A large yellow arrow pointing to the right, with a slight 3D effect on its left side.

PNOZ m EF 4DI4DOR

The PILZ logo, consisting of the word "pilz" in a lowercase, bold, sans-serif font. The "i" has a dot, and the "z" has a horizontal bar.

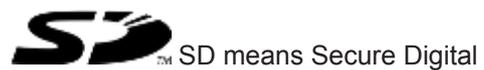
pilz

Configurable Control System PNOZmulti

This document is the original document.

All rights to this documentation are reserved by Pilz GmbH & Co. KG. Copies may be made for internal purposes. Suggestions and comments for improving this documentation will be gratefully received.

Pilz®, PIT®, PMI®, PNOZ®, Primo®, PSEN®, PSS®, PVIS®, SafetyBUS p®, SafetyEYE®, SafetyNET p®, the spirit of safety® are registered and protected trademarks of Pilz GmbH & Co. KG in some countries.



Section 1	Introduction	4
	1.1	Validity of the documentation 4
	1.1.1	Retaining the documentation 4
	1.2	Overview of documentation 4
	1.3	Definition of symbols 5
Section 2	Overview	6
	2.1	Unit structure 6
	2.1.1	Scope of supply 6
	2.1.2	Unit features 6
	2.2	Front view 7
Section 3	Safety	8
	3.1	Intended use 8
	3.1.1	System requirements 8
	3.2	Safety regulations 8
	3.2.1	Use of qualified personnel 8
	3.2.2	Warranty and liability 8
	3.2.3	Disposal 9
	3.2.4	For your safety 9
Section 4	Function description	10
	4.1	Device properties 10
	4.1.1	Integrated protection mechanisms 10
	4.1.2	Function description 10
Section 5	Installation	11
	5.1	General installation guidelines 11
	5.2	Dimensions 11
	5.3	Connect the base unit and expansion modules 11
Section 6	Commissioning	12
	6.1	General wiring guidelines 12
	6.2	Preparing for operation 12
	6.2.1	Download modified project to the PNOZmulti safety system 12
	6.2.2	Connection 12
Section 7	Operation	14
	7.1	Messages 14
Section 8	Technical details	15
	8.1	Safety characteristic data 17
Section 9	Service life graph of output relays	19
Section 10	Permitted ambient temperature T_{amb} dependent on the total current I_{sum}	20
Section 11	Order reference	21

1 Introduction

1.1 Validity of the documentation

This documentation is valid for the product PNOZ m EF 4DI4DOR. 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 PNOZ m EF 4DI4DOR.

Application of the product PNOZ m EF 4DI4DOR:

Expansion module for connection to a base unit from the configurable control system PNOZmulti

1.1.1 Retaining the documentation

This documentation is intended for instruction and should be retained for future reference.

1.2 Overview of documentation

1 Introduction

The introduction is designed to familiarise you with the contents, structure and specific order of this manual.

2 Overview

This chapter provides information on the product's most important features.

3 Safety

This chapter must be read as it contains important information on intended use.

4 Function Description

This chapter describes the product's mode of operation.

5 Installation

This chapter explains how to install the product.

6 Commissioning

This chapter describes the product's commissioning and wiring.

7 Operation

This chapter describes how to operate the product and gives tips in the case of a fault.

8 Technical Details

This chapter contains the product's technical details and order reference.

1.3 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.



ATTENTION!

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.



CAUTION!

This describes a situation in which the unit(s) 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.

