PNOZ m EF PDP Link

Configurable Control System PNOZmulti

Operating Manual-1003019-EN-01

This document is a translation of the original document.

SD means Secure Digital

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product **PNOZ m EF PDP Link**. 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.

ATTENTION!

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.

CAUTION!

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 EF PDP Link**
- Jumper 779 260

2.2 Unit features

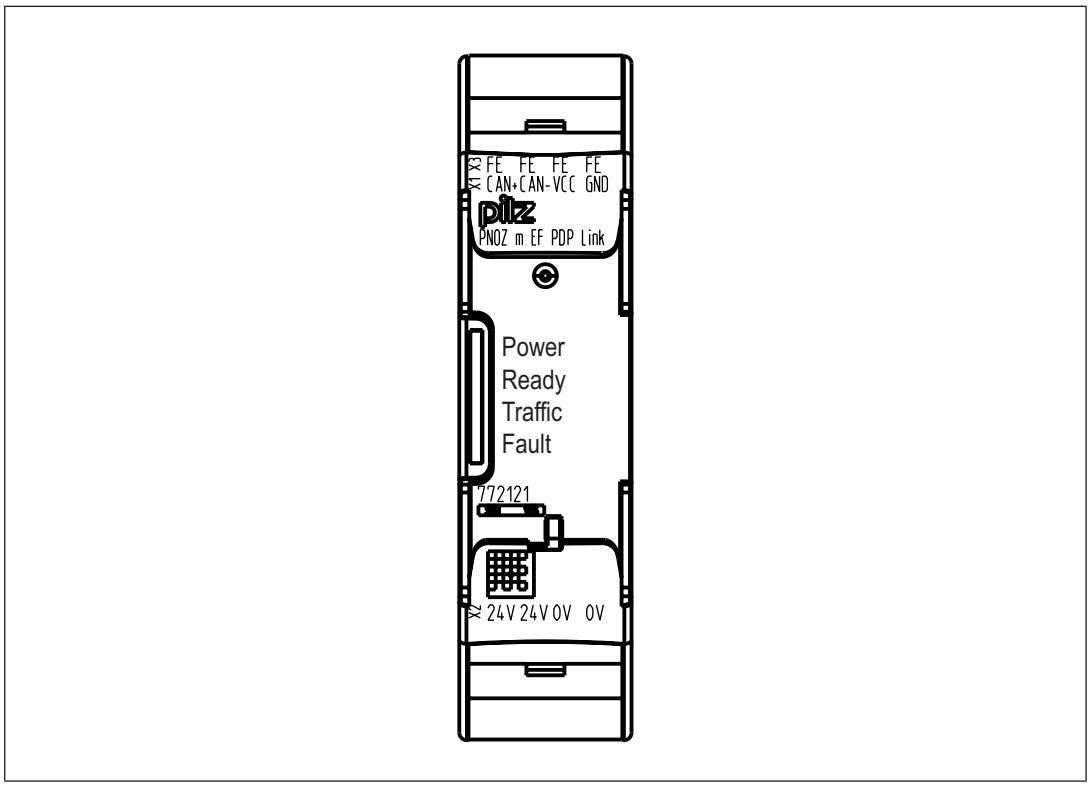
Using the product **PNOZ m EF PDP Link**:

Link module to safely connect decentralised input/output modules to a configurable control system **PNOZmulti 2**

The product has the following features:

- Can be configured in the PNOZmulti Configurator
- Max. 4 PNOZ m EF PDP Link can be connected to the base unit
- Max. 4 decentralised modules can be connected to the link module PNOZ m EF PDP Link
- LEDs for
  - Operating state
  - Error
  - Connection status
- Plug-in connection terminals:
  either spring-loaded terminal or screw terminal available as an accessory (see order reference)

2.3 Front view



Legend:

- 0 V, 24 V:
  Supply connections
- CAN+, CAN-, VCC, GND:
  Connection for decentralised modules
- FE:
  Functional earth

3 Safety

3.1 Intended use

The expansion module is used to connect decentralised input/output modules to a configurable control system **PNOZmulti 2** .

