PNOZ mo4p

PNOZmulti Modular Safety System

Operating Manual – No. 20942-EN-05

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

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1.1 Validity of documentation

This documentation is valid for the product **PNOZ mo4p**. 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 .

1.1.1 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.

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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.

INFORMATION
This gives advice on applications and provides information on special features, as well as highlighting areas within the text that are of particular importance.

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2.1 Unit structure

2.1.1 Scope of supply

- Expansion module **PNOZ mo4p**
- Jumper 774 639

2.1.2 Unit features

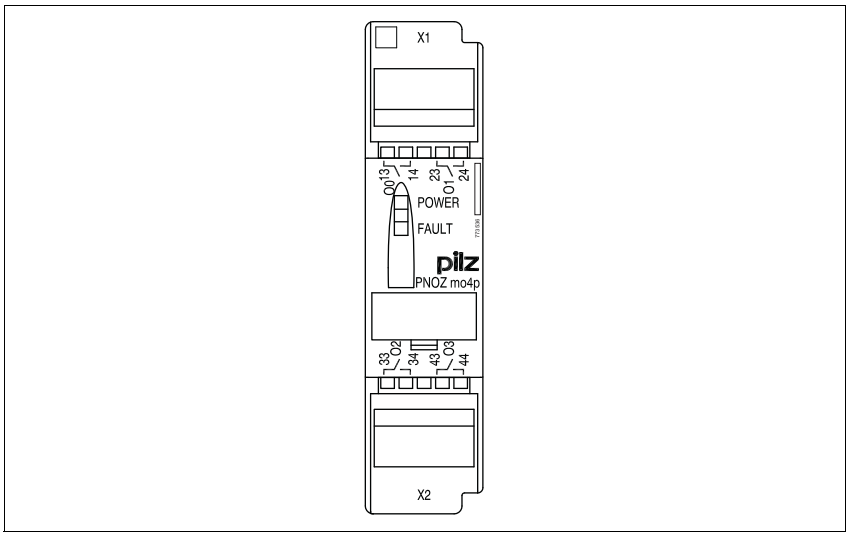
Using the product **PNOZ mo4p**:

Expansion module for connection to a base unit from the PNOZmulti modular safety system

The product has the following features:

- Positive-guided relay 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
- Can be configured in the PNOZmulti Configurator
- Status indicators
- Max. 6 PNOZ mo4p units 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)
- Coated version:
  Increased environmental requirements

2.2 Front view



Legend:

- O0 – O3
  Relay outputs

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3.1 Intended use

The expansion module may only be connected to a base unit from the PNOZmulti modular safety system.

The modular safety system PNOZmulti is used for the safety-related interruption of safety circuits and is designed for use on:
- E-STOP equipment
- Safety circuits in accordance with VDE 0113 Part 1 and EN 60204-1

The coated version of the product **PNOZ mo4p** is suitable for use where there are increased environmental requirements (see Technical Details).

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”)

3.1.1 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).

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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).

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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.
- The relay contacts meet the requirements for safe separation through increased insulation compared with all other circuits in the safety system.

4.1.2 Function description

4.1.2.1 Operation

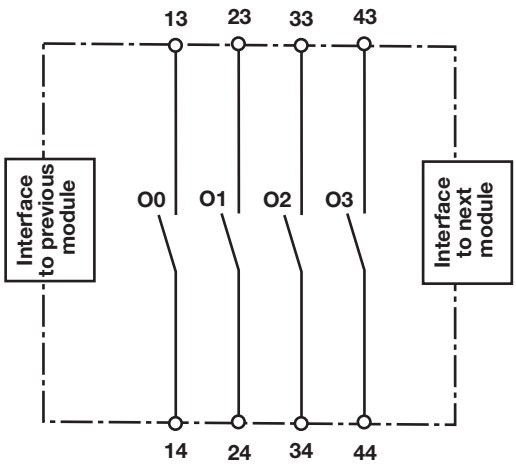
The expansion module provides additional relay outputs.

The function of the outputs on the safety 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 safety system, plus connection examples.

