# PNOZ mc2.1p

▸ Configurable, safe small controllers PNOZmulti Classic

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Contents

# 1 Introduction

## 1.1 Validity of documentation

This documentation is valid for the product PNOZ mc2.1p. 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 mc2.1p

▸ Jumper

## 2.2 Unit features

Application of the product PNOZ mc2.1p:

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

▸ Network protocols: EtherCAT

▸ supports CANopen over EtherCAT (DS301 V4.02-compliant)

▸ Status indicators for communication with EtherCAT and for errors

▸ The data length and the content of the PDOs can be freely configured from EtherCAT-Master (max. 148 Bytes TxPDO and 20 Bytes RxPDO). The data are described in the document entitled "Communication Interfaces".

▸ 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 mc2.1p can be connected to the base unit

▸ Please refer to the document "PNOZmulti System Expansion" for the PNOZmulti base units that can be connected.

## 2.3 Front view
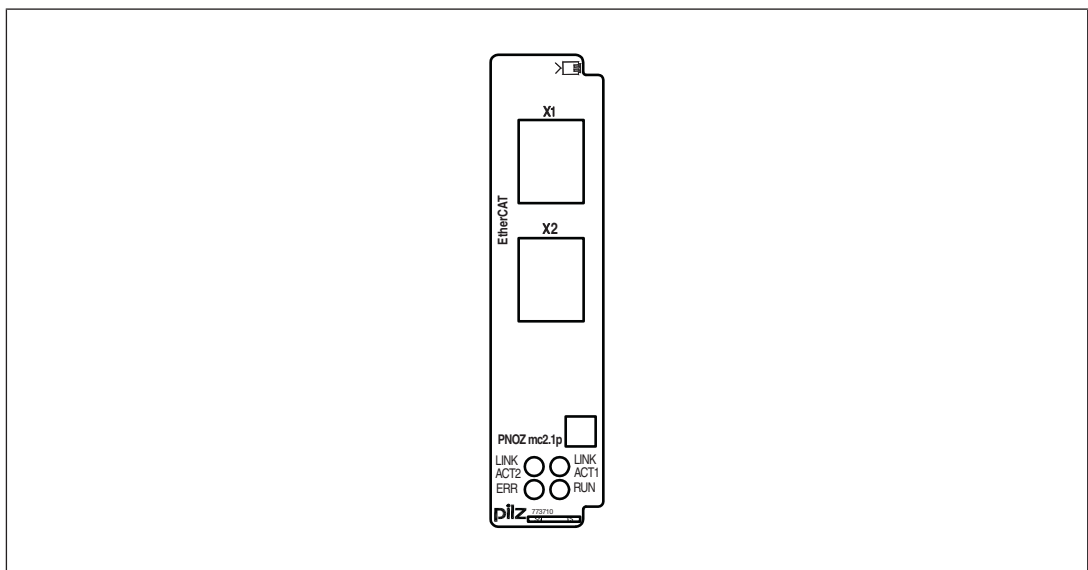
Legend:

▸ X1: EtherCAT IN

▸ X2: EtherCAT OUT

▸ LEDs:

 – LINK ACT1

 – LINK ACT2

 – ERR

 – RUN

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

# 3　Safety

## 3.1　Intended use

The expansion module PNOZ mc2.1p 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 mc2.1p 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 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 expansion module may not be used for safety-related functions.

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 [📖 17]).

> **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　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 mc2.1p are connected via a jumper. After the supply voltage is switched on or the PNOZmulti control system is reset, the expansion module PNOZ mc2.1p 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
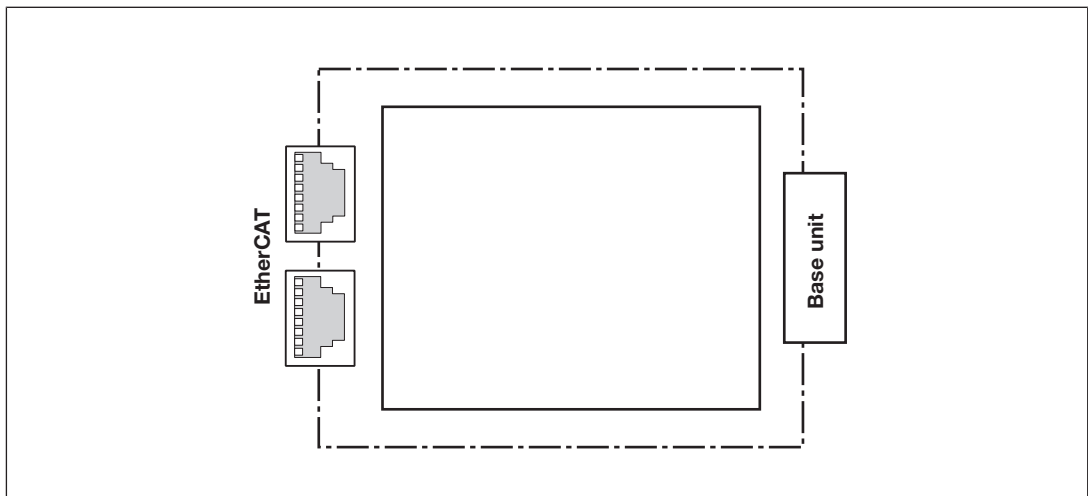
# 5 Installation