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 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

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 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.

4.2 Functions

The link module **PNOZ m EF PDP Link** is used to safely transfer the input information from decentralised modules to the control system **PNOZmulti 2**.

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 LEDs on the base unit and expansion modules indicate the status of the configurable control system PNOZmulti.

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

Data exchange:

- Communication with the decentralised modules is via a safe data link.
- The link module **PNOZ m EF PDP Link** reads the input information from the decentralised modules as part of each cycle and then forwards it to the base unit.
- At the end of a PNOZmulti cycle, the base unit sends its output data to its link module. This output data is immediately sent to the decentralised modules.

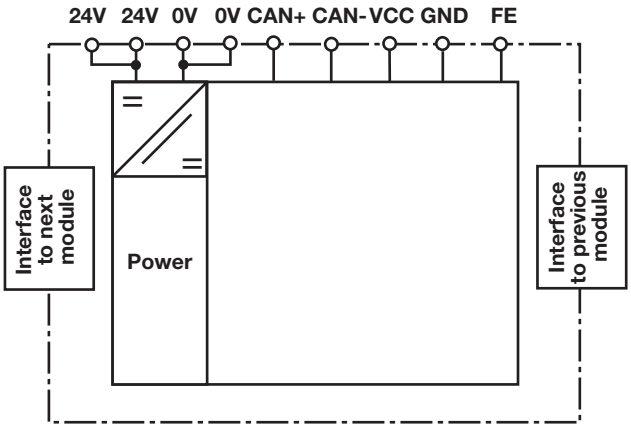
Linking several decentralised modules:

- A maximum of 4 link modules can be connected to a base unit **PNOZmulti 2**.
- A maximum of 4 decentralised modules can be connected to a link module **PNOZ m EF PDP Link**.
- If a decentralised module receives data intended for a different decentralised module that is connected, the data is forwarded without being processed.

4.3 System reaction time

Calculation of the maximum reaction time between an input switching off and a linked output in the system switching off is described in the document "System Expansion".

4.4 Block diagram



5 Installation

5.1 General installation guidelines

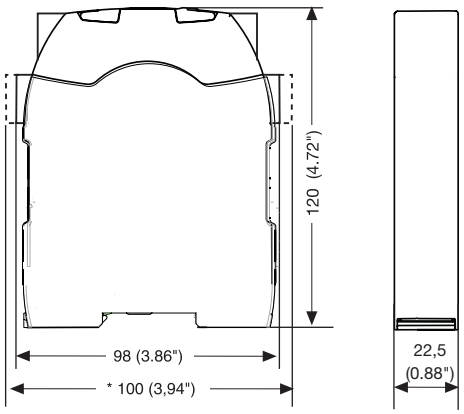
- The unit should be installed in a control cabinet with a protection type of at least IP54.
- Fit the safety system to a horizontal mounting rail. The venting slots must face upwards and downwards. Other mounting positions could destroy the safety system.
- Use the locking slide on the rear of the unit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

ATTENTION!

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 Commissioning

6.1 Wiring

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

Note:

- Information given in the "Technical details" must be followed.
- External measures must be used to connect the FE terminal to the function earth (e.g. mounting rail).
- The power supply must meet the regulations for extra low voltages with safe separation.
- 2 connection terminals are available for each of the supply connections 24 V and 0 V. This means that the supply voltage can be looped through several connections. The current at each terminal may not exceed 3 A.
- Please refer to the technical details for information on the maximum cable length. Please also read the section entitled "Voltage drop".
- Shielded cable must be used from a cable length of **30 m**.
- Pilz pre-assembled cable can be used to connect the decentralised modules (see order reference).
- The plug-in connection terminals are either designed as cage clamp terminals or screw terminals (see order reference).

ATTENTION!

