



Visualisation; Diagnostics

Easy to Configure

Programming IEC 61131-3

Rapid Installation

PNOZ m ES EtherNet/IP

PILZ
THE SPIRIT OF SAFETY

- ▶ Configurable control systems PNOZmulti 2

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SD means Secure Digital

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1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PNOZ m ES EtherNet/IP. 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 m ES EtherNet/IP
- ▶ Jumper

2.2 Unit features

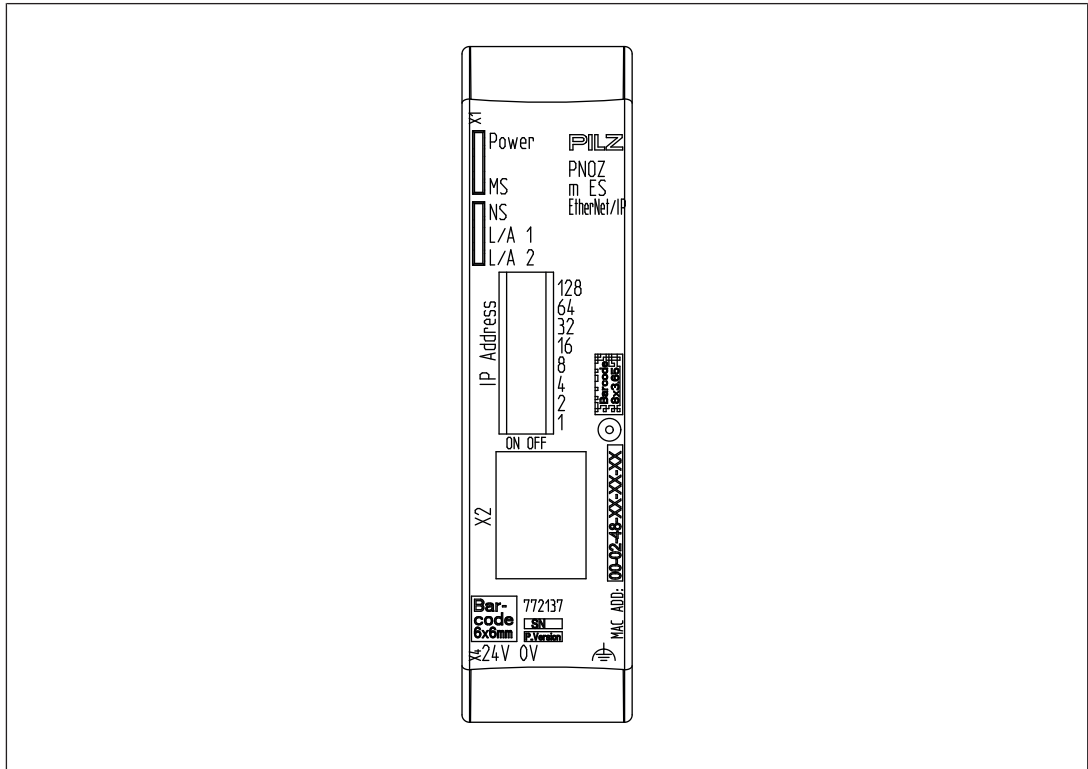
Using the product PNOZ m ES EtherNet/IP:

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
- ▶ Connection for EtherNet/IP as adapter
- ▶ Transmission rate 10 MBit/s (10BaseT) and 100 MBit/s (100BaseTX)
- ▶ Status indicators for communication 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 EtherNet/IP.
- ▶ Max. 1 PNOZ m ES EtherNet/IP can be connected to the base unit
- ▶ 2-port switch
- ▶ Device Level Ring (DLR)
- ▶ Integrated web server
- ▶ 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, X2: EtherNet/IP - Interfaces
- ▶ 0 V, 24 V: Supply connections
- ▶ IP address: for setting the IP address
- ▶ : Functional earth
- ▶ LED:
 - Power
 - MS
 - NS
 - L/A 1
 - L/A 2

EtherNet/IP™ is registered trademark and patented technology, licensed by ODVA.