4.1 Device properties

4.1.2.2 Internal wiring diagram



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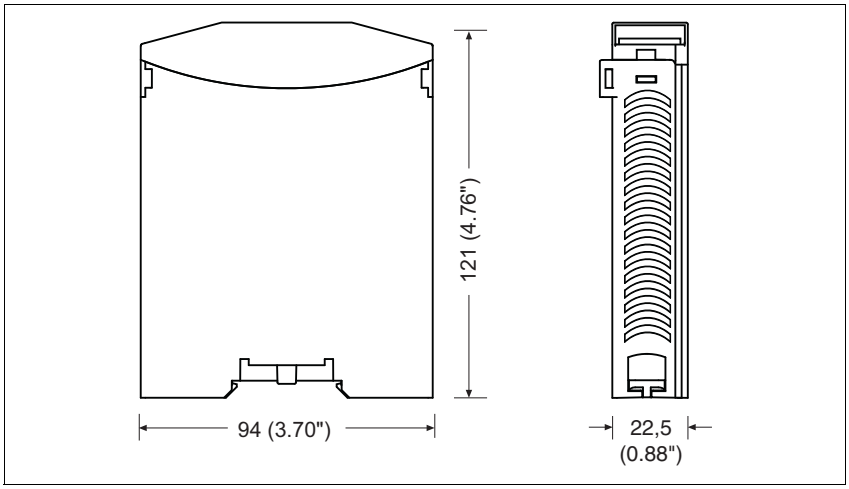
5.1 General installation guidelines

- The safety system 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 notches on the rear of the unit to attach it to a mounting rail. Connect the safety system to the mounting rail in an upright position, so that the earthing springs on the safety system are pressed on to the mounting rail.
- 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.
- To comply with EMC requirements, the mounting rail must have a low impedance connection to the control cabinet housing.

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.

5.1.1 Dimensions



5.2 Connecting the base unit and expansion modules

Connect the base unit and the expansion modules as described in the operating manuals for the base modules.

- The terminator must be fitted to the last expansion module
- Install the expansion module in the position configured in the PNOZmulti Configurator.

Please refer to the document "System Expansion" for details of the number of modules that can be connected to the base unit and the module types.

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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

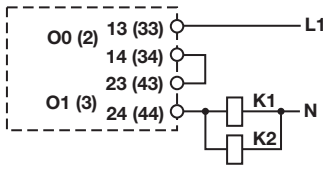
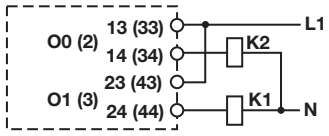
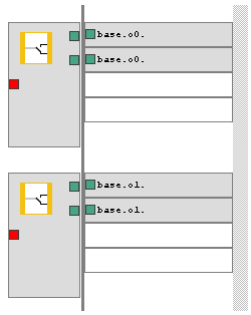
6.2.1 Download modified project to the PNOZmulti safety system

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.

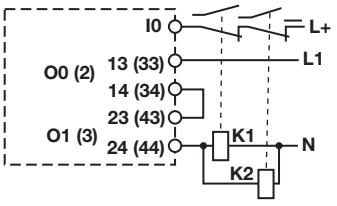
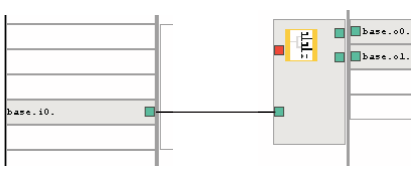
NOTICE
For the commissioning and after every program change, you must check whether the safety devices are functioning correctly.

6.2.2 Connection

- Relay outputs

Redundant		
Single		

- Feedback loop

Feedback loop	Redundant output	
Contacts from external contactors		

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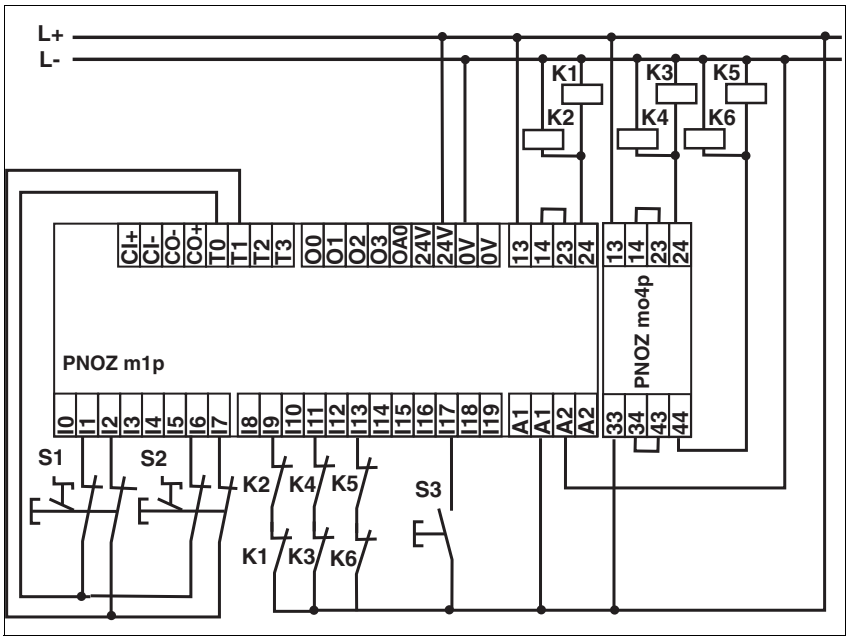
6.3 Connection example



