PNOZ mmc11p

▸ Configurable, safe compact controllers PNOZmulti Mini

PILZ

THE SPIRIT OF SAFETY

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.

SD means Secure Digital

Contents

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PNOZ mmc11p. 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 of supply

▷ Expansion module PNOZ mmc11p

▷ Jumper

2.2 Unit features

Application of the product PNOZ mmc11p:

Expansion module for connection to a base unit from the PNOZmulti Mini system.

The product has the following features:

▷ Can be configured in the PNOZmulti Configurator

▷ Network protocols: EtherCAT

▷ Supports CANopen over EtherCAT (DS301 V4.02 compliant)

▷ Status indicators for communication with EtherCAT and for errors

▷ 24 virtual inputs and outputs on the control system PNOZmulti can be defined in the PNOZmulti Configurator for communication with the fieldbus EtherCAT . The number of inputs and outputs can be extended to 128. Please note that when the extended inputs and outputs 24 - 127 are used they have different properties (see document entitled "Communication Interfaces").

▷ Max. 1 PNOZ mmc11p can be connected to the base unit

▷ Plug-in connection terminals:
Either spring-loaded terminal or screw terminal available as an accessory (see Order references for accessories).

▷ Please refer to the document "PNOZmulti System Expansion" for details of the base units PNOZmulti Mini that can be connected.

2.3   Front view
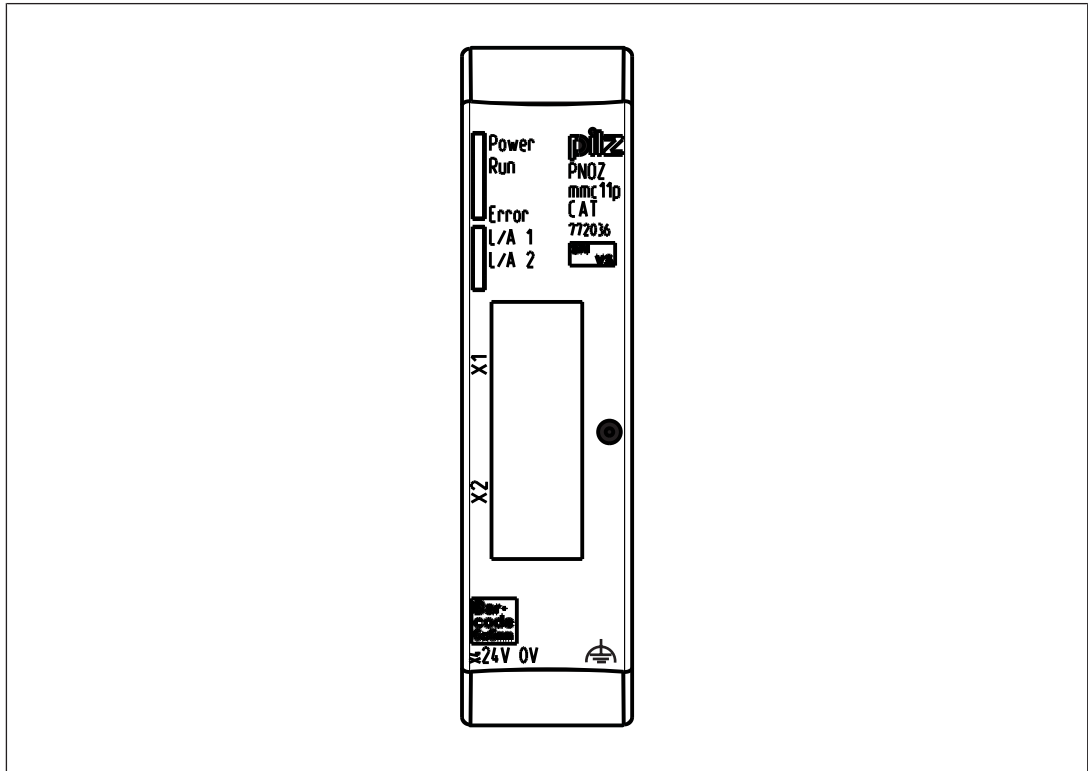
Legend:

▸ X1: EtherCAT IN

▸ X2: EtherCAT OUT

▸ X4: 0 V, 24 V:
  Supply connections

▸ ⏚: Functional earth

▸ LEDs:

  – Power

  – Run

  – Error

  – L/A 1

  – L/A 2

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany

3 Safety

3.1 Intended use

The expansion module PNOZ mmc11p is used for communication between the configurable control system PNOZmulti with EtherCAT.

