PNOZ m ES EtherCAT

Configurable Control System PNOZmulti
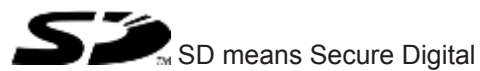
1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PNOZ m ES EtherCAT. 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 Retaining the documentation

This documentation is intended for instruction and 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

2.2 Unit features

Using the product PNOZ m ES EtherCAT:

Expansion module for connection to a base unit from the configurable control system PNOZmulti 2 .

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

▶ 128 virtual inputs and outputs on the control system PNOZmulti can be defined in the PNOZmulti Configurator for communication with the fieldbus EtherCAT.

▶ Max. 1 PNOZ m ES EtherCAT can be connected to the base unit

▶ Plug-in connection terminals:
either spring-loaded terminal or screw terminal available as an accessory (see order reference)

▶ For details of the PNOZmulti 2 base units that can be connected, please refer to the document "PNOZmulti System Expansion".

2.3 Front view
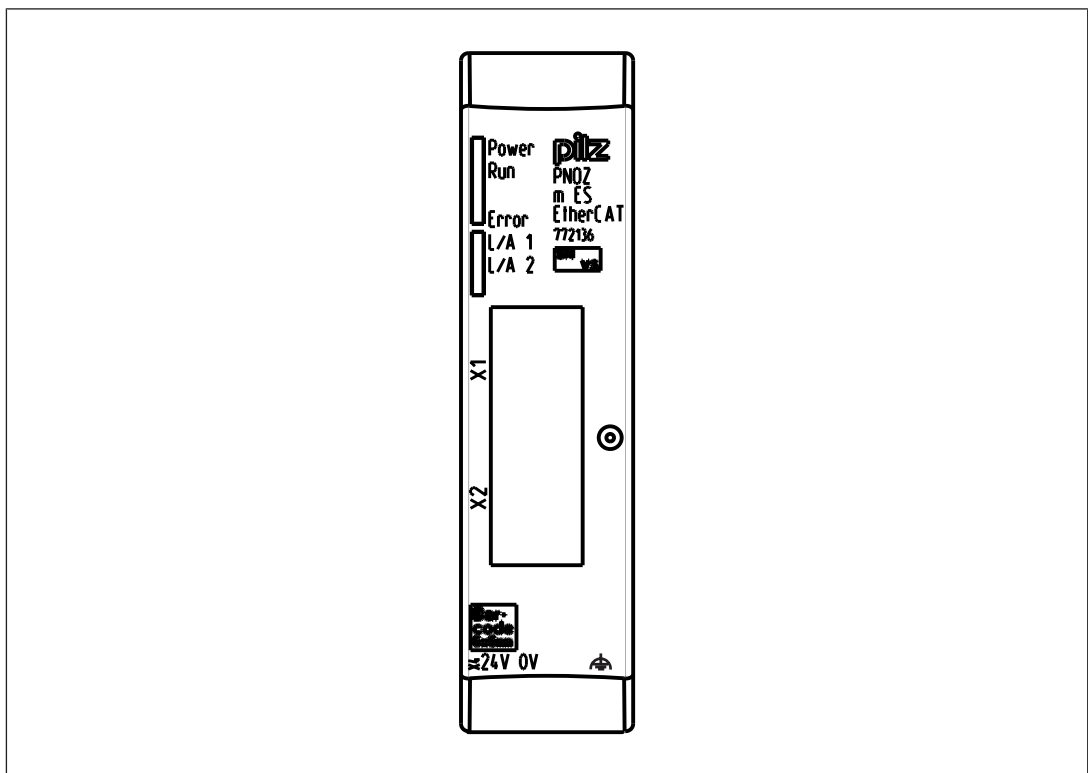
Legend:

▶ 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

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3   Safety

3.1   Intended use

The expansion module PNOZ m ES EtherCAT 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 m ES EtherCAT 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" 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

▶ 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).

3.3.4 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   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 m ES EtherCAT are connected via a jumper. After the supply voltage is switched on or the PNOZmulti control system is reset, the expansion module PNOZ m ES EtherCAT 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   Data access

The data is structured as follows:

▸ Virtual data

– Input area PNOZ m ES EtherCAT

The values for the inputs are set as an output in the Master and transferred to the PNOZmulti 2.

– Output area PNOZ m ES EtherCAT

The outputs are configured in the PNOZmulti Configurator and transferred to the Master.

▸ Status of LEDs:

– Bits 0 … 4: Status of LEDs on the PNOZmulti 2

Bit 0: OFAULT

Bit 1: IFAULT

Bit 2: FAULT

Bit 3: DIAG

Bit 4: RUN

▸ Data exchange is displayed in Bit 5.

▸ Polling the payload data: 2 Bytes with the table number and segment number are sent by the Master for access to the payload data table (15 Bytes are returned to the Master).

The document "Communication Interfaces" contains detailed information

▸ on data exchange (tables, segments) in the section entitled "Fieldbus modules",

▸ and on virtual data in the section entitled "Object directory (Manufacturer Specific Profile Area) for PNOZ m ES EtherCAT .

