PNOZ mo1p

PILZ
THE SPIRIT OF SAFETY

- Configurable safety systems PNOZmulti

Operating Manual 20881-EN-07

This document is a translation of the original document.

Source code from third-party manufacturers or open source software has been used for some components. The relevant licence information is available on the Internet on the Pilz homepage.


SD means Secure Digital

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PNOZ mo1p. 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.

1.2 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.

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.

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.

2 Overview

2.1 Scope

- Expansion module PNOZ mo1p
- Jumper

2.2 Unit features

Using the product PNOZ mo1p:

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

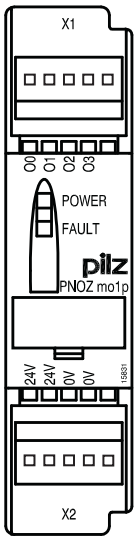
The product has the following features:

- Can be configured in the PNOZmulti Configurator
- Semiconductor 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
- Please refer to the document "PNOZmulti System Expansion" for the PNOZmulti base units that can be connected.
- Plug-in connection terminals:
  either spring-loaded terminal or screw terminal available as an accessory (see order reference)
- Coated version:

  Increased environmental requirements (see Technical details [18])

2.3 Front view



Legend:

- 0 V, 24 V
  Supply connections
- O0 – O4
  Semiconductor outputs

3 Safety

3.1 Intended use

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

The configurable small control systems PNOZmulti are used for the safety-related interruption of safety circuits and are designed for use in:

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

The coated version of the product PNOZ mo1p is suitable for use where there are increased environmental requirements (see Technical details [18]).

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.

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 information provided in this description under "Safety"
- And 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

- 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 the 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. The expanded functions are described in the PNOZmulti Configurator's online help. Only use these functions once you have read and understood the documentations.
- 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).

3.3 System requirements

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

4 Function description

4.1 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.
- The safety outputs are tested periodically using a disconnection test.

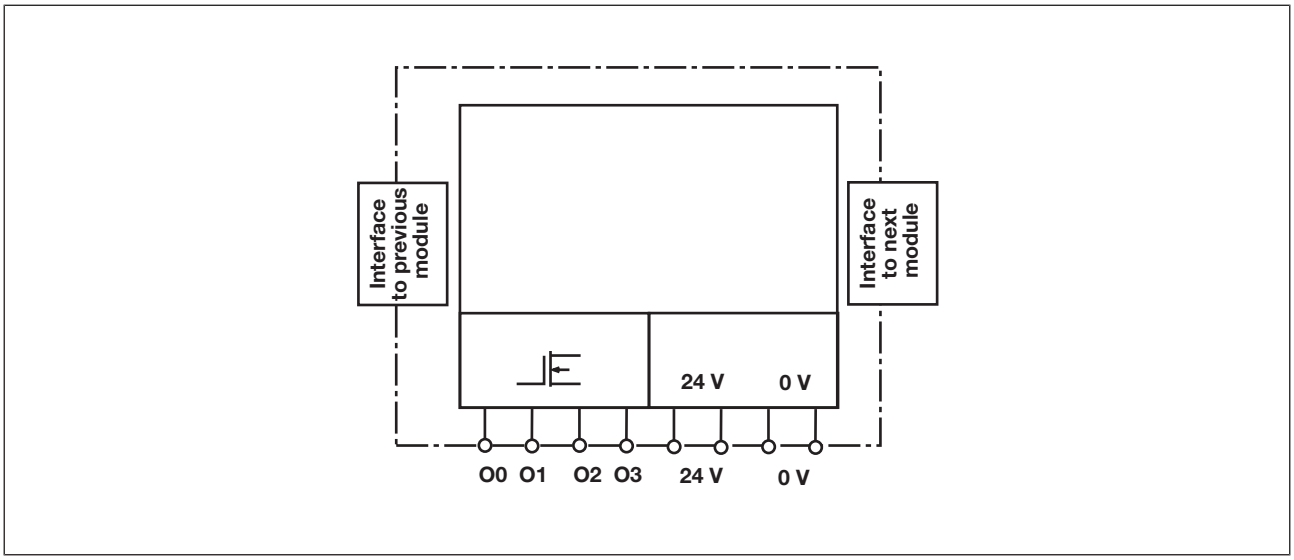
4.2 Functions

The expansion module provides additional semiconductor outputs.