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

6.1.1 Insulation voltage test

The product **PNOZ m EF PDP Link** is connected to functional earth ⏚ via protection elements on the supply voltage. Insulation voltage tests are only possible with voltages up to ca. 42 V.

6.2 Preparing for operation

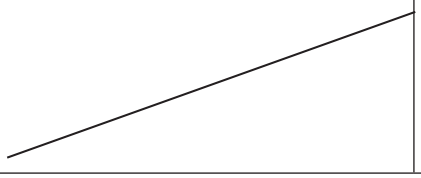
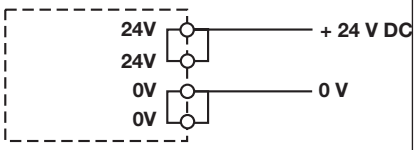
6.2.1 Download modified project to the PNOZmulti safety system

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.

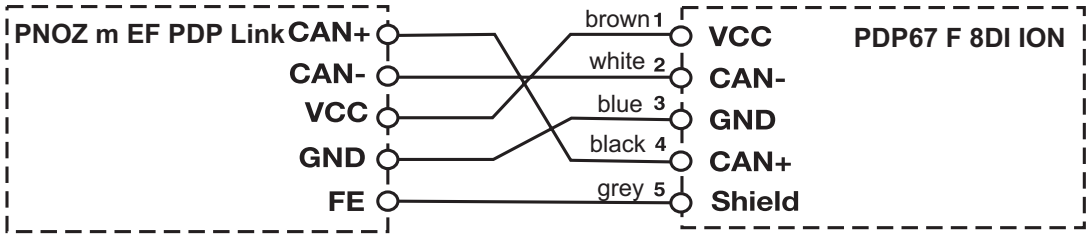
CAUTION!

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

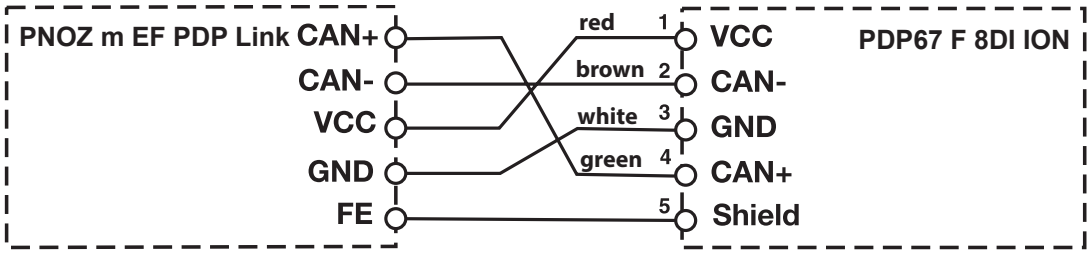
6.2.2 Connection

Supply voltage	AC	DC
		

Connection to a decentralised input module PDP67 when using the PSEN op cable axial M12 5-pole from Pilz (see order reference)