4.3 Block diagram
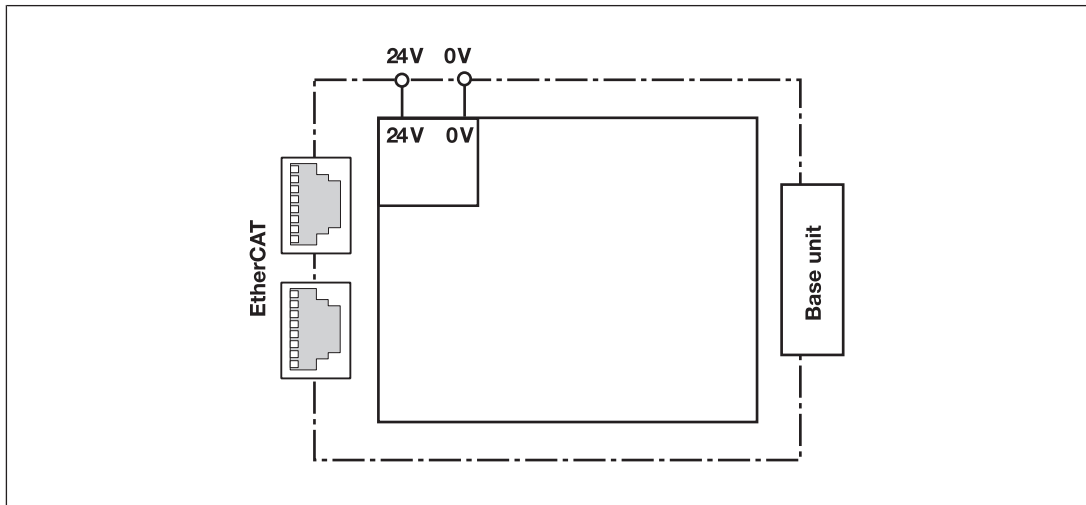
5 Installation

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 of the PNOZmulti units in the control cabinet must not exceed the figure stated in the technical details, otherwise air conditioning will be required.

> ⚠️ **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 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.

5.3 Dimensions
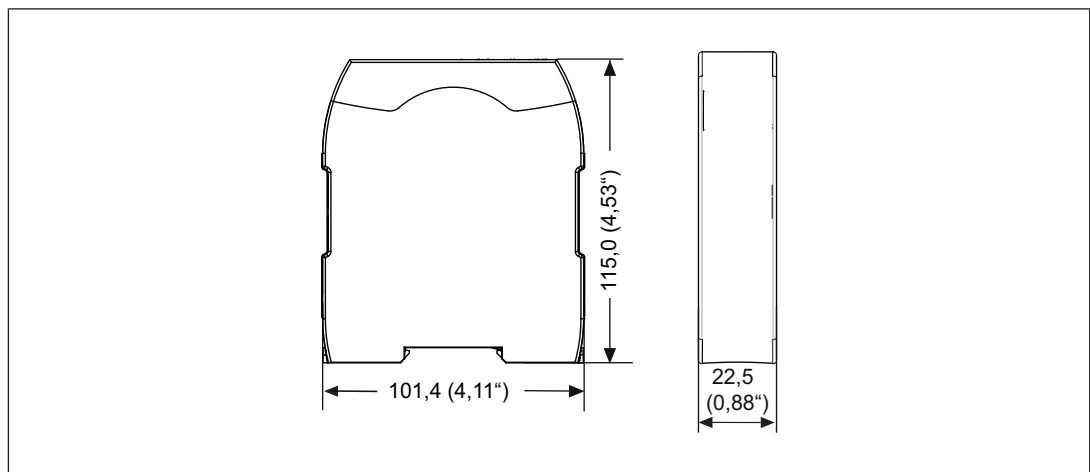
6 Commissioning

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.

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 functional earth, when the mounting rail is **not** connected to the functional earth.

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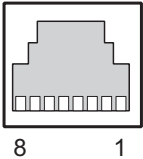
> ⚠ **CAUTION!**
>
> Only connect and disconnect the expansion module when the supply voltage is switched off.

6.2 Connecting the supply voltage

Connect the supply voltage to the fieldbus module:

▸ Terminal **24 V**: + 24 V DC

▸ Terminal **0 V**: 0 V

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 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.

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 m ES EtherCAT.