2 Overview

2.1 Unit structure

2.1.1 Scope of supply

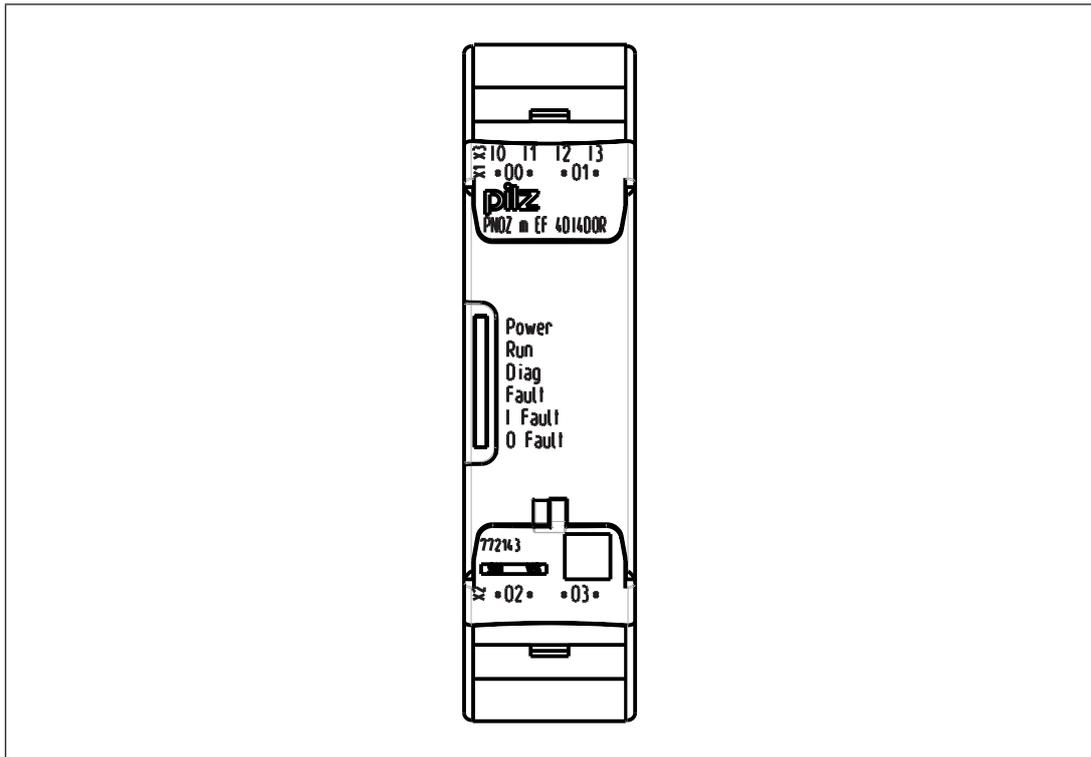
- ▶ Expansion module PNOZ m EF 4DI4DOR
- ▶ Jumper 779 260

2.1.2 Unit features

The product has the following features:

- ▶ Can be configured in the PNOZmulti Configurator
- ▶ Positive-guided relay outputs:
 - 4 safety outputs
 - Depending on the application, up to PL e of EN ISO 13849-1 and up to SIL CL 3 of EN IEC 62061
- ▶ 4 inputs for connecting, for example:
 - Emergency stop pushbutton
 - Two-hand pushbutton
 - Safety gate limit switches
 - Reset Element
 - Light beam devices
 - Scanners
 - Enable Switch
 - PSEN
 - Operating mode selector switch
- ▶ LED for:
 - Error messages
 - Diagnostics
 - Supply voltage
 - Output circuits
 - Input circuits
- ▶ Test pulse outputs used to monitor shorts across the inputs
- ▶ Monitoring of shorts between the safety outputs
- ▶ Plug-in connection terminals:
 - Either spring-loaded terminal or screw terminal available as an accessory (see order reference)
- ▶ Please refer to the document "PNOZmulti System Expansion" for the PNOZmulti base units that can be connected

2.2 Front view



Legend:

- ▶ Inputs I0 – I3
- ▶ Outputs O0 – O3
- ▶ LEDs:
 - POWER
 - Run
 - Diag
 - Fault
 - I Fault
 - O Fault

3 Safety

3.1 Intended use

The expansion module may only be connected to a base unit from the configurable control system PNOZmulti 2 (please refer to the document "PNOZmulti System Expansion" for details of the base units that can be connected)

The configurable control system PNOZmulti 2 is used for the safety-related interruption of safety circuits and is designed for use in:

- ▶ E-STOP equipment
- ▶ Safety circuits in accordance with VDE 0113 Part 1 and EN 60204-1

3.1.1 System requirements

Please refer to the "Product Modifications" document in the "Version overview" section for details of which versions of the base unit and PNOZmulti Configurator can be used for this product.

