detected, depending on the base unit that is used.
- ▶ Earth fault in the input circuit:
The output relays de-energise and the safety contacts open.

Block diagram/terminal configuration



*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

- ▶ Dual-channel operation and supply voltage via PNOZsigma connector
- ▶ 3 safety contacts and 1 auxiliary contact each; these can be controlled separately

Installation

Connect the contact expansion block to the PNOZ s30 or base unit PNOZ mm0.1p/ PNOZ mm0.2p

- ▶ Connect the contact expansion block using the connector supplied.

Control cabinet installation

- ▶ Install the safety relay 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.

Wiring

Please note:

- ▶ Information given in the "Technical details [12]" must be followed.
- ▶ The wiring guidelines in the base units' operating instructions must be taken into account.
- ▶ 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!
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [12]).
- ▶ 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.
- ▶ Adequate protection circuit must be provided on all output contacts with capacitive and inductive loads.

Preparing for operation

Connection

	AC	DC
Supply voltage/input circuit/feed-back loop		

Connection to speed monitor PNOZ s30/PNOZmulti Mini base unit	Base unit: Speed monitor PNOZ s30	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

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. Open the safety contacts (switch off output) and start the device again, so that the internal diagnostics can check that the safety contacts open correctly

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



NOTICE

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

LEDs indicate the status and errors during operation:



LED on

Status indicators



EXT.1/O0

Channel Ext.1/O0 activated.



EXT.2/O1

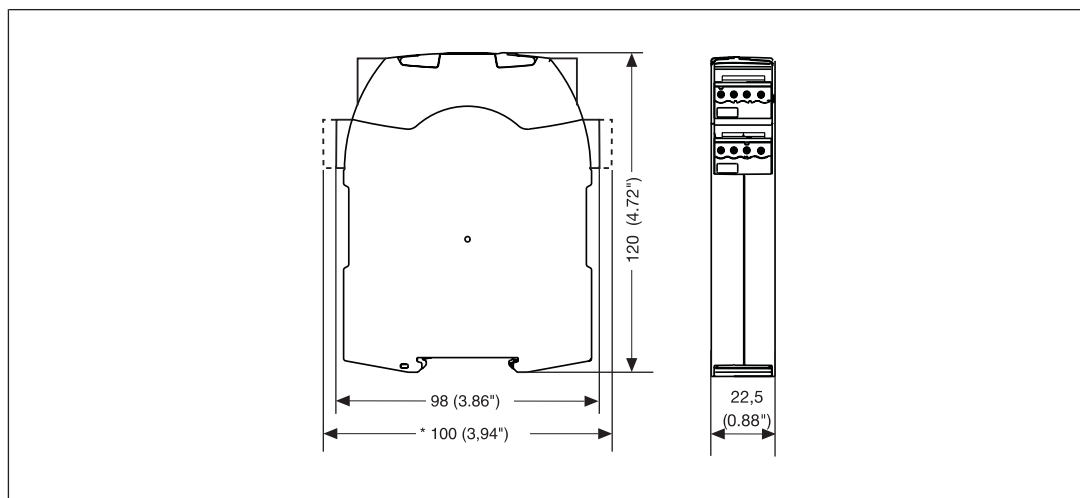
Channel Ext.2/O1 activated.

Faults - malfunctions

- ▶ Contact malfunctions: If the contacts have welded, reactivation will not be possible after the input circuit has opened.

Dimensions in mm

*with spring-loaded terminals



Technical details

Where standards are undated, the 2022-09 valid editions apply.

General	750132	751132
Certifications	CCC, CE, EAC, TÜV, UKCA, cU-Lus Listed	CCC, CE, EAC, TÜV, UKCA, cU-Lus Listed
Electrical data	750132	751132
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Power consumption	1,5 W	1,5 W
Duty cycle	100 %	100 %
Relay outputs	750132	751132
Number of output contacts		
Safety contacts (N/O), instantaneous	6	6
Auxiliary contacts (N/C)	2	2
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
in accordance with the standard	EN 60947-4-1	EN 60947-4-1

