PNOZ m EF 8DI4DO

Configurable Control System PNOZmulti

Operating Manual – No. 1002661-EN-01

This document is a translation of the original document.

Suggestions and comments for improving this documentation will be gratefully received.

SD means Secure Digital.

Contents			Page
Chapter 1	**Introduction**		
	1.1	Validity of the documentation	1-1
	1.1.1	Retaining the documentation	1-1
	1.2	Overview of documentation	1-2
	1.3	Definition of symbols	1-3
Chapter 2	**Overview**		
	2.1	Unit structure	2-1
	2.1.1	Scope of supply	2-1
	2.1.2	Unit features	2-1
	2.2	Front view	2-2
Chapter 3	**Safety**		
	3.1	Intended use	3-1
	3.1.1	System requirements	3-1
	3.2	Safety regulations	3-2
	3.2.1	Use of qualified personnel	3-2
	3.2.2	Warranty and liability	3-2
	3.2.3	Disposal	3-2
	3.2.4	For your safety	3-3
Chapter 4	**Function description**		
	4.1	Device properties	4-1
	4.1.1	Integrated protection mechanisms	4-1
	4.1.2	Function description	4-1
	4.1.2.1	Operation	4-1
	4.1.2.2	Internal wiring diagram	4-1
Chapter 5	**Installation**		
	5.1	General installation guidelines	5-1
	5.2	Dimensions	5-2
	5.3	Connect the base unit and expansion modules	5-3
Chapter 6	**Commissioning**		
	6.1	General wiring guidelines	6-1
	6.2	Preparing for operation	6-2
	6.2.1	Download modified project to the PNOZmulti safety system	6-2
	6.2.2	Connection	6-2
Chapter 7	**Operation**		
	7.1	Messages	7-1

1.1 Validity of the documentation

This documentation is valid for the product **PNOZ m EF 8DI4DO**. 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 **PNOZ m EF 8DI4DO**.

Application of the product **PNOZ m EF 8DI4DO**:

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

1.1.1 Retaining the documentation

This documentation is intended for instruction and should be retained for future reference.

1.2 Overview of documentation

1 Introduction

The introduction is designed to familiarise you with the contents, structure and specific order of this manual.

2 Overview

This chapter provides information on the product's most important features.

3 Safety

This chapter must be read as it contains important information on intended use.

4 Function Description

This chapter describes the product's mode of operation.

5 Installation

This chapter explains how to install the product.

6 Commissioning

This chapter describes the product's commissioning and wiring.

7 Operation

This chapter describes how to operate the product and gives tips in the case of a fault.

8 Technical Details

This chapter contains the product's technical details and order 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 unit(s) 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.

2.1 Unit structure

2.1.1 Scope of supply

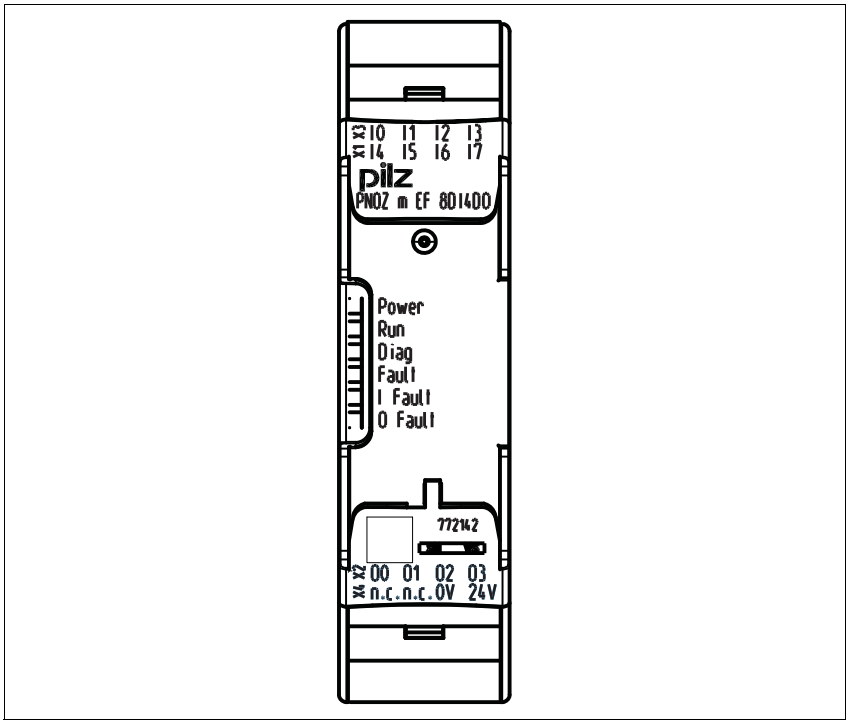
- Expansion module**PNOZ m EF 8DI4DO**
- Jumper 779 260

