



► PZE X5P

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Operating Manual-1003284-EN-11
- 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	4
Validity of documentation	4
Using the documentation	4
Definition of symbols	4
Safety	5
Intended use	5
Safety regulations	5
Safety assessment	5
Use of qualified personnel	6
Warranty and liability	6
Disposal	6
For your safety	6
Unit features	7
Safety features	7
Block diagram/terminal configuration	7
Function description	8
Installation	8
Wiring	8
Preparing for operation	9
Operation	10
Status indicators	10
Faults – Interference	10
Dimensions in mm	11
Technical details	12
Safety characteristic data	15
Supplementary data	16
Service life graph	16
Remove plug-in terminals	17
Order reference	17
EC declaration of conformity	18
UKCA-Declaration of Conformity	18

Introduction

Validity of documentation

This documentation is valid for the product PZE X5P. 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 contact expansion module PZE X5P meets the requirements of EN 60947-5-1 and EN 60204- 1. It is an expansion module for increasing the number of contacts available on a base unit. Base units are all safety relays with feedback loop.

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](#) [ 15] 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, 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. 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 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

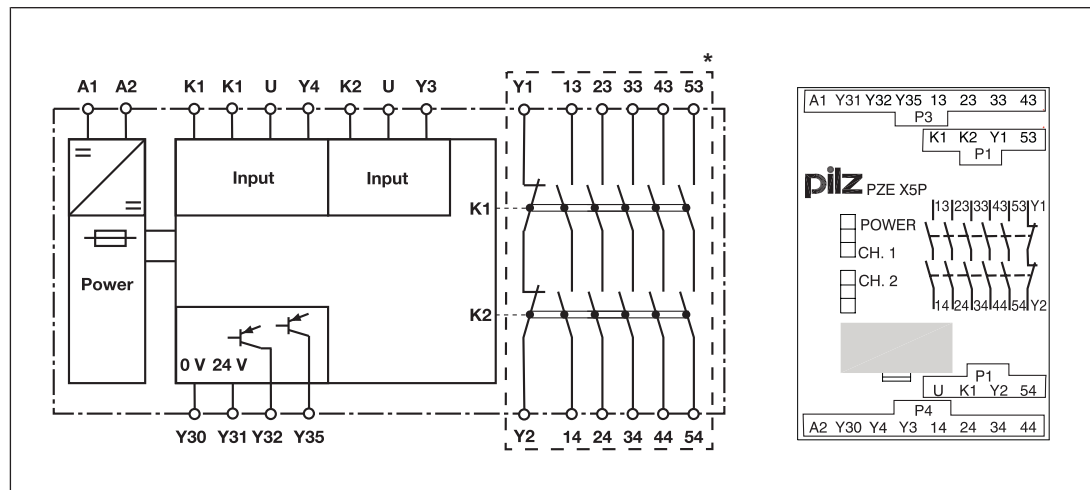
- ▶ Positive-guided relay outputs:
 - 5 safety contacts (N/O), instantaneous
- ▶ 2 semiconductor outputs
- ▶ LED display for:
 - Supply voltage
 - Switch status of the safety contacts
- ▶ Semiconductor outputs signal:
 - Supply voltage is present
 - Switch status of the safety contacts
- ▶ Connection for feedback loop
- ▶ Operation: single or dual-channel

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



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

Function description

The contact expansion module PZE X5P is an add-on device without delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay). When operating voltage is supplied the "POWER" LED will light.

- ▶ Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
 - Safety contacts 13-14, 23-24, 33-34, 43-44 and 53-54 close.
 - The LEDs "CH.1" and "CH.2" are lit.
 - A high signal is present at the semiconductor output switch state Y32.
- ▶ Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
 - Safety contacts 13-14, 23-24, 33-34, 43-44 and 53-54 are opened redundantly.
 - The LEDs "CH.1" and "CH.2" go out.
 - A low signal is present at the semiconductor output switch state Y32.

Semiconductor output supply voltage Y35

- ▶ A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

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 (35 mm).
- ▶ When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).

Wiring

Please note:

- ▶ Information given in the "[Technical details](#)  12]" must be followed.
- ▶ The outputs 13-14, 23-24, 33-34, 43-44, 53-54 are safety contacts.
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see [Technical details](#)  12]).
- ▶ Calculation of the max. cable length $l_{\max}$ in the input circuit:

$$l_{\max} = \frac{R_{l\max}}{R_l / \text{km}}$$

$R_{l\max}$ = max. overall cable resistance (see [Technical details](#)  12])

R_l / km = cable resistance/km

- ▶ Use copper wiring with a temperature stability of 60/75 °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.
- ▶ Do not switch low currents using contacts that have been used previously with high currents.
- ▶ The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- ▶ Semiconductor output supply voltage: Connect surge protection elements between the Y30 and Y31 connections and any DC distribution network (not SELV/PELV) fed from outside of the electrical installation area.