3.2 Safety regulations

3.2.1 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is someone who, because of their training, experience and current professional activity, has the specialist knowledge required to test, assess and operate the work equipment, devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.

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 safety guidelines given in this description
- ▶ Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.2 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.).

3.2.3 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).

3.2.4 For your safety

The unit meets all necessary conditions for safe operation. However, you should always ensure that the following safety requirements are met:

- ▶ This operating manual only describes the basic functions of the unit. Information on the advanced functions can be found in the online help for the PNOZmulti Configurator and in the PNOZmulti technical catalogue. Only use these functions after you have read and understood the documentation. All necessary documentation can be found on the PNOZmulti Configurator CD.
- ▶ Do not open the housing or make any unauthorised modifications.
- ▶ Please make sure you shut down the supply voltage when performing maintenance work (e.g. exchanging contactors).

4 Function description

4.1 Device properties

4.1.1 Integrated protection mechanisms

The relay conforms to the following safety criteria:

- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.

4.1.2 Function description

4.1.2.1 Operation

The expansion module provides additional inputs and additional relay outputs.

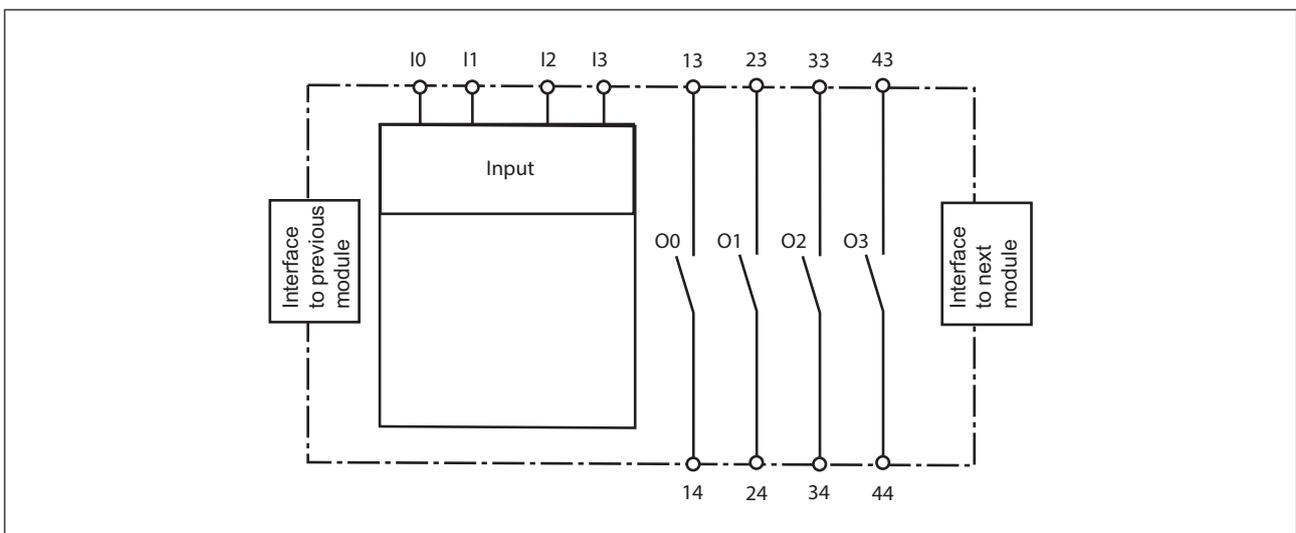
The function of the inputs and outputs on the control system depends on the safety circuit created using the PNOZmulti Configurator. A chip card is used to download the safety circuit to the base unit. The base unit has 2 microcontrollers that monitor each other. They evaluate the input circuits on the base unit and expansion modules and switch the outputs on the base unit and expansion modules accordingly.