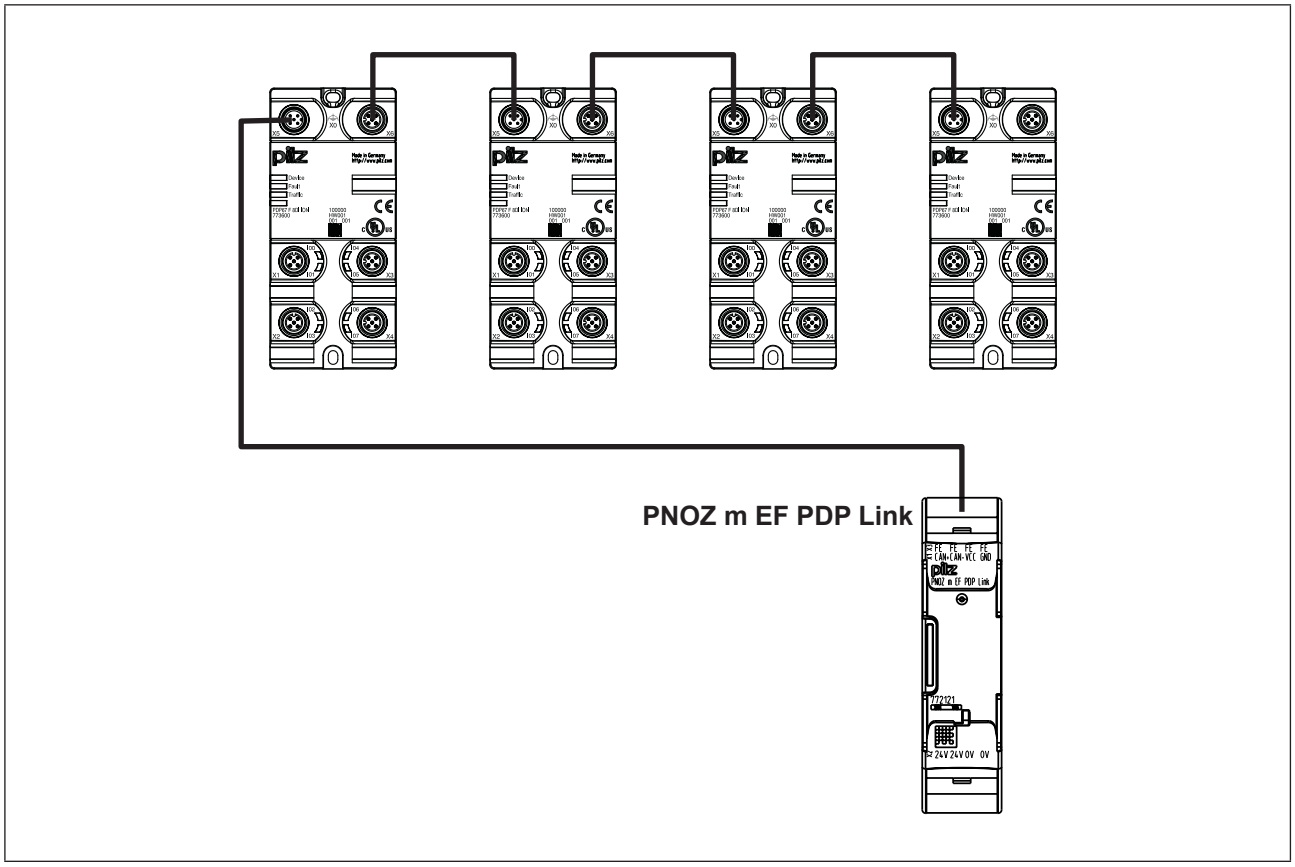


Connection when using the PSS SB BUSCABLE LC in conjunction with a Pilz self-assembly "PSS67 M12 connector" (see order reference in the Technical Catalogue)



6.3 Series connection of 4 decentralised modules

You can connect up to 4 decentralised modules in series to a PNOZmulti link module.



6.4 Voltage drop

The max. cable length depends on the voltage drop in the supply voltage cables. The level of voltage drop is determined by the:

- Cable resistance on the supply voltage cables
- Operating current of the modules
- Load on the modules