The function of the outputs on the safety 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 safety system, plus connection examples.

4.3 Block diagram



4.4 System reaction time

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 "PNOZmulti System Expansion".

5 Installation

5.1 General installation guidelines

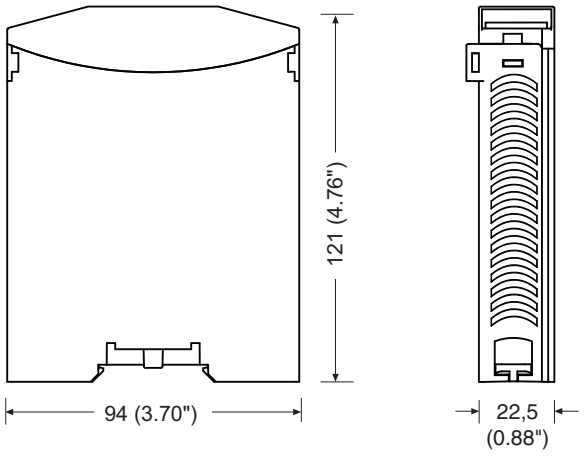
- The control system should be installed in a control cabinet with a protection type of at least IP54. Fit the control system to a horizontal mounting rail. The venting slots must face upward and downward. Other mounting positions could destroy the control system.
- Use the notches on the rear of the unit to attach it to a mounting rail. Connect the control system to the mounting rail in an upright position, so that the earthing springs on the control system are pressed on to the mounting rail.
- 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.
- To comply with EMC requirements, the mounting rail must have a low impedance connection to the control cabinet housing.

CAUTION!

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 in mm



5.3 Connecting 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.

The position of the expansion modules is defined in the PNOZmulti Configurator. The expansion modules are connected to the left or right of the base unit, depending on the type.

Please refer to the document "PNOZmulti System Expansion" for details of the number of modules that can be connected to the base unit and the module types.

6 Commissioning

6.1 General wiring guidelines

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

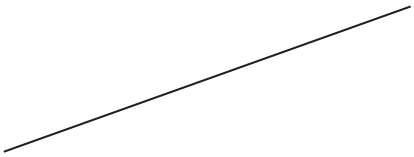
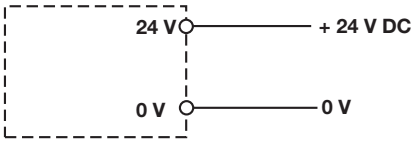
Please note:

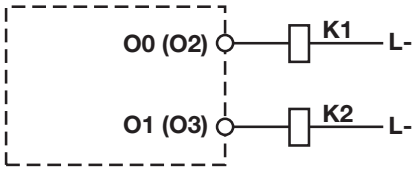
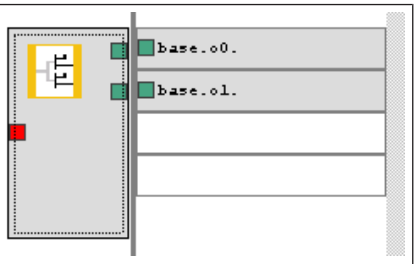
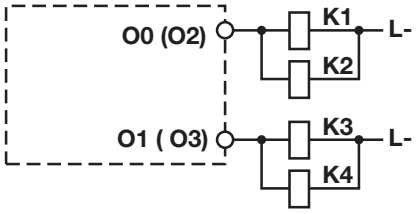
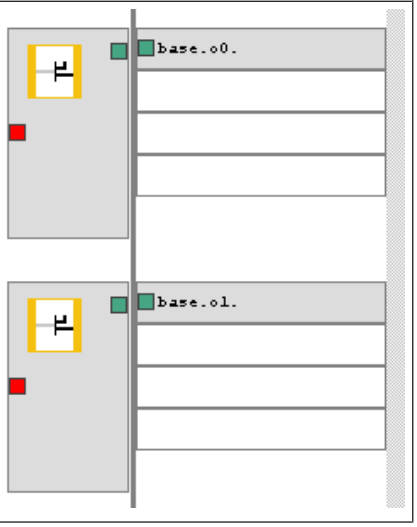
- Information given in the Technical details [📖 18] must be followed.
- Use copper wire that can withstand 75° C.
- Two connection terminals are available for each of the supply connections 24 V and 0 V (semiconductor outputs), plus A1 and A2 (power supply). This means that the supply voltage can be looped through several connections. When the supply voltage is looped, the current at each terminal may not exceed 3 A.