EtherCAT is designed for fast data exchange at field level. The expansion module PNOZ mmc11p is a passive EtherCAT subscriber (Slave). The basic communication functions with EtherCAT conform to the system description published by the EtherCAT User Group. The central controller (master) reads input information from the slaves and writes output information to the slaves as part of each cycle.

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

The configurable control system PNOZmulti 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

The expansion module may not be used for safety-related functions.

Intended use includes making the electrical installation EMC-compliant. The product is designed for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.

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 chapter entitled "Technical Details")

3.2 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.

3.3 Safety regulations

3.3.1 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.

3.3.2 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.).

3.3.3 Disposal

▸ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

3.3.4 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).

4 Function description

4.1 Operation

The virtual inputs and outputs that are to be transferred via EtherCAT are selected and configured in the PNOZmulti Configurator. The base unit and the expansion module PNOZ mmc11p are connected via a jumper. After the supply voltage is switched on or the PNOZmulti control system is reset, the expansion module PNOZ mmc11p is configured and started automatically.

The connection to EtherCAT is made via the two RJ45 sockets.

LEDs indicate the status of the expansion module on EtherCAT.

The configuration is described in detail in the PNOZmulti Configurator's online help.

4.2 Input and output data

The data is structured as follows:

▸ Input area

The inputs are defined in the master and transferred to the PNOZmulti. Each input has a number, e.g. input bit 4 of byte 1 has the number i12.

▸ Output range

The outputs are defined in the PNOZmulti Configurator. Each output that is used is given a number there, e.g. o0, o5... The status of output o0 is stored in bit 0 of byte 0; the status of output o5 is stored in bit 5 of byte 0 etc.

▸ Output range only: Byte 3

Bits 0 … 4: Status of LEDs on the PNOZmulti

- – Bit 0: OFAULT
- – Bit 1: IFAULT
- – Bit 2: FAULT
- – Bit 3: DIAG
- – Bit 4: RUN

Bit 5: Data is being exchanged.

Detailed information on data exchange (tables, segments) is available in the document "Communication Interfaces" in the section entitled "Fieldbus modules".

4.3 Assigning the inputs/outputs in the PNOZmulti Configurator to the EtherCAT inputs/outputs

Virtual inputs on PNOZmulti Configurator	i0 ... I7	i8 ... i15	i16 ... i23
Input data EtherCAT	Byte 0: Bits 0 … 7	Byte 1: Bits 0 … 7	Byte 2: Bits 0 … 7
Virtual outputs on PNOZmulti Configurator	o0 ... o7	o8 ... o15	o16 ... o23
Output data EtherCAT	Byte 0: Bits 0 … 7	Byte 1: Bits 0 … 7	Byte 2: Bits 0 … 7

The number of virtual inputs and outputs can be extended to 128 (see document "Communication Interfaces" in the section entitled "Fieldbus modules")