The online help on the PNOZmulti Configurator contains descriptions of the operating modes and all the functions of the PNOZmulti control system, plus connection examples.

4.1.2.2 System reaction time-Reference-System expansion

Calculation of the maximum reaction time between an input switching off and a linked output in the system switching off is described in the document "System Expansion".

4.1.2.3 Internal wiring diagram



5 Installation

5.1 General installation guidelines

- ▶ The unit should be installed in a control cabinet with a protection type of at least IP54.
- ▶ Fit the safety system to a horizontal mounting rail. The venting slots must face upwards and downwards. Other mounting positions could destroy the safety system.
- ▶ Use the locking slide on the rear of the unit to attach it to a mounting rail.
- ▶ In environments exposed to heavy vibration, the unit should be secured using a fixing element (e.g. retaining bracket or end angle).
- ▶ Open the locking slide before lifting the unit from the mounting rail.
- ▶ To comply with EMC requirements, the mounting rail must have a low impedance connection to the control cabinet housing.
- ▶ The ambient temperature of the PNOZmulti units in the control cabinet must not exceed the figure stated in the technical details, otherwise air conditioning will be required.

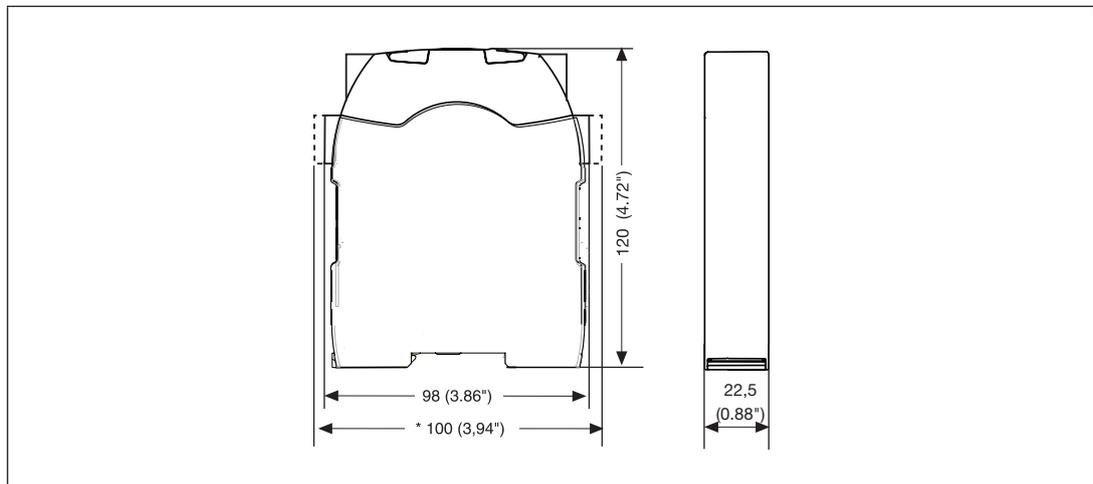


ATTENTION!

Damage due to electrostatic discharge!

Electrostatic discharge can damage components. Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.

5.2 Dimensions



5.3 Connect the base unit and expansion modules

Connect the base unit and the expansion modules as described in the operating manuals for the base modules.

- ▶ The terminator must be fitted to the last expansion module
- ▶ Install the expansion module in the position configured in the PNOZmulti Configurator.

6 Commissioning

6.1 General wiring guidelines

The wiring is defined in the circuit diagram of the PNOZmulti Configurator.

Note:

- ▶ Information given in the "Technical details" must be followed.

6.2 Preparing for operation

6.2.1 Download modified project to the PNOZmulti safety system

As soon as an additional expansion module has been connected to the system, the project must be amended using the PNOZmulti Configurator. Proceed as described in the operating instructions for the base unit.



CAUTION!
For the commissioning and after every program change, you must check whether the safety devices are functioning correctly.