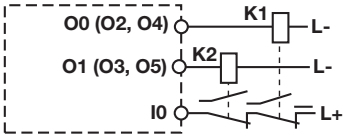
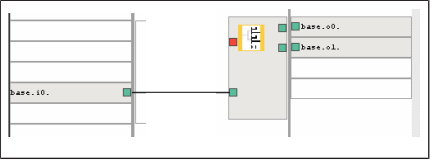
NOTICE

On the module PNOZ mo1p coated version, please note the limited overall performance at the outputs with ambient temperatures >50 °C (see Technical details [📖 18])

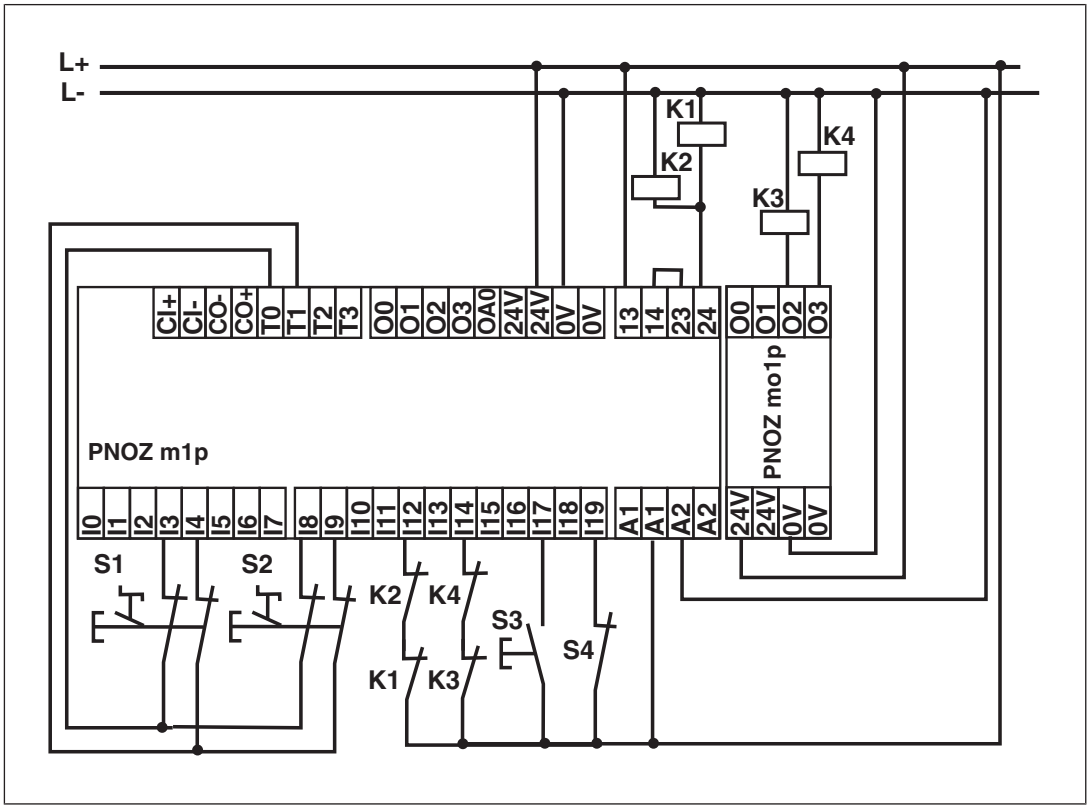
6.2 Connection

Supply voltage	AC	DC
		

Redundant output		
Single output		

Feedback loop	Redundant output	
Contacts from external contactors		

6.3 Connection example



PNOZ mo1p: Contactor K3 and K4
PNOZ m1p: Feedback loop K3 and K4 at I14

6.4 Download modified project to the PNOZmulti 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.

NOTICE

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

7 Operation

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

The LEDs “POWER”, “DIAG”, “FAULT”, “IFAULT” and “OFAULT” will 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