4.4 Block diagram
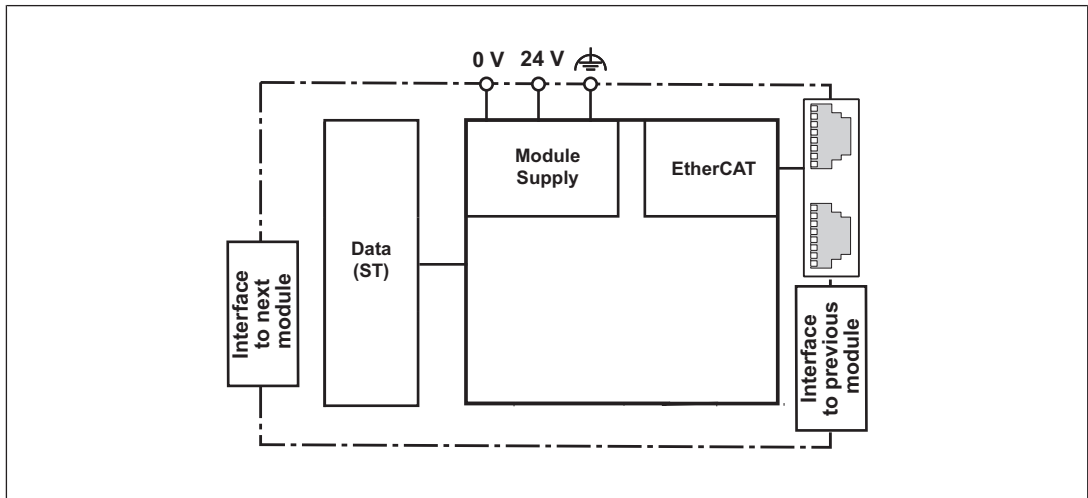
5 Installation

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 notch 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).

‣ Push the unit upwards or downwards before lifting it 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 in the control cabinet must not exceed the figure stated in the technical details. otherwise air conditioning may be required.

> **NOTICE**
>
> **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
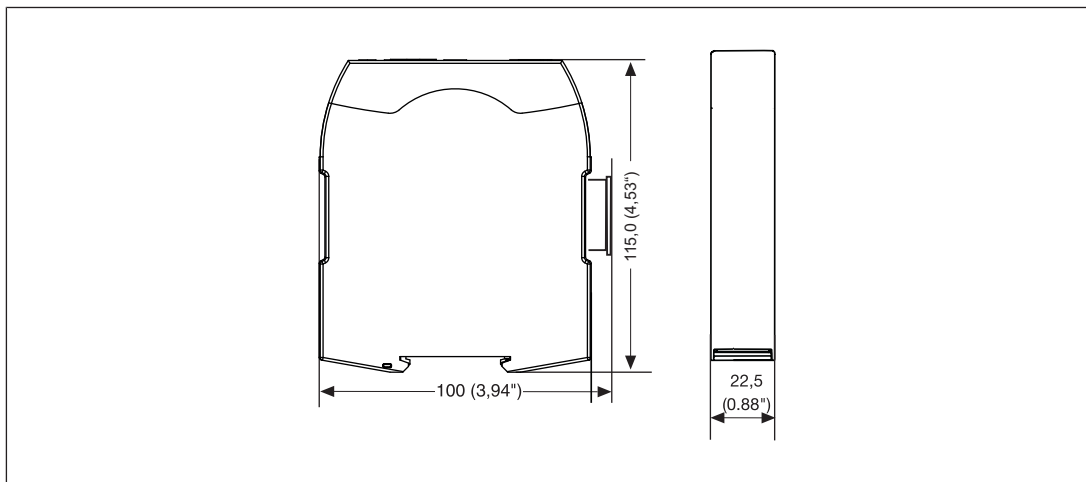
5.3   Connect the base unit and expansion modules

Connect the base unit and the expansion module as described in the operating instructions for the base units.

▸ Connect the black/yellow terminator to the expansion module.

▸ Install the expansion module in the position in which it is 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.

It is possible to define which inputs and outputs on the safety system will communicate with EtherCAT.

Please note:

▸ Information given in the "Technical details" must be followed.

▸ Use copper wire that can withstand 75 °C.

▸ External measures must be used to connect the ⏚ terminal to the function earth (e.g. mounting rail).

Please note the following when connecting to EtherCAT:

▸ The following minimum requirements of the connection cable and connector must be met:

– Only use standard industrial Ethernet cable and connectors.

– Only use double-shielded twisted pair cable and shielded RJ45 connectors (industrial connectors).