3 Safety

3.1 Intended use

The fieldbus module PNOZ m ES EtherNet/IP is an expansion module of the configurable control system PNOZmulti 2. It is used for communication between the configurable control system PNOZmulti 2 and EtherNet/IP. EtherNet/IP is designed for fast data exchange at field level. The expansion module PNOZ m ES EtherNet/IP is a passive subscriber (Adapter) of the EtherNet/IP. The basic functions of communication with EtherNet/IP conform to IEEE 802.3. The central controller (scanner) reads input information from the slaves and writes output information to the slaves as part of each cycle. As well as the cyclical transfer of usable data, the expansion module PNOZ m ES EtherNet/IP can also be used for diagnostic and commissioning functions.


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](#) [ 23]).



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 the fieldbus EtherNet/IP are selected and configured in the PNOZmulti Configurator. The base unit and the fieldbus module PNOZ m ES EtherNet/IP are connected via a jumper. After the supply voltage is switched on or the PNOZmulti control system is reset, the fieldbus module PNOZ m ES EtherNet/IP is configured and started automatically.

LEDs indicate the status of the fieldbus module EtherNet/IP.

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



INFORMATION

The ESD file is available on the Internet at www.pilz.de.

4.2 Data exchange

17 or 32 bytes must always be sent and received for communication with the PNOZmulti.

Fixed parameters for the input/output assembly instances are set in the fieldbus module PNOZ m ES EtherNet/IP. The following data lengths can be selected:

Assembly Instance Input	Data length	Description
100	32 Bytes	Inputs, tables
101	17 Bytes	Inputs
Assembly Instance Output	Data length	Description
150	32 Bytes	Outputs, LEDs, tables
151	17 Bytes	Outputs, LEDs
Assembly Instance Configuration	Data length	Description
4	0 Bytes	-

4.3 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.

Virtual inputs PNOZmulti Configurator	I0 ... I7	I8 ... I15	I16 ... I23	...	I120...I127
EtherNet/IP	Byte 0: Bit 0 ... 7	Byte 1: Bit 0 ... 7	Byte 2: Bit 0 ... 7	...	Byte 15: Bit 0 ... 7

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.

Virtual inputs PNOZmulti Configurator	O0 ... O7	O8 ... O15	O16 ... O23	...	O120... O127
EtherNet/IP	Byte 0: Bit 0 ... 7	Byte 1: Bit 0 ... 7	Byte 2: Bit 0 ... 7	...	Byte 15: Bit 0 ... 7

▶ Status of LEDs:

LED status 1 Output Byte

The LED status of the base unit can be requested directly as follows

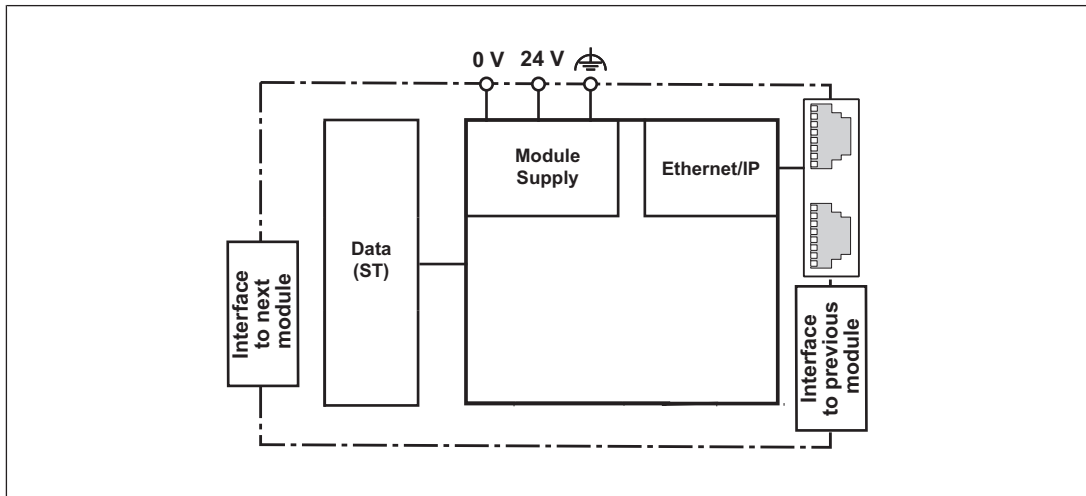
- Bit 0 = 1: LED OFAULT is lit or flashes
- Bit 1 = 1: LED IFAULT is lit or flashes
- Bit 2 = 1: LED FAULT is lit or flashes
- Bit 3 = 1: LED DIAG is lit or flashes
- Bit 4 = 1: LED RUN FS is lit
- Bit 5: Reserved
- Bit 6 = 1: LED RUN ST is lit (not for PNOZ m B0)
- Bit 7: Reserved

▶ 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).