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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.

7.1.1 Display elements

Legend:

☼	LED on
◐	LED flashes
●	LED off

7.1.1.1 Display elements for device diagnostics

Basic								Relay output module		Errors
Input Ix	RUN	DIAG	FAULT	IFAULT	OFAULT	CI	CO	FAULT	IN/OUT	
	☼							◐		External error on the output, e.g. defective feedback loop
	●	◐						◐		Internal error on the expansion module

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8.1 Technical details

Technical details	
Electrical data	
Supply voltage U_B DC	**5 V**
Power consumption at U_B DC	
without load	**3.5 W**
Status display	**LED**
Times	
Switch-on delay	**5.00 s**
Supply interruption before de-energisation	**20 ms**
Relay outputs	
Number	**4**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	**6.0 A**, **1440 VA**
Safety contacts: DC1 at **24 V**	**6.0 A**, **144 W**
Utilisation category in accordance with **EN 60947-5-1**	
Safety contacts: AC15 at **230 V**	**3.0 A**, **690 W**
Safety contacts: DC13 at **24 V** (6 cycles/min)	**3.0 A**, **72 W**
Derating of coated version at an ambient temperature > 50 °C	
Safety contacts: AC1 at 240 V	**2 A** coated version, **480 W** coated version
Safety contacts: DC1 at 24 V	**2 A** coated version, **48 W** coated version
Utilisation category in accordance with **EN 60947-5-1**	
Safety contacts: AC15 at **230 V** coated version	**2 A** coated version, **460 W** coated version
Safety contacts: DC13 at **24 V** coated version (6 cycles/min)	**2 A** coated version, **48 W** coated version
Airgap creepage between	
relay contacts	**3 mm**
relay contacts and other safe circuits	**5.5 mm**
External contact fuse protection (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	**6 A**
Blow-out fuse, slow	**6 A**
Circuit breaker 24 VAC/DC, characteristic B/C	**6 A**
Switch-off delay	**50 ms**
Environmental data	
Climatic suitability	**EN 60068-2-1**, **EN 60068-2-30**, **EN 60068-2-78**
Ambient temperature	**0 - 60 °C**
	-25 - 60 °C coated version
Storage temperature	**-25 - 70 °C**
Climatic suitability	**95 % r. F.** coated version
Condensation	**permitted** coated version
EMC	**EN 60947-5-1**
Vibration to **EN 60068-2-6**	
Frequency	**10 - 55 Hz**
Amplitude	**0.35 mm**
Mechanical data	
Protection type	
Mounting (e.g. cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**

8.1 Technical details

Mechanical data	
DIN rail	
Top hat rail	**35 x 7.5 EN 50022**
Recess width	**27 mm**
Housing material	
Housing	**PPO UL 94 V0**
Front	**ABS UL 94 V0**
Cross section of external conductors with screw terminals	
Power supply, inputs, auxiliary output, semiconductor outputs, test pulse outputs, cascading outputs:	
2 core, same cross section, flexible:	
Relay outputs:	
1 core flexible	**0.5 - 2.5 mm², 22 - 12 AWG**
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.50 - 1.25 mm², 22 - 16 AWG**
without crimp connectors or with TWIN crimp connectors	**0.50 - 1.25 mm², 22 - 16 AWG**
Torque setting with screw terminals	**0.25 Nm**
Spring-loaded terminals: Terminal points per connection	**1**
Stripping length	**9 mm**
Dimensions	
Height	**94.0 mm**
Width	**22.5 mm**
Depth	**121.0 mm**
Weight	**210 g** **215 g** coated version

No. stands for order number.