– 100BaseTX cable in accordance with the Ethernet standard (min. Category 5)

▸ Measures to protect against interference:

Ensure the requirements for the industrial use of EtherCAT are met, as stated in the Installation Manual published by the User Group.
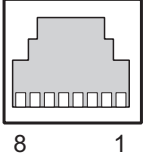
> ⚠ **CAUTION!**
>
> Only connect and disconnect the expansion module when the supply voltage is switched off.

6.2 Connecting the supply voltage

Connect the supply voltage to the fieldbus module:

▸ **24 V** terminal: + 24 VDC

▸ **0 V** terminal: 0 V

▸ Protect the supply voltage as follows:

– Circuit breaker, characteristic C - 6 A

  or

– Blow-out fuse, slow, 6A

6.3 Interface assignment

RJ45 socket 8-pin	PIN	Standard
	1	TD+ (Transmit+)
	2	TD- (Transmit-)
	3	RD+ (Receive+)
	4	n.c.
	5	n.c.
	6	RD- (Receive-)
	7	n.c.
	8	n.c.

n.c.: Not connected

6.4 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 in the PNOZmulti Configurator and downloaded back into the base unit. Proceed as described in the operating manual for the base unit.

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

6.5 Preparing for operation

▸ Install Device Description File

Install the *Device Description File* in your configuration software. You can only then use the PNOZ mmc11p.

▸ Connect the supply voltage to the base unit:

Terminals **24 V** and **A1 (+)**: + 24 VDC

Terminals **0 V** and **A2 (-)** : 0 V

6.6 Connection example
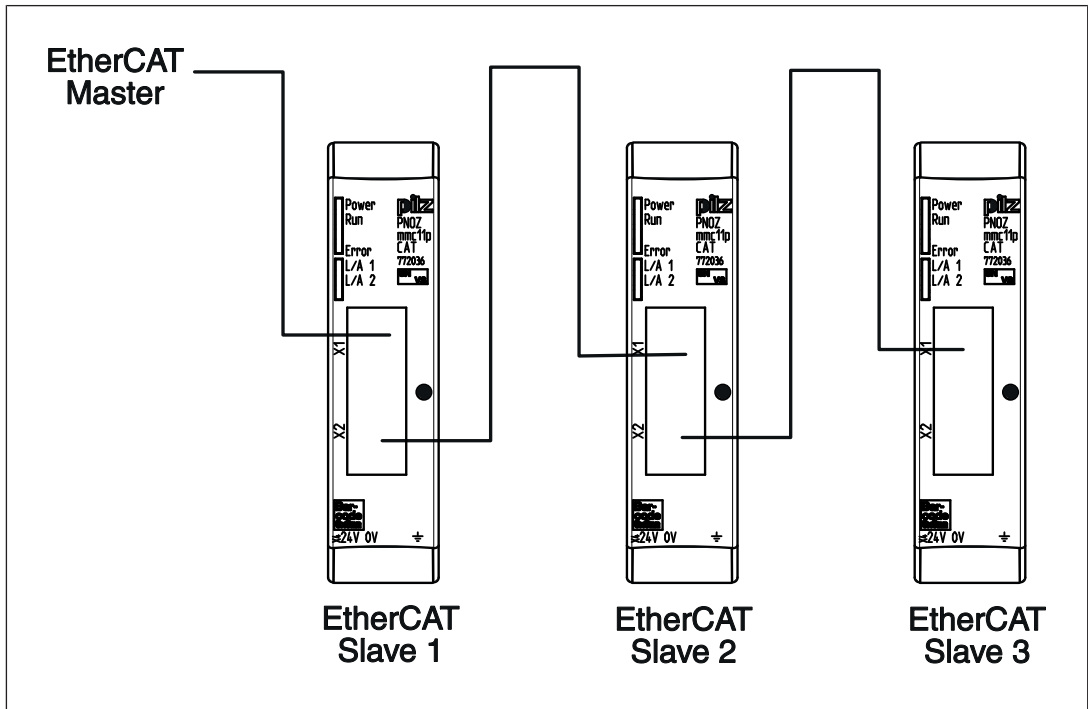
7 Operation

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

The expansion module PNOZ mmc11p is configured and started automatically. The LEDs "L/A 1" and "L/A 2", "Run " and "Error" indicate the status of thePNOZ mmc11p on Ether-CAT.

