PNOZ m ES EtherCAT

PILZ
THE SPIRIT OF SAFETY

- Configurable control systems PNOZmulti 2

Operating Manual-1003057-EN-04

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 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 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 EtherCAT
- Jumper

2.2 Unit features

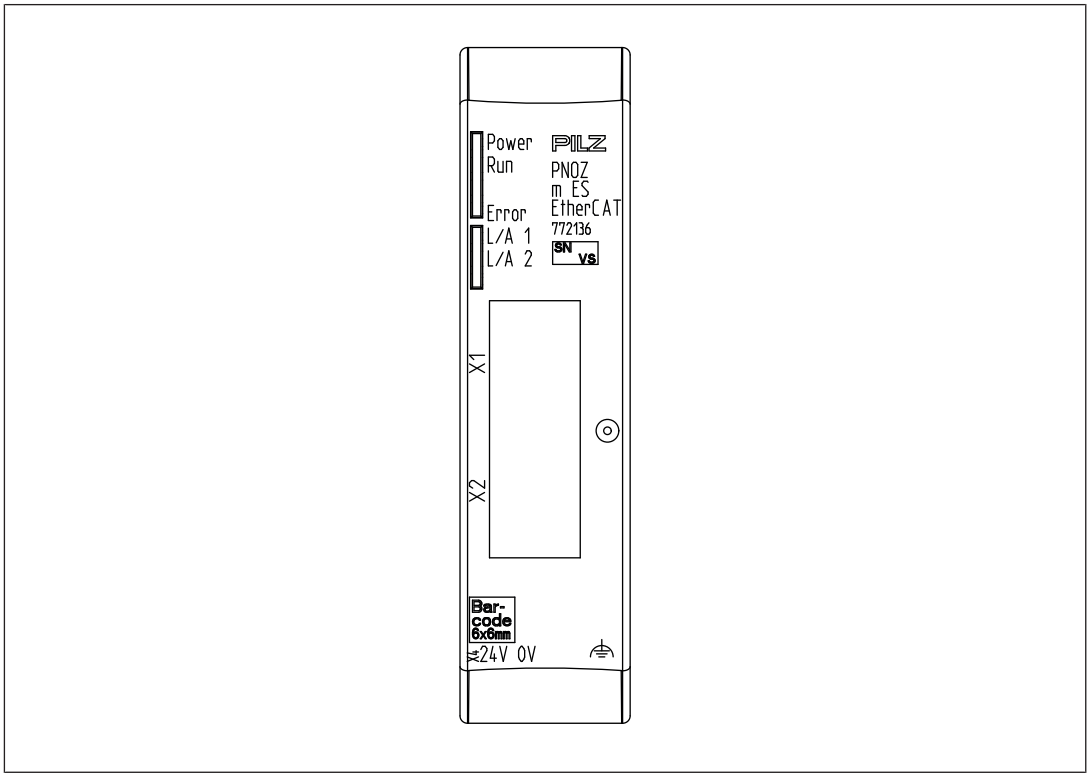
Using the product PNOZ m ES EtherCAT:

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

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

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 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 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 in the Master as an output and transferred to the PNOZmulti 2.
  - Output range PNOZ m ES EtherCAT

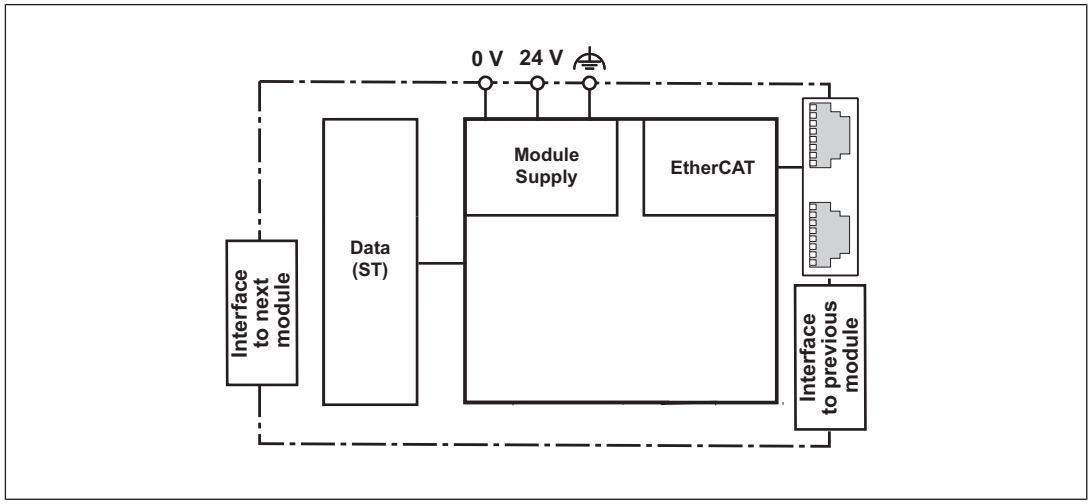
    The outputs are configured in the PNOZmulti Configurator and transferred to the Master.
- Status of LEDs:

  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).

The document "Communication Interfaces" contains detailed information

- on data exchange (tables, segments) in the section entitled "Fieldbus modules",
- on the virtual data in chapter "Service Data Objects (SDOs)" for PNOZ m ES EtherCAT.