2.1.2 Unit features

The product has the following features:

- Can be configured in the PNOZmulti Configurator
- Semiconductor outputs:
  4 safety outputs
  Depending on the application, up to PL e of EN ISO 13849-1 and up to SIL CL 3 of EN IEC 62061
- 8 inputs for connecting, for example:
  - E-STOP pushbuttons
  - Two-hand pushbuttons
  - Safety gate limit switches
  - Reset buttons
  - Light beam devices
  - Scanners
  - Enabling switches
  - PSEN
  - Operating mode selector switches
- LED for:
  - Error messages
  - Diagnostics
  - Supply voltage
  - Output circuits
  - Input circuits
- Test pulse outputs used to monitor shorts across the inputs
- Monitoring of shorts between the safety outputs
- Plug-in connection terminals:
  Either spring-loaded terminal or screw terminal available as an accessory (see order reference)
- Please refer to the document "PNOZmulti System Expansion" for the PNOZmulti base units that can be connected

2.2 Front view



Key:

- 0 V, 24 V: Supply connections
- Inputs I0 – I7
- Outputs O0 – O3
- LEDs:
  - POWER
  - Run
  - Diag
  - Fault
  - I Fault
  - O Fault

3.1 Intended use

The expansion module may only be connected to a base unit from the configurable control system PNOZmulti 2 (please refer to the document "PNOZmulti System Expansion" for details of the base units that can be connected)

The configurable control system PNOZmulti 2 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

3.1.1 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.

3.2 Safety regulations

3.2.1 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 safety guidelines given in this description
- Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.2 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.).

3.2.3 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).

3.2 Safety regulations

3.2.4 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).

4.1 Device properties

4.1.1 Integrated protection mechanisms

The relay conforms to the following safety criteria:

- The circuit is redundant with built-in self-monitoring.
- The safety function remains effective in the case of a component failure.

4.1.2 Function description

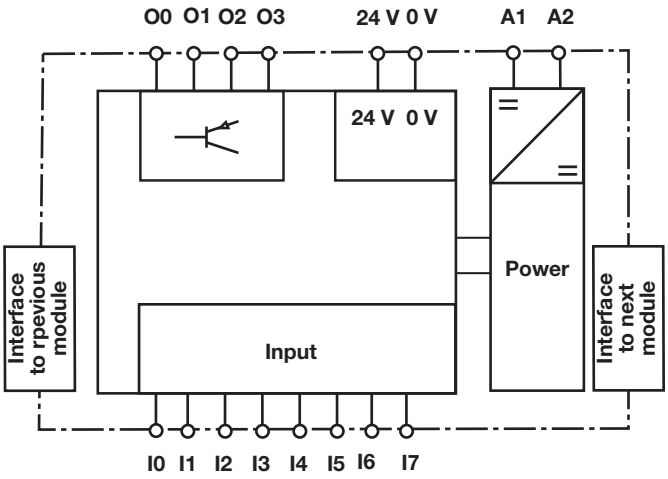
4.1.2.1 Operation

The expansion module provides additional inputs and additional semiconductor outputs.

The function of the inputs and outputs on the control system depends on the safety circuit created using the PNOZmulti Configurator. A chip card is used to download the safety circuit to the base unit. The base unit has 2 microcontrollers that monitor each other. They evaluate the input circuits on the base unit and expansion modules and switch the outputs on the base unit and expansion modules accordingly.

The online help on the PNOZmulti Configurator contains descriptions of the operating modes and all the functions of the PNOZmulti control system, plus connection examples.