▸ 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
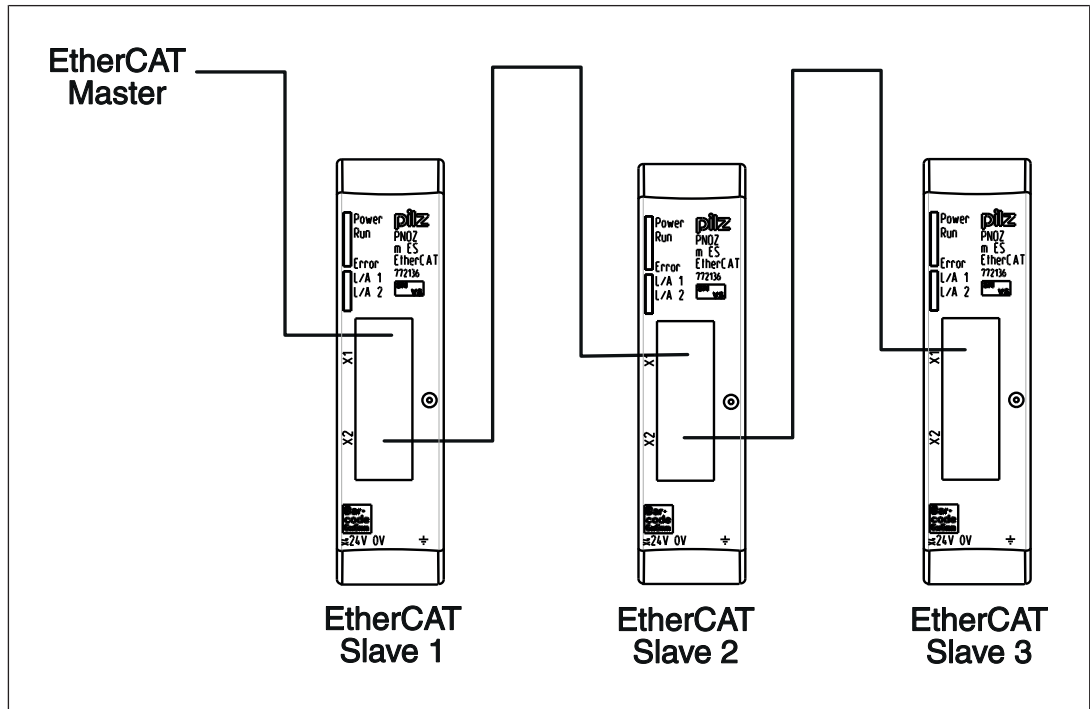
7 Operation

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

The LEDs "POWER","DIAG", "FAULT", "IFAULT" and "OFAULT" light up on the base unit.

The expansion module PNOZ m ES EtherCAT is configured and started automatically. The LEDs "L/A 1" and "L/A 2", "Run " and "Error" indicate the status of thePNOZ m ES EtherCAT on EtherCAT.

7.1 Messages

LED	LED status		Meaning
PWR	☼		Supply voltage is present
	●		Supply voltage is not present
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
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
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

Key:

●	LED off
◖1	LED flashes once
◖2	LED flashes twice
◖⚡	LED flashes once

◐	LED flashes	18
⚬	LED on	

8   Technical details

General	772136
Approvals	**CCC, CE, EAC (Eurasian), cULus Listed**
Electrical data	**772136**
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-20 %/+25 %**
Supply voltage	
Current consumption	**35 mA**
Power consumption	**0,9 W**
Max. power dissipation of module	**1,50 W**
Status indicator	**LED**
Fieldbus interface	**772136**
Fieldbus interface	**EtherCAT**
Unit type	**Slave**
Protocol	**CANopen over EtherCAT**
Transmission rates	**100 MBit/s**
Connection	**RJ45**
Galvanic isolation	**Yes**
Environmental data	**772136**
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 during operation	**Not permitted**
EMC	**EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10,0 - 150,0 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	772136
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**
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
Potential isolation	**772136**
Potential isolation between	**Fieldbus and module voltage**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**500 V**
Mechanical data	**772136**
Mounting position	**Horizontal on top hat rail**
DIN rail	
Top hat rail	**35 x 7,5 EN 50022**
Recess width	**27 mm**
Material	
Bottom	**PC**
Front	**PC**
Top	**PC**
Conductor cross section with screw terminals	
1 core flexible	**0,25 - 2,50 mm², 24 - 12 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,20 - 1,50 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,50 Nm**
Connection type	**Spring-loaded terminal, screw terminal**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,20 - 2,50 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	**2**
Stripping length	**9 mm**
Dimensions	
Height	**101,4 mm**
Width	**22,5 mm**
Depth	**115,0 mm**
Weight	**85 g**

The standards current on 2013-06 apply.

9 Order reference

9.1 Module

Product type	Features	Order no.
PNOZ m ES EtherCAT	Fieldbus module, EtherCAT	772 136

9.2 Accessories

Terminator, jumper

Product type	Features	Order no.
PNOZ mm0.xp connector left	Jumper yellow/black to connect the modules, 1 piece	779 260

Connection terminals

Product type	Features	Order no.
Spring terminals PNOZ mmcxp 1 pc.	Spring-loaded terminals, 1 pieces	783 542
Spring terminals PNOZ mmcxp 10 pcs.	Spring-loaded terminals, 10 pieces	783 543
Screw terminals PNOZ mmcxp 1 pc.	Screw terminals, 1 piece	793 542
Screw terminals PNOZ mmcxp 10 pcs.	Screw terminals, 10 pieces	793 543

▶ Support

Technical support is available from Pilz round the clock.

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