6.2.2 Connection

input circuit	Single-channel	Dual-channel
Example: Emergency stop without detection of shorts across contacts		
Example: Emergency stop with detection of shorts across contacts		

Tab. 6-1: Connection examples for the input circuit

Dual output		
Single output		

Tab. 6-2: Relay outputs

Feedback loop Contacts from external contactors		
--	--	--

Tab. 6-3: Feedback loop

7 Operation

7.1 Messages

When the supply voltage is switched on, the PNOZmulti safety system copies the configuration from the chip card.

The LEDs "POWER", "DIAG", "FAULT", "IF-AULT" and "O-FAULT" light up on the base unit.

The PNOZmulti safety system is ready for operation when the "POWER" and "RUN" LEDs on the base unit are lit continuously.

Legend:

	LED on
	LED flashes
	LED off

LED						Error
POWER	Run	Diag	Fault	IF-aUlt	OFault	
						No supply voltage
						Expansion module PNOZ m EF 4DI4DOR running without error
						Expansion module PNOZ m EF 4DI4DOR is in a STOP condition
						Internal error on the expansion module PNOZ m EF 4DI4DOR or on the overall system. Expansion module is in a safe condition.
						External error on the expansion module PNOZ m EF 4DI4DOR or on the overall system. Expansion module is in a safe condition.
						Internal error on the inputs of the expansion module PNOZ m EF 4DI4DOR. Expansion module is in a safe condition, e.g. pulse error.
						Internal error on the outputs of the expansion module PNOZ m EF 4DI4DOR. Expansion module is in a safe condition.
						External error on the inputs of the expansion module PNOZ m EF 4DI4DOR. Expansion module is in a safe condition.
						External error on the outputs of the expansion module PNOZ m EF 4DI4DOR. Expansion module is in a safe condition, e.g. defective feedback loop

8 Technical details

General	772143
Approvals	BG, CCC, CE, GOST, TÜV
Application area	Failsafe
Module's device code	00E1h
Electrical data	772143
Supply voltage	
Module's current consumption	122 mA
Module's power consumption	3,0 W
Max. power dissipation of module	6,50 W
Status indicator	LED
Permitted loads	inductive, resistive
Inputs	772143
Number	4
Voltage at inputs	24 V DC
Input current range	2,5 - 5,3 mA
Input current at rated voltage	5 mA
Pulse suppression	0,5 ms
Maximum input delay	8 ms
Potential isolation	No
Relay outputs	772143
Utilisation category	
In accordance with the standard	EN 60947-4-1
Safety contacts: AC1 at	250 V
Max. current	6,0 A
Min. current	10,00 mA
Performance	1500 VA
Safety contacts: DC1 at	24 V
Max. current	6,0 A
Min. current	10,00 mA
Power	144 W
Utilisation category	
In accordance with the standard	EN 60947-5-1
Safety contacts: AC15 at	230 V
Max. current	3,0 A
Power	690 W
Safety contacts: DC13 (6 cycles/min) at	24 V
Max. current	3,0 A
Power	72 W
Airgap creepage between	
Relay contacts	3 mm
Relay contacts and other safe circuits	5,5 mm
Contact fuse protection, external safety contacts	
In accordance with the standard	VDE 0660
Blow-out fuse, quick	10 A
Blow-out fuse, slow	6 A
Switch-off delay	22 ms
Contact material	AgCuNi + 0,2 µm Au

Relay outputs	772143
Potential isolation	Yes
Environmental data	772143
Ambient temperature	
In accordance with the standard	EN 60068-2-14
Temperature range	0 - 60 °C
Forced convection in control cabinet off	55 °C
Storage temperature	
In accordance with the standard	EN 60068-2-1/-2
Temperature range	-25 - 70 °C
Climatic suitability	
In accordance with the standard	EN 60068-2-30, EN 60068-2-78
Condensation	Not permitted
EMC	EN 61131-2
Vibration	
In accordance with the standard	EN 60068-2-6
Frequency	5,0 - 150,0 Hz
Max. acceleration	1g
Airgap creepage	
In accordance with the standard	EN 61131-2
Overvoltage category	II
Pollution degree	2
Rated insulation voltage	30 V
Shock stress	
In accordance with the standard	EN 60068-2-27
Acceleration	15g
Duration	11 ms
Max. operating height above sea level	<2000 m über NN
Mechanical data	772143
Mounting position	Horizontal on top hat rail
Mechanical life	10,000,000 cycles
Protection type	
In accordance with the standard	EN 60529
Mounting (e.g. cabinet)	IP54
Housing	IP20
Terminals	IP20
DIN rail	
Top hat rail	35 x 7,5 EN 50022
Recess width	27 mm
Max. cable length	
Max. cable length per input	1,0 km
Material	
Bottom	PC
Front	PC
Top	PC
Cross section of external conductors with screw terminals	
1 core flexible	0,25 - 2,50 mm², 24 - 12 AWG