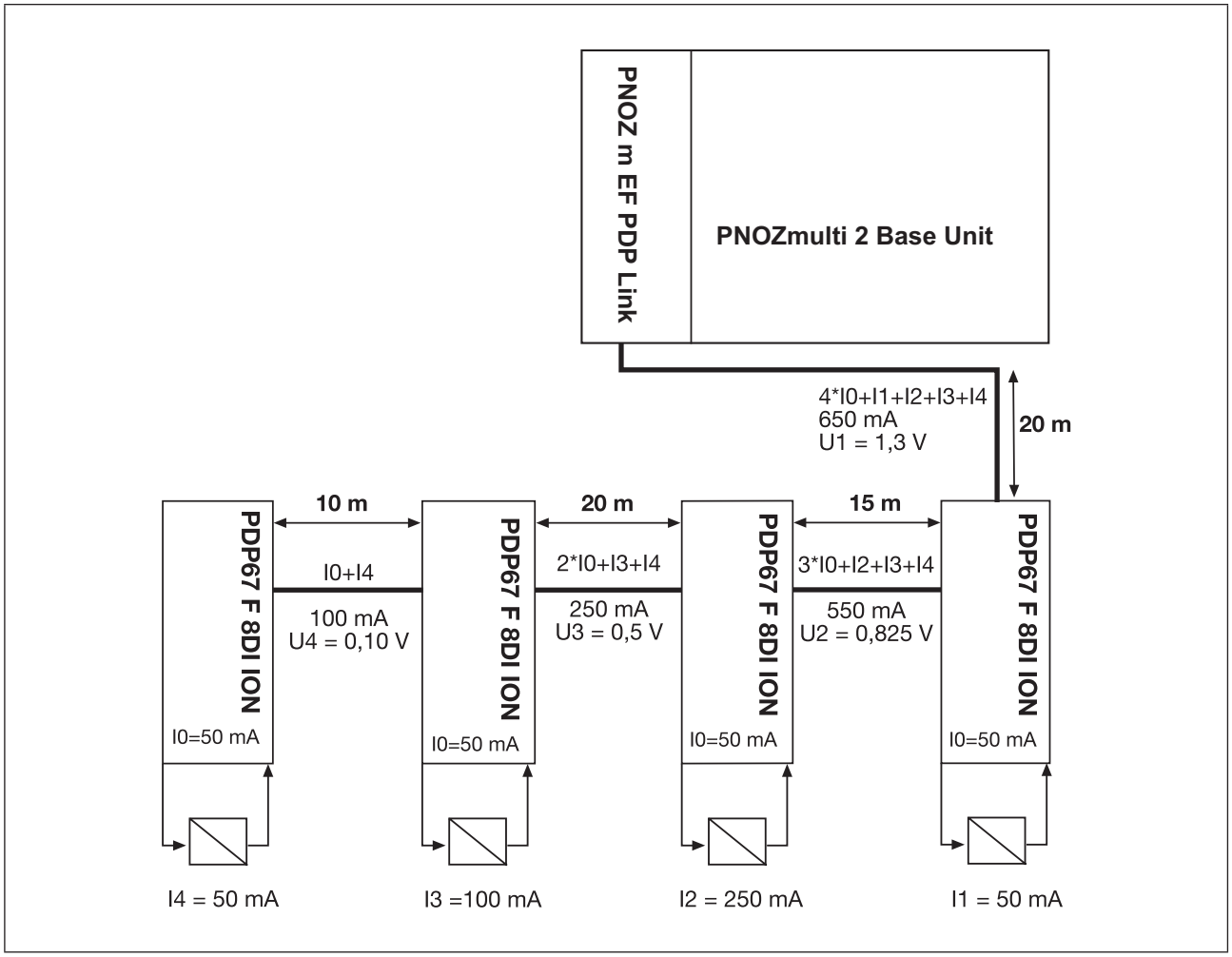
To increase the max. cable length, the input voltage can be permanently increased by the voltage tolerance (see Technical Details).

6.4.1 Guidelines for various cable types

Cable type	Voltage drop per 10 m and per 100 mA
PSS SB BUSCABLE LC	0.1 V
Sensor cable 0.25 mm²	0.15 V
Sensor cable 0.34 mm²	0.11 V
Sensor cable 0.5 mm²	0.07 V

6.4.2 Calculation example

- The PSS SB BUSCABLE LC is used in accordance with the pin assignment in section 6.2.2.
  Voltage drop per 10 m and per 100 mA: 0.1 V



Legend:

- I0: Module's consumption.
- I1 ... I5: Load current taken from the module
- U1 … U4: Voltage drop on the respective connection path

Total voltage drop from the link module **PNOZ m EF PDP Link** to the final PDP67 F 8DI ION:

$U_{total} = U_1 + U_2 + U_3 + U_4$

$U_{total} = 1.3\ V + 0.825\ V + 0.5\ V + 0.10\ V = 2.725\ V$

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 PNOZmulti safety system is ready for operation when the "POWER" and "RUN" LEDs on the base unit and the "READY" LED on the **PNOZ m EF PDP Link** are lit continuously.