7.1 Messages

Base unit						PNOZ mo1p		
Input Ix	RUN	DIAG	FAULT	IFAULT	OFAULT	FAULT	IN/OUT	**Error**
	●							External error on the output, e.g. short across contacts
	☼	◐				●		Internal error on the expansion module
	☼					◐		External error on the output, e.g. feedback loop defective

8 Technical details

General	773500	773505
Approvals	BG, CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	BG, CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**773500**	**773505**
Supply voltage		
for	Supply to the SC outputs	Supply to the SC outputs
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+20 %	-15 %/+20 %
Output of external power supply (DC)	192,0 W	192,0 W
Residual ripple DC	5 %	5 %
Potential isolation	yes	yes
Supply voltage		
for	Module supply	Module supply
internal	Via base unit	Via base unit
Voltage	5,0 V	5,0 V
Kind	DC	DC
Voltage tolerance	-2 %/+2 %	-2 %/+2 %
Power consumption	2,5 W	2,5 W
Status indicator	LED	LED
Semiconductor outputs	**773500**	**773505**
Number	4	4
Switching capability		
Voltage	24 V	24 V
Current	2,0 A	2,0 A
Power	48 W	48 W
Voltage	–	24 V
Current	–	1 A
Power	–	24 W
Signal level at "1"	UB - 0.5 VDC at 2 A	UB - 0.5 VDC at 2 A
Residual current at "0"	0,5 mA	0,5 mA
Max. capacitive load	1 µF	1 µF
Max. duration of off time during self test	300 µs	300 µs
Switch-off delay	30 ms	30 ms
Potential isolation	yes	yes
Short circuit-proof	yes	yes
Times	**773500**	**773505**
Switch-on delay	5,00 s	5,00 s
Supply interruption before de-energisation	20 ms	20 ms

Environmental data	773500	773505
Ambient temperature		
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**
Temperature range	**0 - 60 °C**	**-25 - 60 °C**
Forced convection in control cabinet off	**55 °C**	–
Storage temperature		
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-25 - 70 °C**	**-25 - 70 °C**
Climatic suitability		
In accordance with the standard	**EN 60068-2-30, EN 60068-2-78**	**EN 60068-2-30, EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
EMC	**EN 61131-2**	**EN 61131-2**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 150,0 Hz**	**5,0 - 500,0 Hz**
Acceleration	**1g**	**1g**
Broadband noise		
In accordance with the standard	–	**EN 60068-2-64**
Frequency	–	**5 - 500 Hz**
Acceleration	–	**1,9grms**
Corrosive gas check		
SO2: Concentration 10 ppm, duration 10 days, passive	–	**DIN V 40046-36**
H2S: Concentration 1 ppm, duration 10 days, passive	–	**DIN V 40046-37**
Shock stress		
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Acceleration	**15g**	**15g**
Duration	**11 ms**	**11 ms**
Max. operating height above sea level	**2000 m**	**2000 m**
Airgap creepage		
In accordance with the standard	**EN 61131-2**	**EN 61131-2**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**30 V**	**30 V**
Protection type		
In accordance with the standard	**EN 60529**	**EN 60529**
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP20**	**IP20**
Terminals	**IP20**	**IP20**
Potential isolation	**773500**	**773505**
Potential isolation between	**SC output and system voltage**	**SC output and system voltage**
Type of potential isolation	**Protective separation**	**Protective separation**