Detailed information on data exchange is available in the document "Communication Interfaces PNOZmulti 2" 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 upward and downward. Other mounting positions could damage the safety system.
- ▶ Use the locking elements 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.

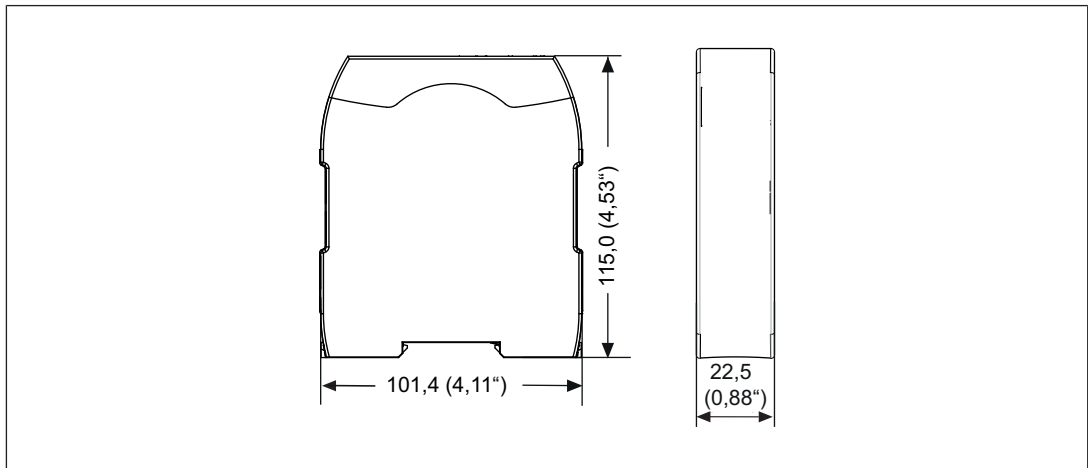


NOTICE

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 EtherNet/IP.

Please note:

- ▶ Information given in the "[Technical details \[23\]](#)" must be followed.
- ▶ Use copper wiring with a temperature stability of 75 °C.

Please note the following when connecting to EtherNet/IP:

- ▶ 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 EtherNet/IP are met, as stated in the Installation Manual published by the User Group.
- ▶ External measures must be used to connect the terminal  to the functional earth, when the mounting rail is **not** connected to the functional earth.
- ▶ Always connect the mounting rail to the protective earth via an earthing terminal. This will be used to dissipate hazardous voltages in the case of a fault.
- ▶ The power supply must meet the regulations for extra low voltages with protective separation.



CAUTION!

Only connect and disconnect the expansion module when the supply voltage is switched off.



NOTICE

When installing, you must refer to the guidelines of the EtherNet/IP User Group.

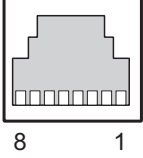
6.2 Connecting the supply voltage

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 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 Set IP address

The IP address of the fieldbus module PNOZ m ES EtherNet/IP is set using the DIP switch on the front.

- ▶ The first three bytes of the IP address are: 192.168.1.
- ▶ Subnet mask: 255.255.255.0.
- ▶ The last byte of the IP address is configured (value range: 1 ...255).



INFORMATION

The IP address should **only** be set when the fieldbus module PNOZ m ES EtherNet/IP is switched off (no voltage applied).

The settings are **only** transferred when booting. Any changes made to the settings during operation will **not** be transferred.



INFORMATION

Type and source of danger

The IP address for the fieldbus module PNOZ m ES EtherNet/IP should not be the same as the PC's IP address.

There are various options for setting the IP address.

- ▶ Use of the DHCP Server is enabled
 DHCP is automatically enabled on a new module. In this case the IP address is taken from the DHCP Server, if the DIP switch is set to 0. The module waits to receive an address from a DHCP Server.
- ▶ If a fixed IP address has been assigned via the web server or by the EtherNet/IP scanner, then this will be used. The DIP switch must be set to zero for this purpose.
- ▶ Setting via the DIP switch
 The IP address that is set at the DIP switch is used. DHCP is therefore disabled.
 Set the DIP switch to a value between 1 – 254.
- ▶ Enable DHCP via DIP switch
 If you set the DIP switch to 255, then DHCP will always be used, irrespective of the configuration in the web server.