## 5.1 General installation guidelines

▸ The 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 locking elements 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 devices in the control cabinet must not exceed the figure stated in the technical details. Air conditioning may otherwise be required.

▸ To comply with EMC requirements, the mounting rail must have a low impedance connection to the control cabinet housing.
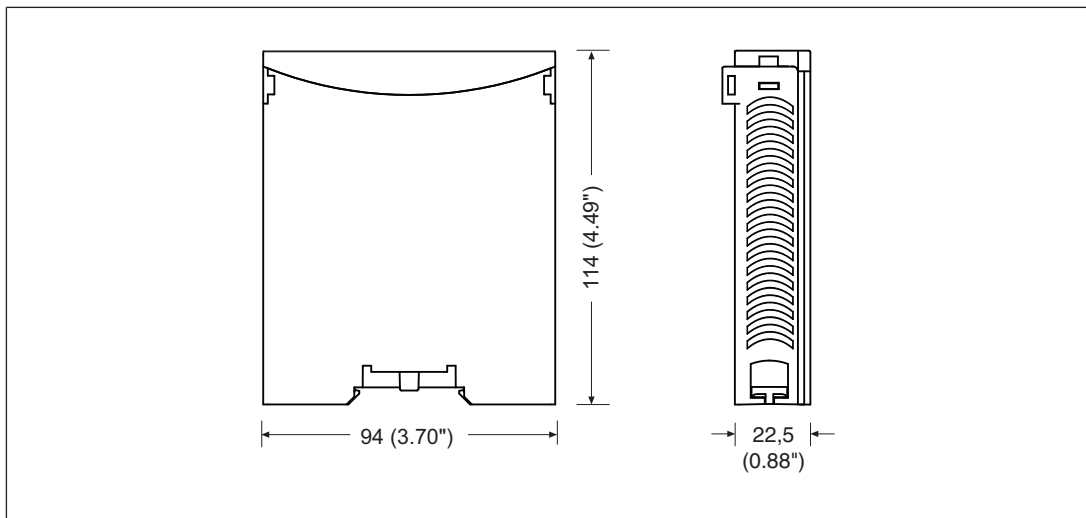
> **!** **NOTICE**
>
> Damage due to electrostatic discharge!
>
> Electrostatic discharge can damage components. Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed armband.

## 5.2 Dimensions in mm

## 5.3 Connecting the base unit and expansion modules

You can install a maximum of 1 PNOZ mc2.1p to the left of the base unit.

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

▸ Do **not** connect a terminator to the last expansion module on the left-hand side.

▸ Install the expansion module in the position in which it is configured in the PNOZmulti Configurator.

# 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 [📖 17] must be followed.

▸ Use copper wiring with a temperature stability of 75 °C.

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:
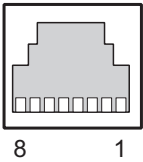
Ensure the requirements for the industrial use of EtherCAT are met, as stated in the Installation Manual published by the User Group.

> ⚠️ **CAUTION!**
>
> Only connect and disconnect the expansion module when the supply voltage is switched off.

## 6.2 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

## 6.3 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 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.

## 6.4 Preparing for operation

▸ Install Device Description File

Install the *Device Description File* in your configuration software. You can only then use the PNOZ mc2.1p.