4.1.2.2 Internal wiring diagram

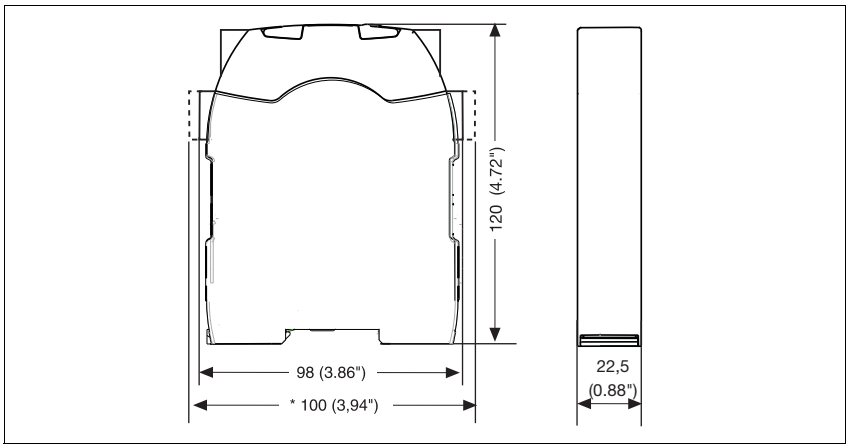


5.1 General installation guidelines

- 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 destroy the safety system.
- Use the locking slide 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.

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 Dimensions



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.

6.1 General wiring guidelines

The wiring is defined in the circuit diagram of the PNOZmulti Configurator.

Note:

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

6.2 Preparing for operation

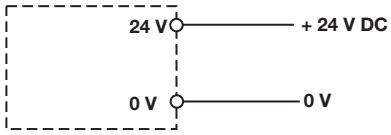
6.2.1 Download modified project to the PNOZmulti safety system

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.

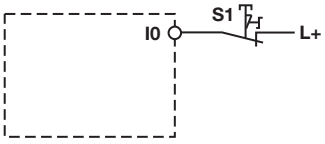
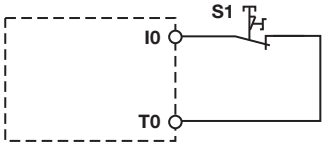
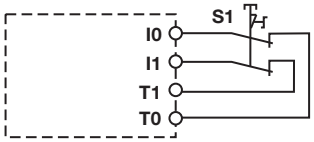
NOTICE
For the commissioning and after every program change, you must check whether the safety devices are functioning correctly.

6.2.2 Connection

- Supply voltage

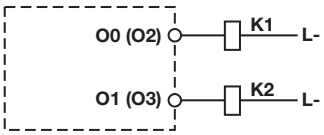
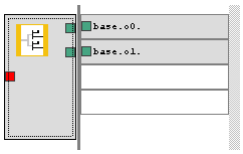
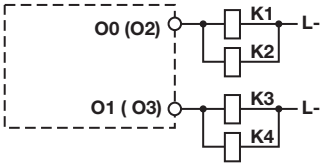
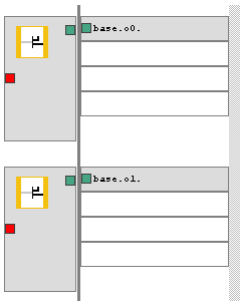
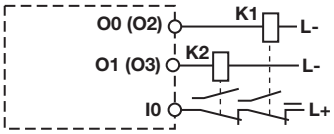
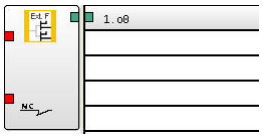
Supply voltage	DC
	

- Connection examples for the input circuit

Input circuit	Single-channel	Dual-channel
Example: E-STOP without detection of shorts across contacts		
Example: E-STOP with detection of shorts across contacts		

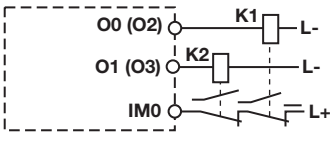
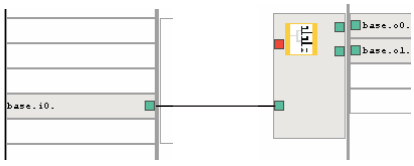
6.2 Preparing for operation

▸ Connection examples for semiconductor outputs

Redundant output		
Single output		
Single output with advanced fault detection*		

*Two loads may be connected to each safety output with advanced fault detection, even on applications in accordance with EN IEC 62061, SIL CL 3. Prerequisite: Feedback loop is connected, shorts across contacts and external power sources are excluded (e.g. through separate multi-core cables). Please note that, in the event of an error in the feedback loop, the safety system switches to a safe condition and shuts down **all** the outputs.