Mechanical data	772143
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	
Torque setting with screw terminals	0,50 Nm
Connection type	Spring-loaded terminal, screw terminal
Mounting type	pluggable
Cross section of external conductors with spring-loaded terminals: flexible with/without crimp connector	
Spring-loaded terminals: Terminal points per connection	2
Stripping length	9 mm
Dimensions	
Height	101,4 mm
Width	22,5 mm
Depth	120,0 mm
Weight	190 g

The standards current on 2012-08 apply.

8.1 Safety characteristic data

Unit	Operating mode	EN ISO 13849-1: 2006 PL	EN ISO 13849-1: 2006 Category	EN IEC 62061 SIL CL	PFH [1/h]	EN ISO 13849-1: 2006 TM [year]
Logic						
CPU		PL e	Cat. 4	SIL CL 3	2,84E-10	20
Input						
SC inputs	1-channel	PL d	Cat. 2	SIL CL 2	2,10E-09	20
SC inputs	2-channel	PL e	Cat. 4	SIL CL 3	4,27E-11	20
SC inputs	1-ch., pulsed light beam device	PL e	Cat. 4	SIL CL 3	2,10E-10	20
Output						
Relay outputs	1-channel	PL c	Cat. 1	-	3,75E-08	20
Relay outputs	2-channel	PL e	Cat. 4	SIL CL 3	7,52E-12	20

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.