Potential isolation	**773500**	**773505**
Rated surge voltage	**2500 V**	**2500 V**
Mechanical data	**773500**	**773505**
Mounting position	**Horizontal on top hat rail**	**Horizontal on top hat rail**
DIN rail		
Top hat rail	**35 x 7,5 EN 50022**	**35 x 7,5 EN 50022**
Recess width	**27 mm**	**27 mm**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Connection type	**Spring-loaded terminal, screw terminal**	**Spring-loaded terminal, screw terminal**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 1,50 mm², 24 - 16 AWG**	**0,25 - 1,50 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,25 - 0,75 mm², 24 - 20 AWG**	**0,25 - 0,75 mm², 24 - 20 AWG**
Torque setting with screw terminals	**0,25 Nm**	**0,25 Nm**
Stripping length with screw terminals	**7 mm**	**7 mm**
Conductor cross section with spring-loaded terminals		
1 core flexible without crimp connector	**0,25 - 1,50 mm², 24 - 16 AWG**	**0,25 - 1,50 mm², 24 - 16 AWG**
1 core flexible with crimp connector	**0,25 - 0,75 mm², 24 - 20 AWG**	**0,25 - 0,75 mm², 24 - 20 AWG**
Spring-loaded terminals: Terminal points per connection	**1**	**1**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**
Dimensions		
Height	**94,0 mm**	**94,0 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121,0 mm**	**121,0 mm**
Weight	**154 g**	**156 g**

Where standards are undated, the 2008-03 latest editions shall apply.

8.1 Safety characteristic data

NOTICE

You must comply with the safety-related 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]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**7,00E-09**	**SIL 2**	**6,14E-04**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**8,60E-10**	**SIL 3**	**1,30E-05**	**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.

9 Order reference

9.1 Product

Product type	Features	Order No.
PNOZ mo1p	Expansion module, 2 or 4 semiconductor outputs, safe	773 500
PNOZ mo1p coated version	Expansion module, 2 or 4 semiconductor outputs, safe, coated version	773 505

9.2 Accessories

Terminator, jumper

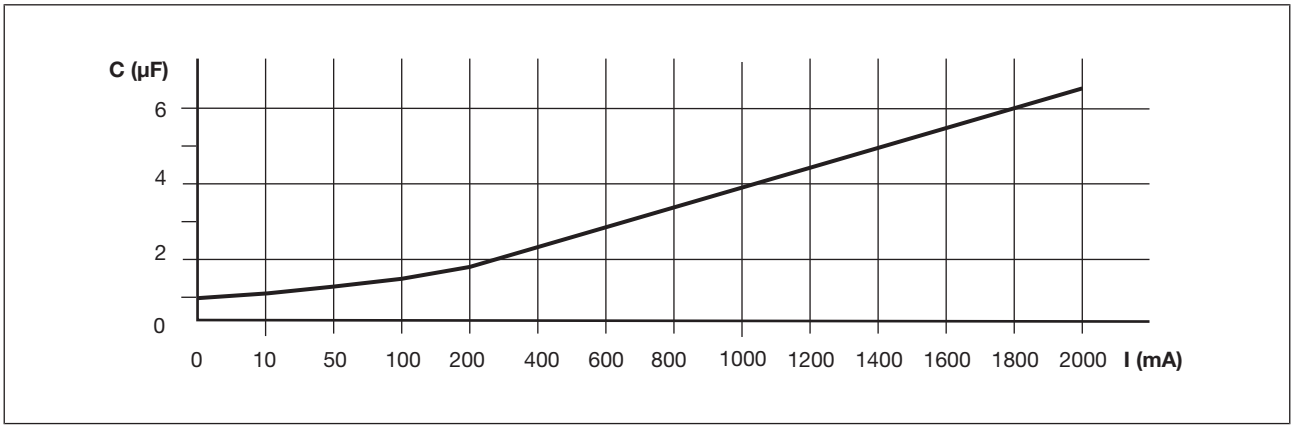
Product type	Features	Order No.
PNOZmulti bus terminator	Terminator	779 110
PNOZmulti bus terminator coated	Terminator, coated version	779 112
KOP-XE	Jumper	774 639
KOP-XE coated	Jumper, coated version	774 640

Connection terminals

Product type	Features	Order No.
Set spring terminals	1 set of spring-loaded terminals	783 400
Set screw terminals	1 set of screw terminals	793 400

10 Supplementary data

10.1 Maximum capacitive load C (µF) with load current I (mA) at the semiconductor outputs



Support

Technical support is available from Pilz round the clock.

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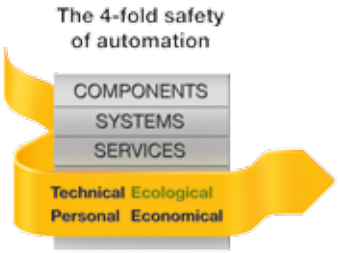

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