▸ Connection examples for feedback loop

Feedback loop	Redundant output
Contacts from external contactors	 

7.1 Messages

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 PNOZmulti safety system is ready for operation when the "POWER" and "RUN" LEDs on the base unit are lit continuously.

Legend:

☼	LED on
◐	LED flashes
●	LED off

LED						Fault
POWER	Run	Diag	Fault	IFault	OFault	
						No supply voltage
☼	☼					Expansion module **PNOZ m EF 8DI4DO** running without error
☼						Expansion module **PNOZ m EF 8DI4DO** is in a STOP condition
☼	☼			◐		Internal error on the inputs of the expansion module **PNOZ m EF 8DI4DO**. Expansion module is in a safe condition, e.g. pulse error.
☼					◐	Internal error on the outputs of the expansion module **PNOZ m EF 8DI4DO**. Expansion module is in a safe condition.
☼				☼		External error on the inputs of the expansion module **PNOZ m EF 8DI4DO**. Expansion module is in a safe condition.
☼	☼				◐	External error on the outputs of the expansion module **PNOZ m EF 8DI4DO**. Expansion module is in a safe condition, e.g. defective feedback loop

8.1 Technical details

Technical details	
Electrical data	
Module's current consumption	**39 mA**
Module's power consumption	**1.0 W**
Infeed for	**Supply to the SC outputs**
Supply voltage	**24 VDC**
Voltage tolerance	**-20 %/+25 %**
Max. continuous current that the external power supply must provide	**8.0 A**
Potential isolation from system voltage	**yes**
Type of potential isolation	**Basic insulation**
Rated surge voltage	**2500 V**
Max. power dissipation of the module	**4.50 W**
Inputs	
Number	**8**
Potential isolation from system voltage	**no**
Input voltage in accordance with EN 61131-2 type 1	**24 V DC**
Input current at rated voltage	**5 mA**
Input current range	**2.5 - 5.3 mA**
Pulse suppression	**0.5 ms**
Maximum input delay	**8 ms**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**4**
Potential isolation from system voltage	**yes**
Type of potential isolation	**Basisisolierung**
Rated surge voltage	**2,500 V**
Voltage	**24 V DC**
Output current	**2.00 A**
Output current range	**0.00 - 2.50 A**
Max. transient pulsed current	**12 A**
Short circuit-proof	**yes**
Residual current (I_r)	**0.05 mA**
Max. internal voltage drop	**500 mV**
Max. duration of off time during self test	**330 µs**
Permitted loads	**inductive**, **capacitive**, **resistive**
Max. capacitive load	**1 µF**
Environmental data	
Ambient temperature	**0 - 60 °C**
Forced convection off in control cabinet	**55 °C**
Storage temperature	**-25 - 70 °C**
Climatic suitability in accordance with standard	**EN 60068-2-30**, **EN 60068-2-78**
Condensation	**not permitted**
Max. operating height above sea level	**<2000 m**
EMC	**EN 61131-2**
Vibration to **EN 60068-2-6**	
Frequency	**5.0 - 150.0 Hz**
Max. acceleration	**1g**
Airgap creepage in accordance with **EN 61131-2**	
Overvoltage category	**II**
Pollution degree	**2**

8.1 Technical details

Environmental data	
Rated insulation voltage	**30 V**
Shock stress	
EN 60068-2-27	**15g**
	11 ms
Mechanical data	
Protection type	
Mounting (e.g. cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
DIN rail	
Top hat rail	**35 x 7.5 EN 50022**
Recess width	**27 mm**
Maximum cable runs	
Max. cable length per input	**1.0 km**
Housing material	
Housing	**PC**
Front	**PC**
Cross section of external conductors with screw terminals	
Power supply, inputs, configurable inputs/outputs, semi-conductor outputs, test pulse outputs:	
1 core flexible	**0.25 - 2.50 mm² , 24 - 12 AWG**
2 core, 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**
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**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	**120.0 mm**
Weight	**105 g**