Example: DIP switch: 00010100 (20 decimal)

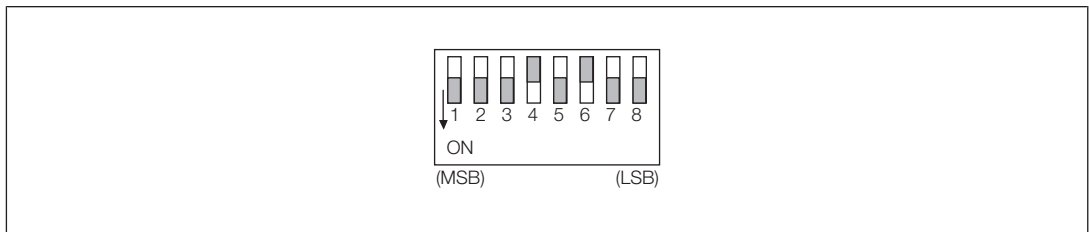
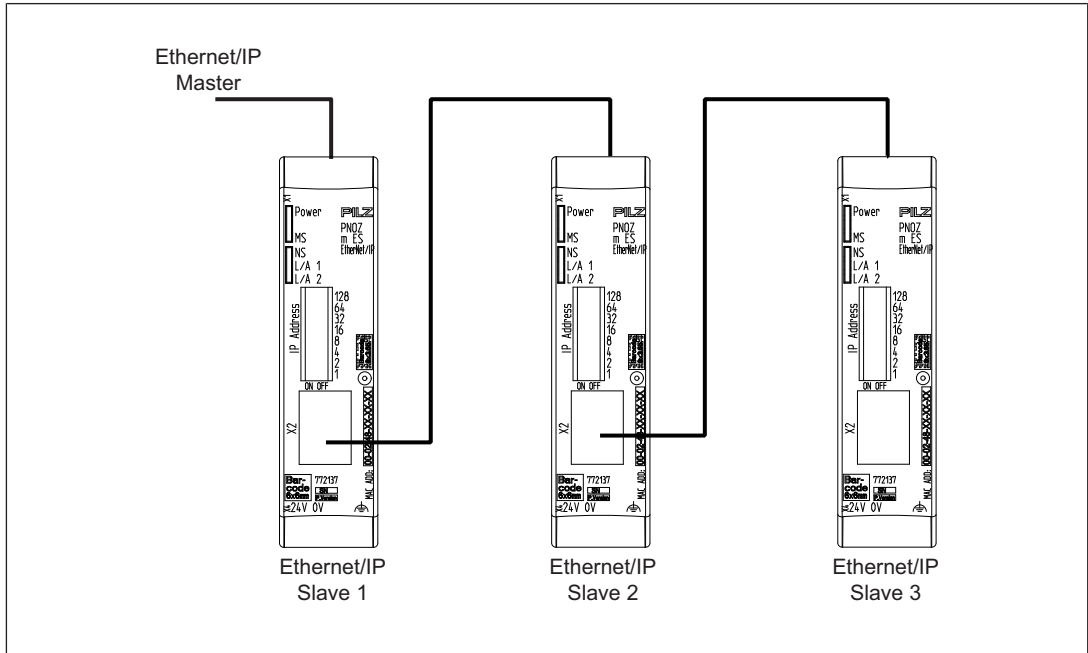


Fig.: DIP switch setting: 20 (decimal) as the value for the last byte of the IP address

DIP switch "IP address"	Meaning		Example: IP address 020 _D
	OFF	ON	
1	0	128 _D	
2	0	64 _D	
3	0	32 _D	
4	0	16 _D	
5	0	8 _D	
6	0	4 _D	
7	0	2 _D	
8	0	1 _D	

DIP switch IP address

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", "IFAUULT" and "OFAULT" will light up on the base unit.






The fieldbus module PNOZ m ES EtherNet/IP is configured and started automatically. The LEDs "MS", "NS", "L/A1" and "L/A2" indicate the status of the PNOZ m ES EtherNet/IP on the EtherNet/IP.