7.1 Messages

LED	LED status		Meaning
L/A 1	☼	Green	Bus connection available at X1
	⚡	Green	Data traffic present at X1
	●		Bus connection is not available at X1
L/A 2	☼	Green	Bus connection available at X2
	⚡	Green	Data traffic present at X2
	●		Bus connection not available at X2
Run	☼	Green	The device is in "OPERATIONAL" status
	◐←1	Green	The device is in "SAFE-OPERATIONAL" status
	◐←	Green	The device is in "PRE-OPERATIONAL" status
	●		The device is in "INIT" status
Error	☼	Red	Application Watchdog Timeout
	◐←2	Red	Sync Manager Watchdog Timeout.
	◐←1	Red	The Slave device application has changed the Ether-CAT status independently: The "Change" parameter in the AL status register is set to 01 (change/error).
	◐←	Red	Configuration error
	●		EtherCAT communication is in operation

Legend

●	LED off
◐←1	LED flashes once
◐←2	LED flashes twice
⚡	LED flashes briefly
◐←	LED flashes
☼	LED on

8 Technical details

General	
Certifications	**CE, EAC, UKCA, cULus Listed**
Electrical data	
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-20 %/+25 %**
Output of external power supply (DC)	**1,5 W**
Status indicator	**LED**
Fieldbus interface	
Fieldbus interface	**EtherCAT**
Device type	**Slave**
Log	**CANopen over EtherCAT**
Transmission rates	**100 MBit/s**
Connection	**RJ45**
Galvanic isolation	**yes**
Times	
Supply interruption before de-energisation	**20 ms**
Environmental data	
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**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
Max. operating height above sea level	**2000 m**
EMC	**EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 150 Hz**
Acceleration	**1g**
Shock stress	
In accordance with the standard	**EN 60068-2-27**
Acceleration	**15g**
Duration	**11 ms**

Environmental data	
Airgap creepage	
In accordance with the standard	**EN 61131-2**
Overvoltage category	**II**
Pollution degree	**2**
Rated insulation voltage	**30 V**
Protection type	
In accordance with the standard	**EN 60529**
Housing	**IP20**
Terminals	**IP20**
Mounting area (e.g. control cabinet)	**IP54**
Potential isolation	
Potential isolation between	**Fieldbus and module voltage**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**500 V**
Mechanical data	
Mounting position	**horizontally on mounting rail**
DIN rail	
Top hat rail	**35 x 7,5 EN 50022**
Recess width	**27 mm**
Material	
Bottom	**PC**
Front	**PC**
Top	**PC**
Connection type	**Spring-loaded terminal, screw terminal**
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 without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**
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**
Dimensions	
Height	**100 mm**
Width	**22,5 mm**
Depth	**115 mm**
Weight	**81 g**

Where standards are undated, the 2012-10 latest editions shall apply.

9 Order reference

9.1 Product

Product type	Features	Order no.
PNOZ mmc11p	Fieldbus module, EtherCAT	772 036

9.2 Accessories

Connection terminals

Product type	Features	Order no.
Spring terminals PNOZ mmcxp 1 pc.	Spring-loaded terminals, 1 pieces	783542
Spring terminals PNOZ mmcxp 10 pcs.	Spring-loaded terminals, 10 pieces	783543
Screw terminals PNOZ mmcxp 1 pc.	Screw terminals, 1 piece	793542
Screw terminals PNOZ mmcxp 10 pcs.	Screw terminals, 10 pieces	793543

Terminator, jumper

Product type	Features	Order No.
PNOZ s terminator plug	Terminator, yellow, 10 pieces	750 010
PNOZ s connector	Jumper, 10 pieces	750 020

▶ Support

Technical support is available from Pilz round the clock.

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BLUE COMPETENCE
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