Relay outputs	750132	751132
Utilisation category of safety con- tacts		
AC1 at	240 V	240 V
Min. current	0,003 A	0,003 A
Max. current	6 A	6 A
Min. power	0,04 VA	0,04 VA
Max. power	1.500 VA	1.500 VA
DC1 at	24 V	24 V
Min. current	0,003 A	0,003 A
Max. current	6 A	6 A
Min. power	0,04 W	0,04 W
Max. power	150 W	150 W
Utilisation category of auxiliary con- tacts		
AC1 at	240 V	240 V
Min. current	0,003 A	0,003 A
Max. current	6 A	6 A
Min. power	0,04 VA	0,04 VA
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,003 A	0,003 A
Max. current	6 A	6 A
Min. power	0,04 W	0,04 W
Max. power	150 W	150 W
Utilisation category in accordance with the standard EN 60947-5-1		
Utilisation category of safety con- tacts		
AC15 at	230 V	230 V
Max. current	3 A	3 A
DC13 (6 cycles/min) at	24 V	24 V
Max. current	4 A	4 A
Utilisation category of auxiliary con- tacts		
AC15 at	230 V	230 V
Max. current	4 A	4 A
DC13 (6 cycles/min) at	24 V	24 V
Max. current	4 A	4 A
Utilisation category in accordance with UL		
Voltage with current	240 V AC G.U. (same polarity) 6 A	240 V AC G.U. (same polarity) 6 A
Voltage with current	24 V DC G. U. 6 A	24 V DC G. U. 6 A

Relay outputs	750132	751132
External contact fuse protection, safety contacts		
in accordance with the standard	EN 60947-5-1	EN 60947-5-1
Max. melting integral	66 A²s	66 A²s
Blow-out fuse, quick	6 A	6 A
Blow-out fuse, slow	4 A	4 A
Blow-out fuse, gG	6 A	6 A
Circuit breaker 24V AC/DC, characteristic B/C	4 A	4 A
External contact fuse protection, auxiliary contacts		
Max. melting integral	66 A²s	66 A²s
Blow-out fuse, quick	6 A	6 A
Blow-out fuse, slow	4 A	4 A
Blow-out fuse, gG	6 A	6 A
Circuit breaker, 24 V AC/DC, characteristic B/C	4 A	4 A
Contact material	AgCuNi + 0,2 µm Au	AgCuNi + 0,2 µm Au
Conventional thermal current while loading several contacts	750132	751132
I _{th} per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	6 A	6 A
Conv. therm. current with 2 contacts	5 A	5 A
Conv. therm. current with 3 contacts	4 A	4 A
Times	750132	751132
Switch-on delay		
with automatic start typ.	11 ms	11 ms
with automatic start max.	20 ms	20 ms
Delay-on de-energisation		
with E-STOP typ.	12 ms	12 ms
with E-STOP max.	20 ms	20 ms
Environmental data	750132	751132
Climatic suitability	EN 60068-2-78	EN 60068-2-78
Ambient temperature		
Temperature range	-10 - 55 °C	-10 - 55 °C
Storage temperature		
Temperature range	-40 - 85 °C	-40 - 85 °C
Climatic suitability		
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1

Environmental data	750132	751132
Vibration		
in accordance with the standard	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm
Airgap creepage		
in accordance with the standard	EN 60947-1	EN 60947-1
Overvoltage category	III	III
Pollution degree	2	2
Rated insulation voltage	250 V	250 V
Rated impulse withstand voltage	6 kV	6 kV
Protection type		
Housing	IP40	IP40
Terminals	IP20	IP20
Mounting area (e.g. control cabinet)	IP54	IP54
Mechanical data	750132	751132
Mounting position	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles
Material		
Bottom	PC	PC
Front	PC	PC
Top	PC	PC
Connection type	Screw terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in
Conductor cross section with screw terminals		
1 core flexible	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	—
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm², 24 - 16 AWG	—
Torque setting with screw terminals	0,5 Nm	—
Stripping length with screw terminals	7 mm	—
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	—	0,2 - 2,5 mm², 24 - 12 AWG
Spring-loaded terminals: Terminal points per connection	—	2
Stripping length with spring-loaded terminals	—	9 mm

Mechanical data	750132	751132
Dimensions		
Height	98 mm	100 mm
Width	22,5 mm	22,5 mm
Depth	120 mm	120 mm
Weight	265 g	265 g

The values for conventional thermal current stated in the technical details apply when the contacts from Ext.1/O0 **and** Ext.2/O1 are under load simultaneously.

Conventional thermal current when either the contacts from Ext.1/O0 **or** the contacts from Ext.2/O1 are under load:

Number of contacts in total	I_{th} [A] per contact
1	6 A
2	6 A
3	5 A

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	EN ISO 13849-1: 2015	EN IEC 62061 SIL CL/max. SIL	EN IEC 62061 61508 PFH [1/h]	EN/IEC 61511 61508 SIL	EN/IEC 61511 61508 PFD	EN ISO 13849-1: 2015 T _M [year]
PL		Category					

Safety con-
tacts, in-
stantaneous

PL e

Cat. 4

SIL 3

2,31E-09

SIL 3

2,03E-06

20

**NOTICE**

The safety-related characteristic data applies per channel of the contact expansion block. The safety-related characteristic data of the base unit and all other devices that are used must be taken into account when calculating the safety function.

Explanatory notes for the safety-related characteristic data:

- 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/IEC 61508-6 and EN/IEC 61511 and as the proof test interval and mission time in accordance with EN IEC 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 products used and may differ from these.