4.3 Block diagram



5 Installation

5.1 General installation guidelines

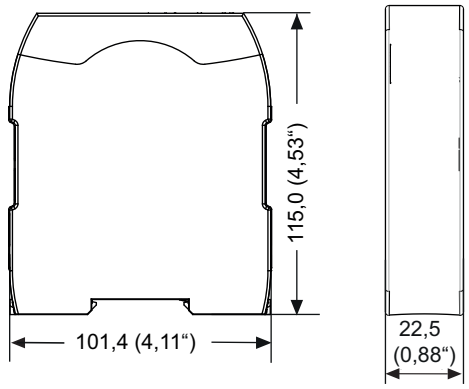
- The unit should be installed in a control cabinet with a protection type of at least IP54.
- Fit the safety system to a horizontal mounting rail. The venting slots must face upward and downward. Other mounting positions could damage the safety system.
- Use the locking elements on the rear of the unit 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 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.

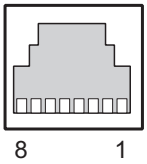
6.2 Connecting the supply voltage

Connect the supply voltage to the fieldbus module:

- **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
 8 1	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

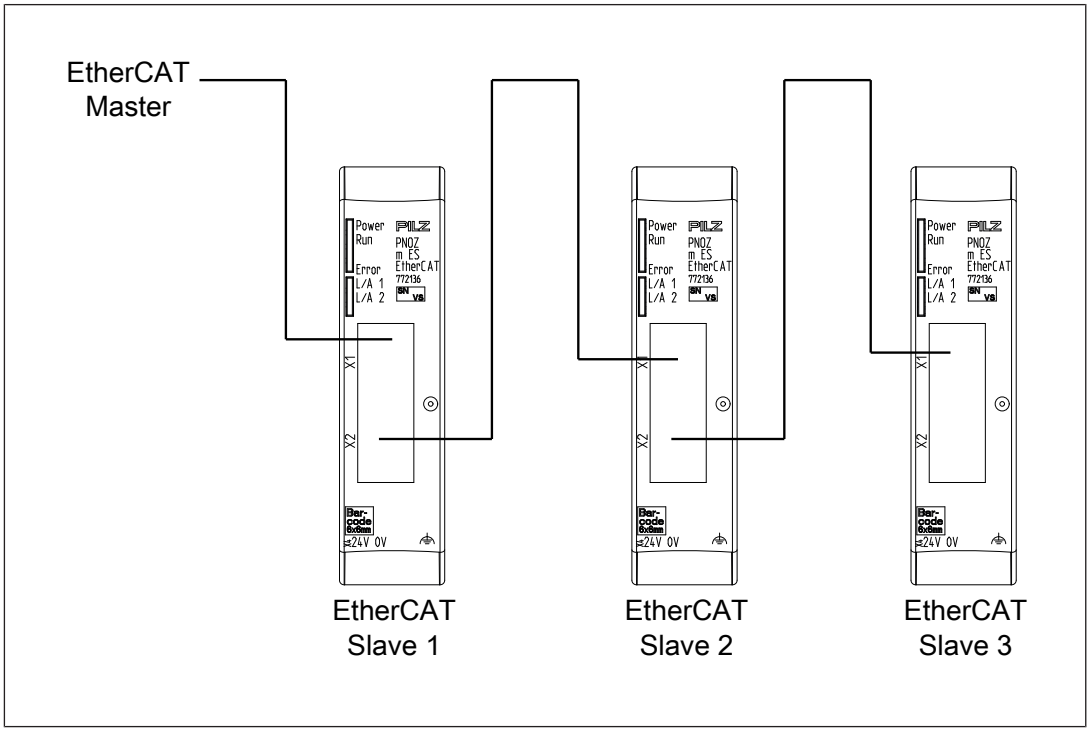
  Install the *Device Description File* in your configuration software. You can only then use the PNOZ m ES EtherCAT.

- 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” will 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
	◐ϟ	Green	Data traffic present at X1
	●		Bus connection is not available at X1
L/A 2	☼	green	Bus connection available at X2
	◐ϟ	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

Legend

- ● LED off
- ◐1 LED flashes once
- ◐2 LED flashes twice
- ◐ϟ LED flashes briefly
- ◐ LED flashes
- ☼ LED on

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	**35 mA**
Output of external power supply (DC)	**0,9 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	**EtherCAT**
Device type	**Slave**
Log	**CANopen over EtherCAT**
Transmission rates	**100 MBit/s**
Connection	**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	**115 mm**
Weight	**85 g**

Where standards are undated, the 2013-06 latest editions shall apply.

9 Order reference

9.1 Product

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, 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.

Americas
Brazil
+55 11 97569-2804
Canada
+1 888-315-PILZ (315-7459)
Mexico
+52 55 5572 1300
USA (toll-free)
+1 877-PILZUSA (745-9872)

Asia
China
+86 21 60880878-216
Japan
+81 45 471-2281
South Korea
+82 31 450 0680

Australia
+61 3 95600621

Europe
Austria
+43 1 7986263-0
Belgium, Luxembourg
+32 9 3217575
France
+33 3 88104000
Germany
+49 711 3409-444
Ireland
+353 21 4804983
Italy, Malta
+39 0362 1826711
Scandinavia
+45 74436332
Spain
+34 938497433
Switzerland
+41 62 88979-30
The Netherlands
+31 347 320477
Turkey
+90 216 5775552
United Kingdom
+44 1536 462203

You can reach our international hotline on:
+49 711 3409-444
support@pilz.com

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Pilz GmbH & Co. KG
Felix-Wankel-Straße 2
73760 Ostfildern, Germany
Tel.: +49 711 3409-0
Fax: +49 711 3409-133
info@pilz.com
www.pilz.com

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