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]
relay outputs	single-channel	**PL c** (**Cat. 1**)	**Cat. 2**	**-**	**2.90E-08**	**20**
relay outputs	dual-channel	**PL e** (**Cat. 4**)	**Cat. 4**	**SIL CL 3**	**3.00E-10**	**20**

Requirement on 1-channel relay outputs for Cat. 2 in accordance with EN 954-1: An additional output switches to a safe condition in the event of an error or, if that is impossible, signals a hazardous condition.

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

The standards current on **2009-01** apply.

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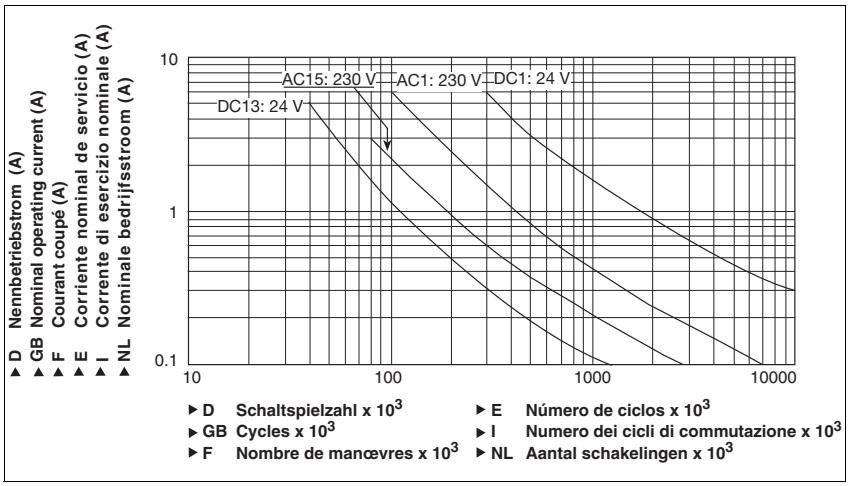
8.1 Technical details

CAUTION!
It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.

The PFH value depends on the switching frequency and the load on the relay output. If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

8.2 Service life graph of output relays

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.



Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application requires fewer than 1 000 000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

We recommend you use semiconductor outputs to switch 24 VDC loads.

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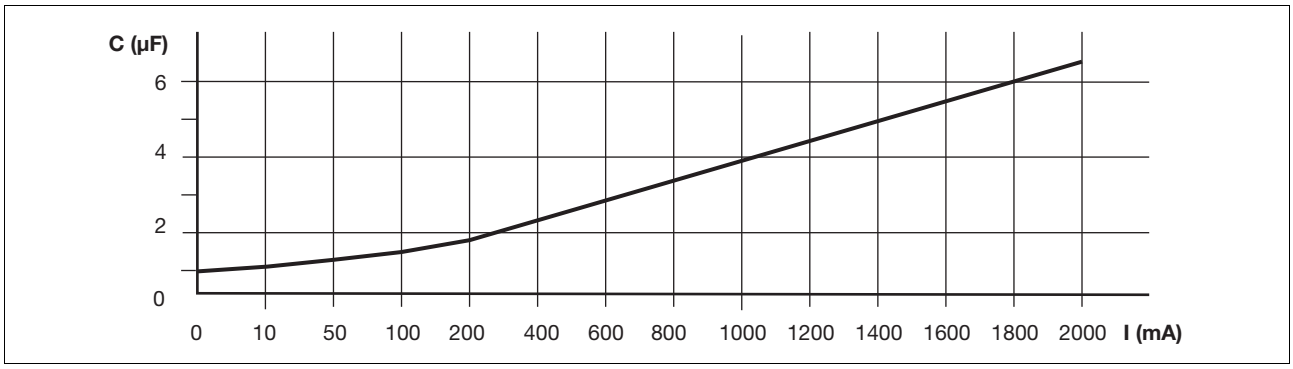
8.3 Maximum capacitive load C (mF) with load current I (A) at the semiconductor outputs



8.4 Order reference

Order reference

Product type	Features	Order no.
PNOZ mo4p	Expansion module, 2 or 4 relay outputs, positive-guided	773 536
PNOZ mo4p coated version	Expansion module, 2 or 4 relay outputs, positive-guided, coated version	773 537

Order reference: Accessories

Product type	Features	Order no.
Set spring terminals	1 set of spring-loaded terminals	783 536
Set screw terminals	1 set of screw terminals	793 536

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