Preparing for operation

Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Feedback loop		
Y1 and Y2 are feedback loop inputs on the base unit		
Semiconductor output		
Y31, Y30: External supply voltage		

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 of the contact expansion module (switch off outputs of the base unit) and start the base unit again so that the internal diagnostics can check that the safety contacts open correctly

- ▶ 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 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.

Status indicators

LEDs indicate the status and errors during operation:



LED on



POWER

Supply voltage is present.



CH.1

Safety contacts of channel 1 are closed.



CH.2

Safety contacts of channel 2 are closed.

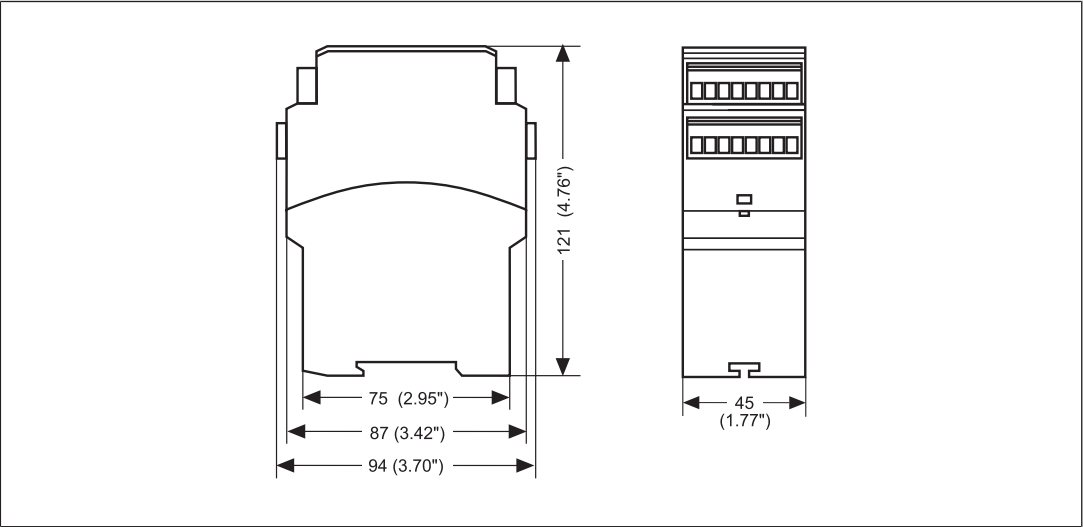
Faults – Interference

By closing or interrupting the input circuit you can check whether the unit switches on or off correctly.

For safety reasons, the unit cannot be started if the following faults are present:

- ▶ Contact malfunction: As the contact block is connected to a base unit, reactivation will not be possible if the contacts have welded after the input circuit has opened.
- ▶ Open circuit, short circuit or earth fault (e.g. in the input circuit)

Dimensions in mm



Technical details

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

General	
Certifications	CCC, CE, EAC, TÜV, UKCA, cULus Listed
Electrical data	
Supply voltage	
Voltage	24 V
Kind	DC
Voltage tolerance	-15 %/+10 %
Output of external power supply (DC)	3,5 W
Residual ripple DC	20 %
Duty cycle	100 %
Max. inrush current impulse	
Current pulse, A1	10 A
Pulse duration, A1	0,5 ms
Inputs	
Quantity	2
Voltage at	
Input circuit DC	24 V
Current at	
Input circuit DC	40 mA
Max. overall cable resistance R _{lmax}	
Single-channel at UB DC	120 Ohm
Dual-channel without detection of shorts across contacts at UB DC	240 Ohm
Dual-channel with detection of shorts across contacts at UB DC	4 Ohm
Semiconductor outputs	
Quantity	2
Voltage	24 V
Current	20 mA
External supply voltage	24 V
Voltage tolerance	-20 %/+20 %
Residual current at "0" signal	0,1 mA
Max. internal voltage drop	4 V
Conditional rated short circuit current	100 A
Lowest operating current	0 mA
Utilisation category in accordance with EN 60947-1	DC-12
Relay outputs	
Number of output contacts	
Safety contacts (N/O), instantaneous	5
Max. short circuit current I _K	1 kA