Supplementary data



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.

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.

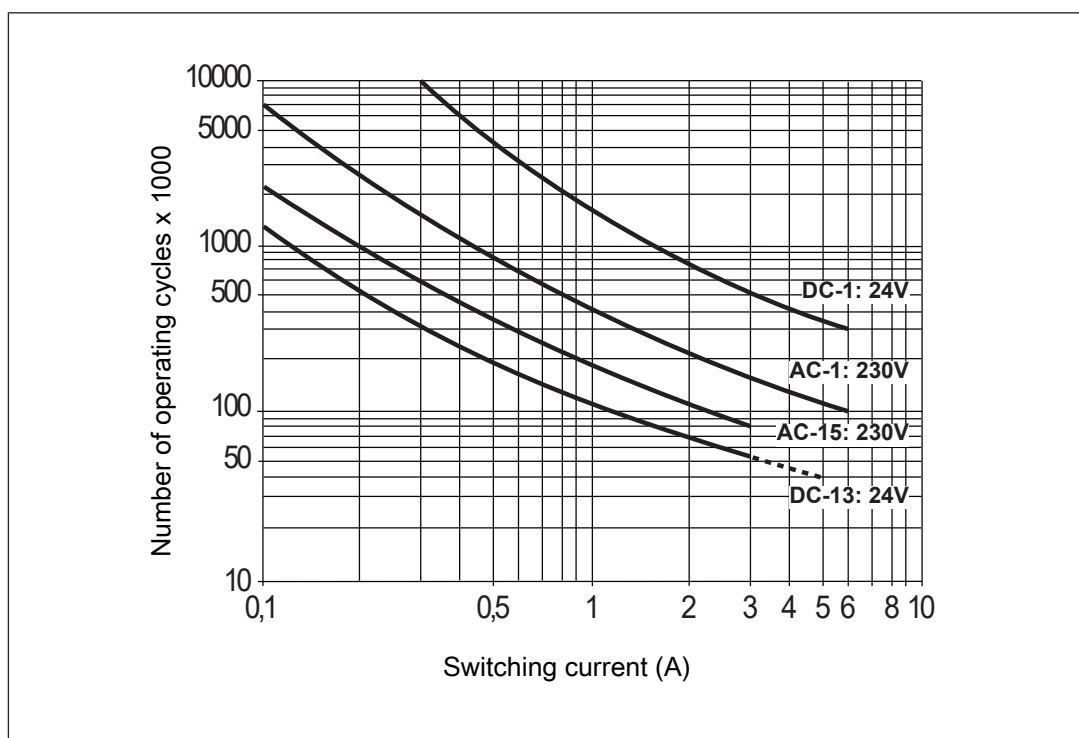


Fig.: Service life graphs at 24 VDC and 230 VAC

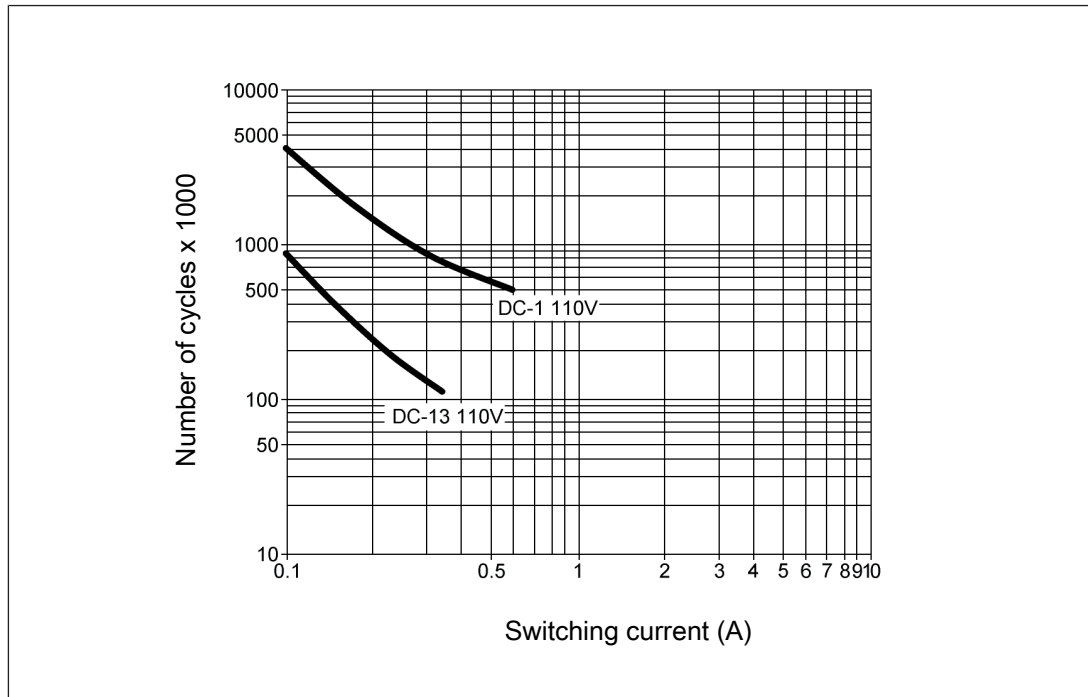


Fig.: Service life graphs at 110 VDC

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 \[12\]](#)) 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.