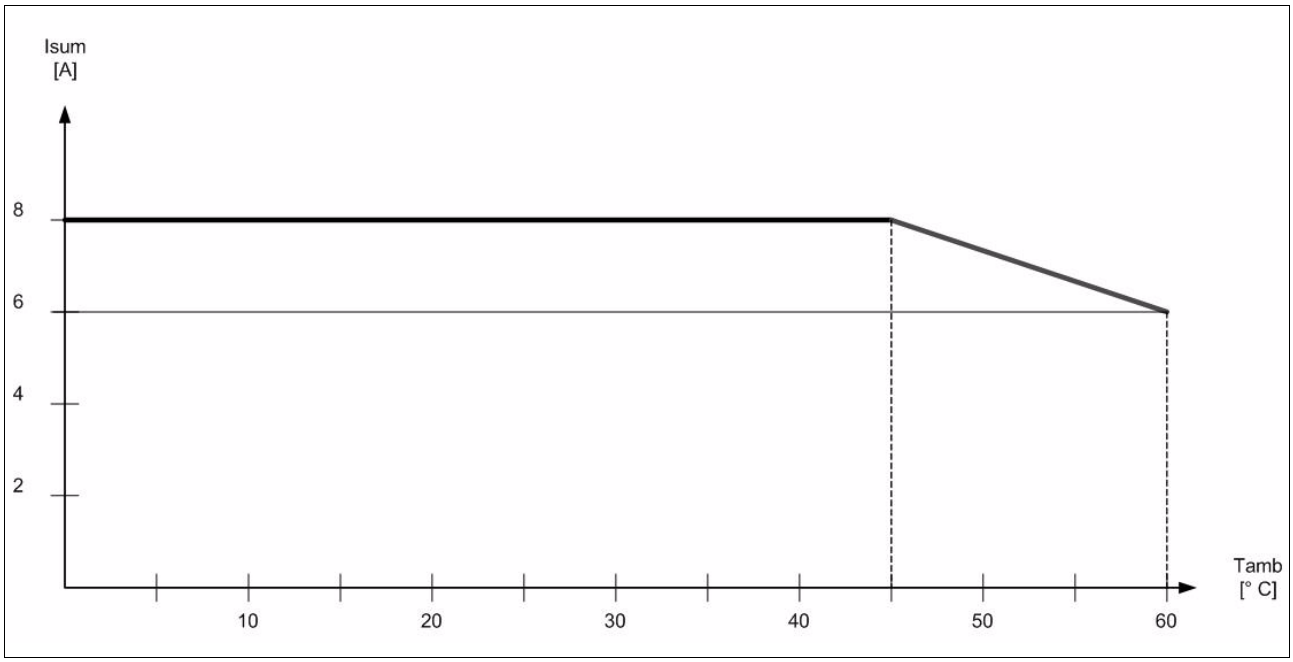
8.1 Technical details

Safety characteristic data						
Unit	**Operating mode**	**EN ISO 13849-1: 2006 PL**	**EN 954-1 Category**	**EN IEC 62061 SIL CL**	**PFH [1/h]**	**EN ISO 13849-1: 2006 T_M [year]**
Logic						
CPU		PL e (Cat. 4)	Cat. 4	SIL CL 3	2.84E-10	20
Input						
SC inputs	single-channel	PL d (Cat. 2)	Cat. 3	SIL CL 2	2.10E-09	20
SC inputs	dual-channel	PL e (Cat. 4)	Cat. 4	SIL CL 3	4.27E-11	20
SC inputs	light beam device	PL e (Cat. 4)	Cat. 4	SIL CL 3	2.10E-10	20
Output						
SC outputs	single-channel with advanced fault detection	PL e (Cat. 4)	Cat. 4	SIL CL 3	2.12E-11	20
SC outputs	single-channel	PL d (Cat. 2)	Cat. 3	SIL CL 2	2.29E-10	20
SC outputs	dual-channel	PL e (Cat. 4)	Cat. 4	SIL CL 3	1.64E-10	20

All the units used within a safety function must be considered when calculating the safety characteristic data.

The standards current on **2012-04** apply.

8.2 Permitted ambient temperature Tamb dependent on the total current Isum



8.3 Order reference

Order reference		
Product type	**Features**	**Order no.**
PNOZ m EF 8DI4DO	Expansion module	772 142

Order reference: Accessories		
Product type	**Features**	**Order no.**
Set spring terminals	1 set of spring-loaded terminals	751 004
Set screw terminals	1 set of screw terminals	750 004

Order reference: Terminator, jumper		
Product type	**Features**	**Order no.**
PNOZ mm0.xp connector left	Black/yellow jumper to connect the modules on the left-hand side, 1 piece	779 260

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In many countries we are represented by our subsidiaries and sales partners.

Please refer to our homepage for further details or contact our headquarters.

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