Relay outputs

Utilisation category

in accordance with the standard

EN 60947-4-1

Utilisation category of safety contacts

AC1 at	240 V
Min. current	0,01 A
Max. current	8 A
Max. power	2.000 VA
DC1 at	24 V
Min. current	0,01 A
Max. current	8 A
Max. power	200 W

Utilisation category

in accordance with the standard

EN 60947-5-1

Utilisation category of safety contacts

AC15 at	230 V
Max. current	5 A
DC13 (6 cycles/min) at	24 V
Max. current	7 A

Utilisation category in accordance with UL

Voltage	240 V AC G. P.
with current	8 A
Voltage	24 V DC G. P. Resistive
with current	5 A
Pilot Duty	B300, R300

External contact fuse protection, safety contacts

in accordance with the standard	EN 60947-5-1
Max. melting integral	240 A²s
Blow-out fuse, quick	10 A
Blow-out fuse, slow	6 A
Blow-out fuse, gG	10 A
Circuit breaker 24V AC/DC, characteristic B/C	6 A

Contact material

AgSnO₂ + 0,2 µm Au**Conventional thermal current while loading several contacts**I_{th} per contact at UB DC; AC1: 240 V, DC1: 24 V

Conv. therm. current with 1 contact	8 A
Conv. therm. current with 2 contacts	8 A
Conv. therm. current with 3 contacts	6,5 A
Conv. therm. current with 4 contacts	5,6 A
Conv. therm. current with 5 contacts	5 A

Times

Switch-on delay

with automatic start typ.	15 ms
with automatic start max.	30 ms
with automatic start after power on typ.	15 ms
with automatic start after power on max.	30 ms

Delay-on de-energisation

with E-STOP typ.	15 ms
with E-STOP max.	30 ms
with power failure typ.	110 ms
with power failure max.	150 ms

Supply interruption before de-energisation in the input circuit

8 ms

Supply interruption before de-energisation

20 ms

Environmental data

Climatic suitability

EN 60068-2-78

Ambient temperature

Temperature range

-10 - 55 °C

Storage temperature

Temperature range

-40 - 85 °C

Climatic suitability

Humidity

93 % r. h. at 40 °C

Condensation during operation

Not permitted

EMC

EN 60947-5-1, EN 61000-6-2, EN 61326-3-1

Vibration

in accordance with the standard

EN 60068-2-6

Frequency

10 - 55 Hz

Amplitude

0,35 mm

Airgap creepage

in accordance with the standard

EN 60947-1

Overvoltage category

III / II

Pollution degree

2

Rated insulation voltage

250 V

Rated impulse withstand voltage

4 kV

Protection type

Housing

IP40

Terminals

IP20

Mounting area (e.g. control cabinet)

IP54

Mechanical data

Mounting position

Any

Mechanical life

10,000,000 cycles

Material

Bottom

PPO UL 94 V1

Front

ABS UL 94 V0

Top

PPO UL 94 V1

Connection type

Screw terminal

Mechanical data

Mounting type	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
Dimensions	
Height	94 mm
Width	45 mm
Depth	121 mm
Weight	260 g

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 e	Cat. 4	SIL 3	2,31E-09	SIL 3	2,03E-06	20