Operating height in accordance with EN 60664-1

The values stated in the technical details apply to the use of the product 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 rated insulation voltage and rated impulse withstand voltage for applications with safe separation:

Maximum operation height	Rated insulation voltage	Overvoltage category	Max. rated impulse withstand voltage
3000 m	150 V	II	2.5 kV
	100 V	III	2.5 kV
4000 m	150 V	II	2.5 kV
	100 V	III	2.5 kV
5000 m	150 V	II	2.5 kV
	100 V	III	2.5 kV

- ▶ Reduction of rated insulation voltage and rated impulse withstand voltage for applications with basic insulation:

Maximum operation height	Rated insulation voltage	Overvoltage category	Max. rated impulse withstand voltage
3000 m	250 V	II	2.5 kV
	150 V	III	2.5 kV
4000 m	250 V	II	2.5 kV
	150 V	III	2.5 kV
5000 m	250 V	II	2.5 kV
	150 V	III	2.5 kV

- ▶ 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

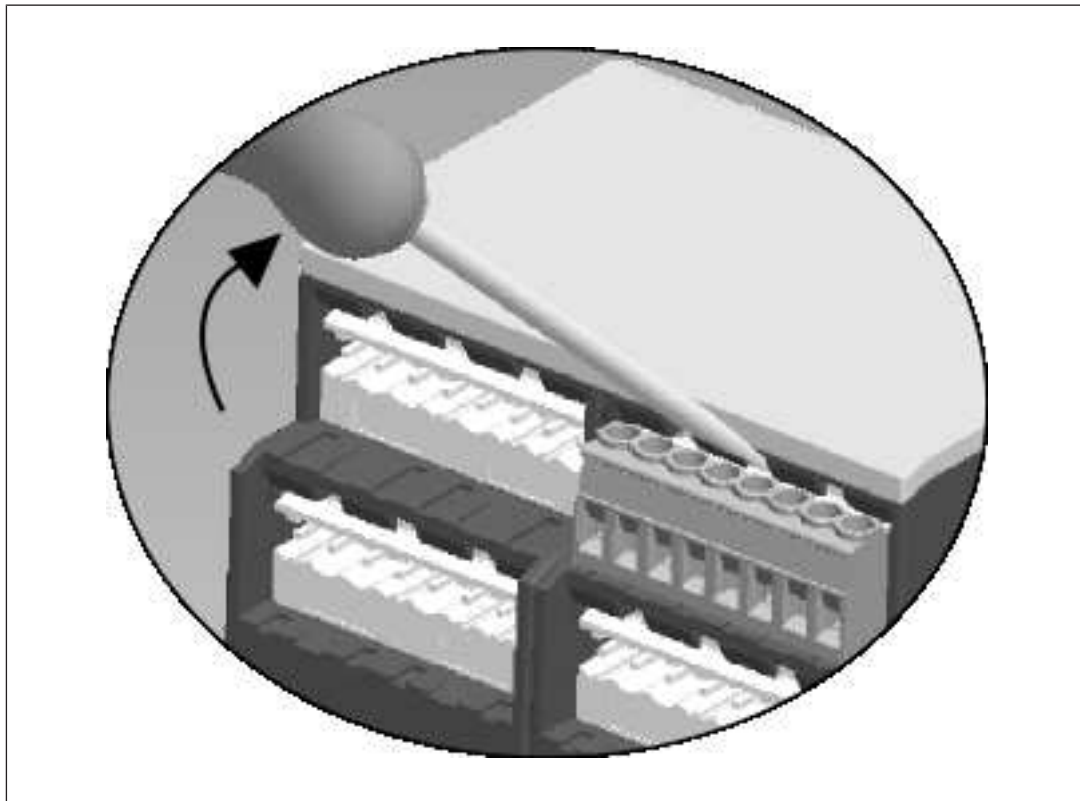
Remove plug-in terminals

Procedure

► Insert a suitable screwdriver into the housing recess behind the terminal.

Do **not** remove the terminals by pulling the cables!

► Lever the terminal out.



Order reference

Product type	Features	Connection type	Order no.
PNOZ s22	24 V DC	Screw terminals	750132
PNOZ s22 C	24 V DC	Spring-loaded terminals	751132

EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC on 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.

Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.

The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

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