7.1 Messages

Legend

-  LED on
-  LED flashes
-  LED off

LED			Meaning
Power		green	Supply voltage is present
			Supply voltage is not present
L/A1		green	Bus connection present at X1 (100 Mbit/s)
		green	Data traffic present at X1 (100 Mbit/s)
		orange	Bus connection present at X1 (10 Mbit/s)
		orange	Data traffic present at X1 (10 Mbit/s)
			Bus connection is not available at X1
L/A2		green	Bus connection present at X2 (100 Mbit/s)
		green	Data traffic present at X2 (100 Mbit/s)
		orange	Bus connection present at X2 (10 Mbit/s)
		orange	Data traffic present at X2 (10 Mbit/s)
			Bus connection not available at X2
MS			No supply voltage on PNOZ m ES EtherNet/IP
		green	The fieldbus module PNOZ m ES EtherNet/IP is operating correctly
		green	The fieldbus module PNOZ m ES EtherNet/IP is not configured
		red	Recoverable fault
		red	Major internal error (not recoverable)
		green/red	Self test after switching on the supply voltage

LED		Meaning
NS	●	No supply voltage present or no IP address assigned
	 green	The fieldbus module PNOZ m ES EtherNet/IP has established at least one connection
	 green	The fieldbus module PNOZ m ES EtherNet/IP has no IP connection
	 red	The connection to the master was interrupted. Remedy: Reconnect.
	 red	IP address is already in use.
	 green/red	Self test after switching on the supply voltage

7.2 Web server

A web server is implemented in the fieldbus module PNOZ m ES EtherNet/IP. This can be used to poll data from the PNOZmulti.

- ▶ The web server is started once the PNOZ m ES EtherNet/IP is connected to the supply voltage.
- ▶ The web server is intended for use with Internet Explorer or Firefox.
- ▶ Make sure that Javascript and Cookies are enabled in your browser's security settings.

7.2.1 Password administration

- ▶ Two users are preset for access to the web server when the product is delivered.

User	Access type	Password
User	Read-only	1111
User	Read/write	0000

- ▶ A password is required for access.
- ▶ The user names and passwords can be changed.
- ▶ If you change the password and then forget the new password, you will no longer be able to access the fieldbus module PNOZ m ES EtherNet/IP via the web server. In this case you will need to return the module to Pilz for it to be reset to its original delivery status. All settings will be lost in the process.
So if you have changed the password, make sure that you store the (new) password securely and reliably.
- ▶ **Before** changing the passwords, make sure that the configuration is saved along with the passwords from the delivery status.

7.2.2 Call web server

1. Connect the PNOZ m ES EtherNet/IP to the PC.
2. Call up the HTML page:
 - ***http://192.168.1.xxx***
 - For xxx, enter the value that you have set as the last byte of the IP address.
3. Enter the user name and password correctly and log on to the web server.
4. Select the option you require in the overview and then follow the instructions.

8 Technical Details

General	
Approvals	CE, EAC (Eurasian), cULus Listed
Electrical data	
Supply voltage	
for	Module supply
Voltage	24 V
Kind	DC
Voltage tolerance	-20 %/+25 %
Max. continuous current that the external power supply must provide	50 mA
Output of external power supply (DC)	1,2 W
Potential isolation	yes
Supply voltage	
for	Module supply
internal	Via base unit
Voltage	3,3 V
Kind	DC
Current consumption	60 mA
Power consumption	0,2 W
Max. power dissipation of module	1,5 W
Status indicator	LED
Fieldbus interface	
Fieldbus interface	EtherNet/IP
Device type	Adapter
Transmission rates	10 MBit/s, 100 MBit/s
Connection	2 x RJ45
Galvanic isolation	yes
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
Condensation during operation	Not permitted
Max. operating height above sea level	2000 m
EMC	EN 61131-2

Environmental data	
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
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	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
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

Mechanical data

Dimensions

Height **101,4 mm**

Width **22,5 mm**

Depth **110,4 mm**

Weight **90 g**

Where standards are undated, the 2014-04 latest editions shall apply.

9 Order reference

9.1 Product

Product type	Features	Order no.
PNOZ m ES EtherNet/IP	Fieldbus module, EtherNet/IP	772 137

9.2 Accessories

Terminator, jumper

Product type	Features	Order No.
PNOZ mm0.xp connector left	Jumper yellow/black to connect the modules, 10 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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