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



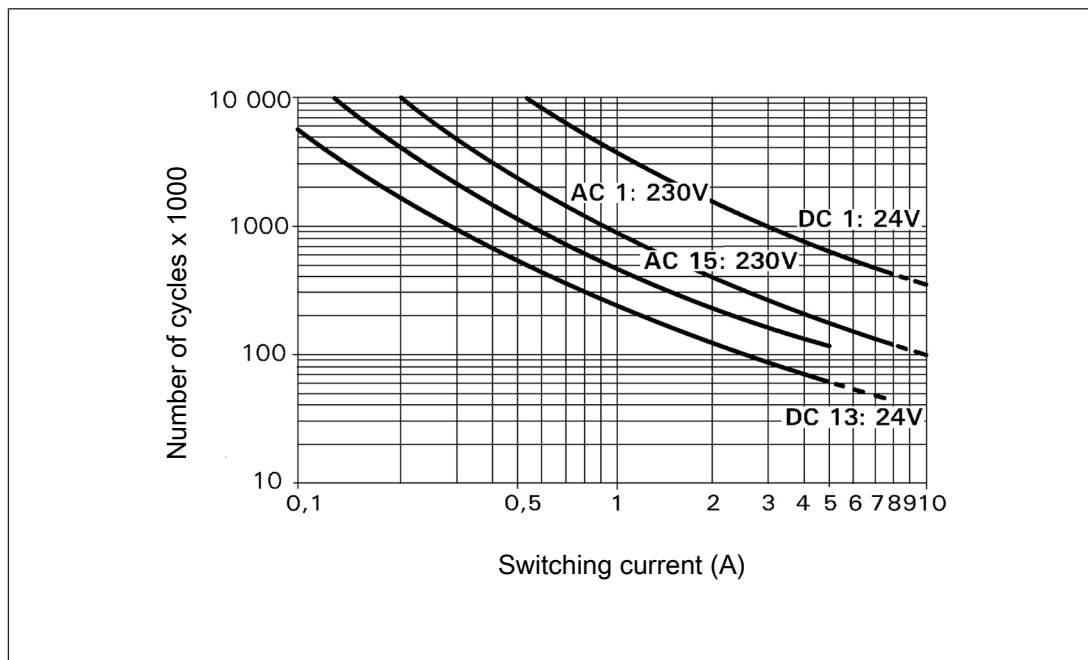
CAUTION!

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.



Example

- ▶ Inductive load: 0.2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 4 000 000 cycles

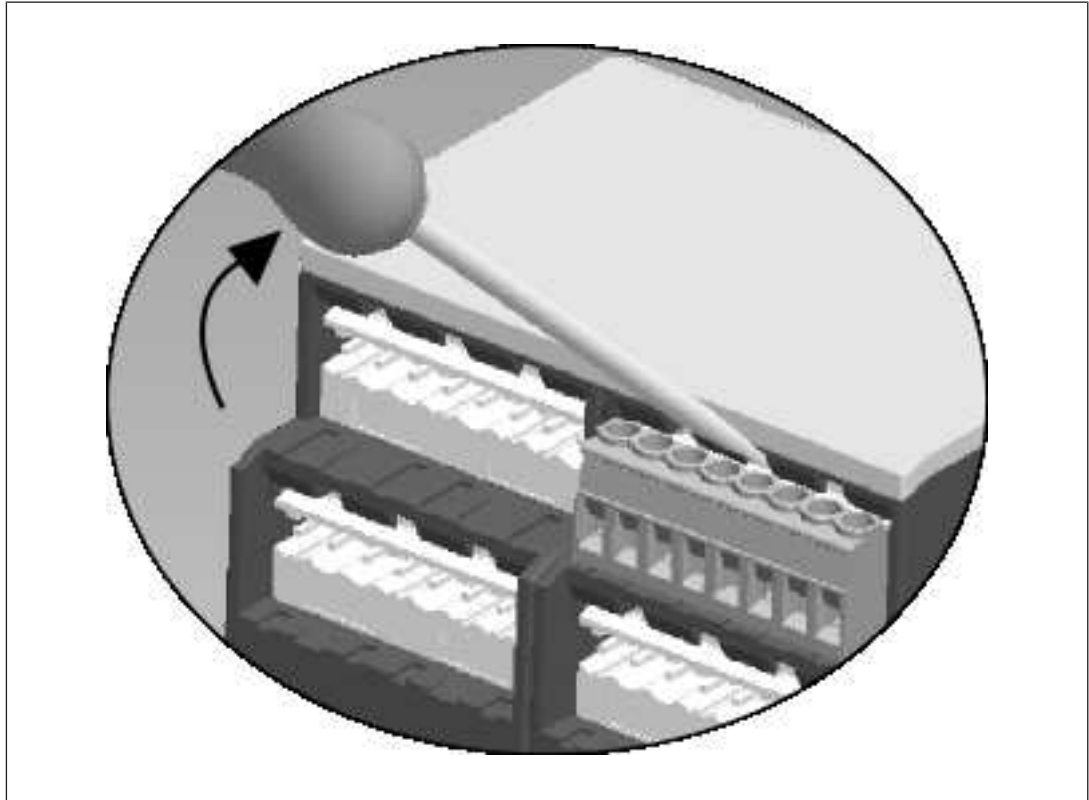
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

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	Terminals	Order no.
PZE X5P	24 VDC	Screw terminals	777150

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.

Representative: Pilz Automation Technology, Pilz House, Little Colliers Field, Corby, Northamptonshire, NN18 8TJ United Kingdom, eMail: mail@pilz.co.uk

Support

Technical support is available from Pilz round the clock.

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