▸ Connect the supply voltage to the base unit:

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

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

## 6.5 Connection example
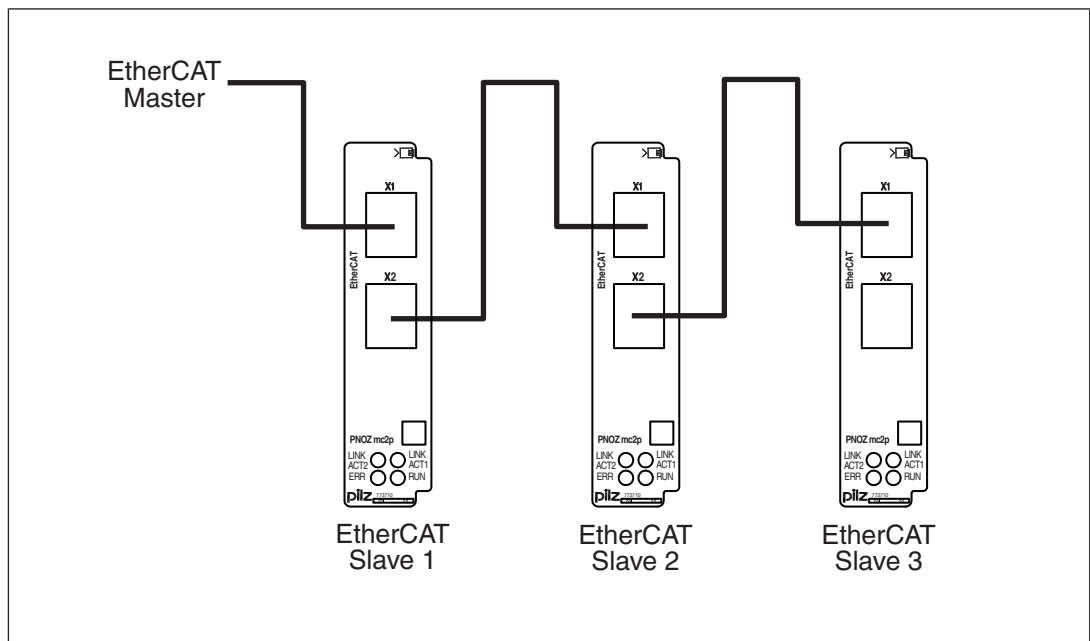
# 7 Operation

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

The expansion module PNOZ mc2.1p is configured and started automatically. The LEDs "Link/Activity", "RUN " and "ERR" indicate the status of the PNOZ mc2.1p at EtherCAT.

## 7.1 LED indicator

| LED | LED status | | Meaning |
|---|---|---|---|
| Link ACT 1 | ☀ | green | Bus connection available at X1 |
| | ⚡ | green | Data traffic present at X1 |
| | ● | | Bus connection is not available at X1 |
| Link ACT 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 |
| ERR | ☀ | red | Application Watchdog Timeout |
| | ◑–2 | red | Sync Manager Watchdog Timeout. |
| | ◑–1 | red | The Slave device application has changed the EtherCAT 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 | **CCC, CE, EAC (Eurasian), cULus Listed** |
| **Electrical data** | |
| Supply voltage | |
|     for | **Module supply** |
|     internal | **Via base unit** |
|     Voltage | **5 V** |
|     Kind | **DC** |
|     Voltage tolerance | **-2 %/+2 %** |
|     Power consumption | **1,6 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** |
| Test voltage | **500 V AC** |
| **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** |
| 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** |
|     Humidity | **93 % r. h. at 40 °C** |
| Condensation during operation | **Not permitted** |
| 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** |
| Max. operating height above sea level | **2000 m** |

| Environmental data | |
|---|---|
| Airgap creepage | |
|     In accordance with the standard | **EN 61131-2** |
|     Overvoltage category | **III** |
|     Pollution degree | **2** |
| Rated insulation voltage | **30 V** |
| Protection type | |
|     In accordance with the standard | **EN 60529** |
|     Mounting area (e.g. control cabinet) | **IP54** |
|     Housing | **IP20** |
|     Terminals | **IP20** |
| **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 | **PPO UL 94 V0** |
|     Front | **ABS UL 94 V0** |
| Dimensions | |
|     Height | **94 mm** |
|     Width | **22,5 mm** |
|     Depth | **114 mm** |
| Weight | **114 g** |

Where standards are undated, the 2020-07 latest editions shall apply.

# 9 Order reference

## 9.1 Product

| Product type | Features | Order No. |
|---|---|---|
| PNOZ mc2.1p | Fieldbus module, EtherCAT | 773 713 |

## 9.2 Accessories

**Jumper**

| Product type | Features | Order No. |
|---|---|---|
| KOP-XE | Jumper | 774 639 |

# ▶ Support

Technical support is available from Pilz round the clock.

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