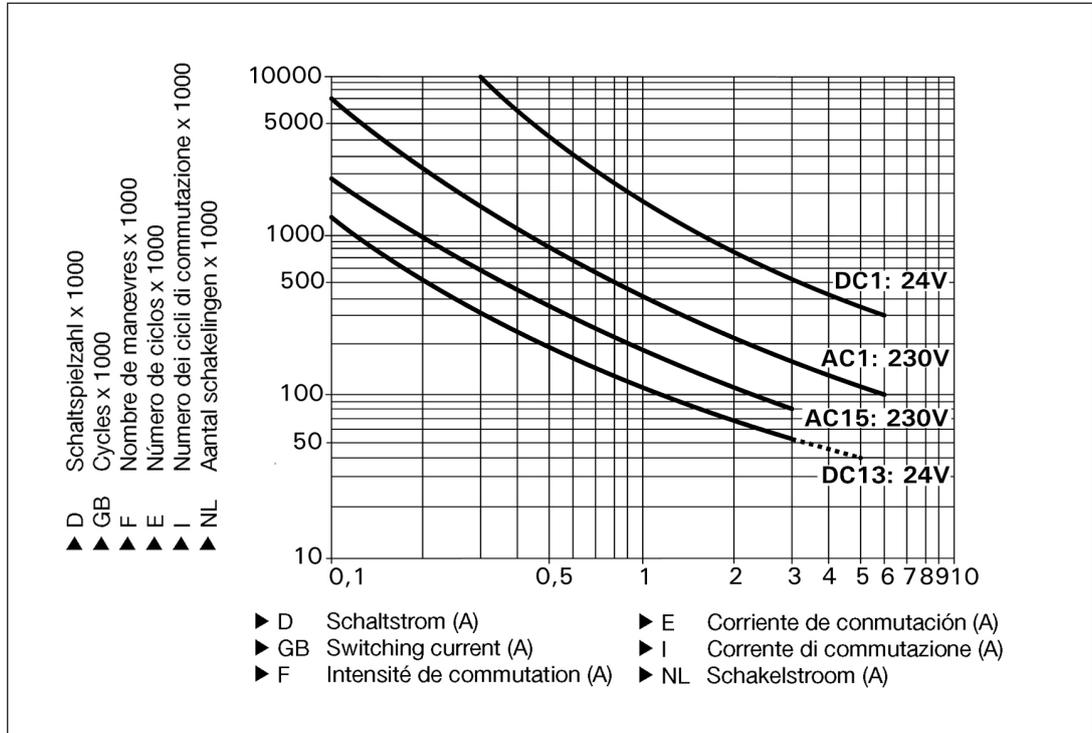
**ATTENTION!**

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.

9 Service life graph of output relays

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

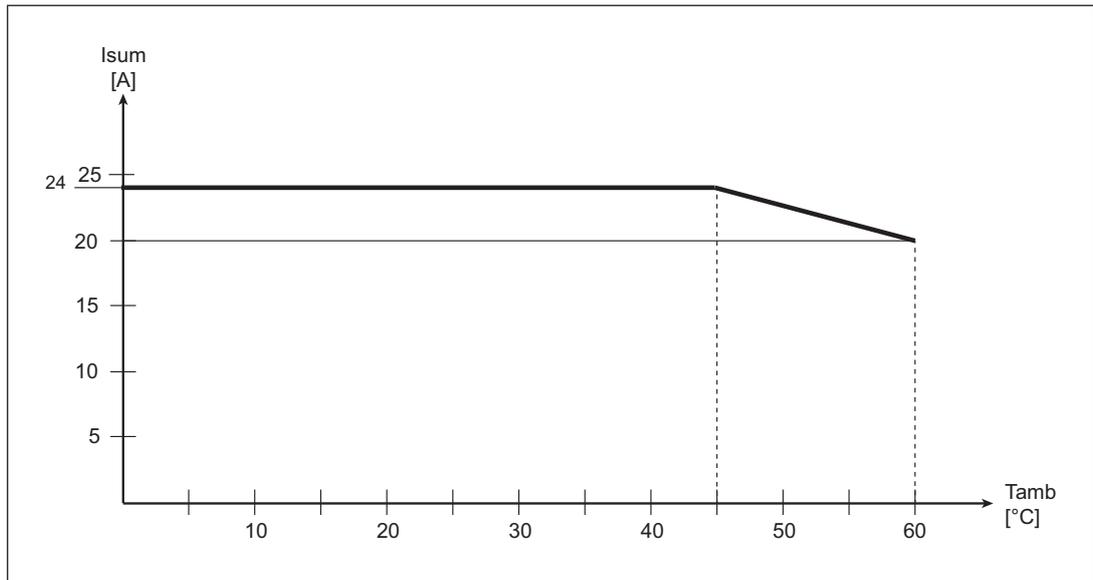
- Inductive load: 0,2 A
- Utilisation category: AC15
- Contact service life: 1,000,000 cycles

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.

We recommend you use semiconductor outputs to switch 24 VDC loads.

10 Permitted ambient temperature T_{amb} dependent on the total current I_{sum}



Max. permitted total current of relay outputs at an ambient temperature of < 45 °C: 24 A

Max. permitted total current of relay outputs at an ambient temperature of $= 60$ °C: 20 A

11 Order reference

Order reference		
Product type	Features	Order no.
PNOZ m EF 4DI4DOR	Expansion module	772 143
Order reference: Accessories		
Product type	Features	Order no.
Set spring terminals	1 set of spring-loaded terminals	751 004
Set screw terminals	1 set of screw terminals	750 004
Order reference: Terminator, jumper		
Product type	Features	Order no.
PNOZ mm0.xp connector left	Jumper yellow/black to connect the modules, 1 piece	779 260



...
In many countries we are represented by our subsidiaries and sales partners.

Please refer to our homepage for further details or contact our headquarters.

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

► Technical support

+49 711 3409-444
support@pilz.com

pilz