7.1 Messages

Legend:

	LED on
	LED flashes
●	LED off

LED	LED status		Meaning
Power	●		No supply voltage
		Green	Supply voltage is present
Ready		Green	The unit is ready for operation
	●		The unit is not ready for operation
Fault		Red	External error
		Red	Internal error
	●		No fault
Traffic		Yellow	Connection to a decentralised module available
		Yellow	Connection is not available to all decentralised modules.
	●		No connection to a decentralised module

7.2 Fault detection

The base unit contains information about the

- Link module (in order, defective, no supply voltage)
- Status of communication with the decentralised modules (data valid, data invalid)

If the connection to a decentralised module is interrupted or there is a major error on the decentralised module, the inputs on the devices connected to the link module are set to zero. The base unit remains in a RUN condition.

8 Technical details

General	772121
Approvals	**BG, CCC, CE, GOST, TÜV, UL/cUL**
Application area	**Failsafe**
Electrical data	**772121**
Supply voltage	
for	**Module supply**
Voltage	**24 V**
Type	**DC**
Voltage tolerance	**-15 %/+20 %**
Output of external power supply (DC)	**5,0 W**
Supply voltage	
For	**Supply to the system**
Internal	**Via base unit**
Voltage	**3,3 V**
Type	**DC**
Status indicator	**LED**
Inputs	**772121**
Maximum input delay	**15 ms**
Semiconductor outputs	**772121**
Switch-off delay	**5 ms**
Fieldbus interface	**772121**
Galvanic isolation	**Yes**
Environmental data	**772121**
Ambient temperature	
In accordance with the standard	**EN 60068-2-14**
Temperature range	**0 - 60 °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	**Not permitted**
EMC	**EN 61131-2**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**5,0 - 55,0 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	772121
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 (e.g. cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
Potential isolation	**772121**
Potential isolation between	**Module and system voltage**
Type of potential isolation	**Safe separation**
Rated surge voltage	**2500 V**
Mechanical data	**772121**
Mounting position	**Horizontal on top hat rail**
DIN rail	
Top hat rail	**35 x 7,5 EN 50022**
Recess width	**27 mm**
Max. cable length unshielded	**30 m**
Max. cable length shielded	**100 m**
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**
Rigid single-core, flexible multi-core or multi-core with crimp connector	**0,5 - 1,5 mm²**
Torque setting with screw terminals	**0,50 Nm**
Connection type	**Spring-loaded terminal, screw terminal**
Mounting type	**plug in**
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	**120,0 mm**
Weight	**96 g**

The standards current on 2013-01 apply.

8.1 Safety characteristic data

Operating mode	EN ISO 13849-1: 2008 PL	EN ISO 13849-1: 2008 Category	EN IEC 62061 SIL CL	EN IEC 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2008 T_M [year]
–	PL e	Cat. 4	SIL CL 3	5,35E-09	SIL 3	3,30E-05	20

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

Information

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

9 Order reference

Order reference		

Product type	Features	Order no.
PNOZ m EF PDP Link	Link module	772 121

Order reference: Accessories		

Product type	Features	Order no.
Spring terminals PNOZ mml2p 1 pc.	Spring-loaded terminals, 1 piece	783 540
Spring terminals PNOZ mml2p 10 pcs.	Spring-loaded terminals, 10 pieces	783 541
Screw terminals PNOZ mml2p 1 pc.	Screw terminals, 1 piece	793 540
Screw terminals PNOZ mml2p 10 pcs.	Screw terminals, 10 pieces	793 541

Order reference: Terminator, jumper		

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

Order reference: Cable		

Product type	Features	Order no.
PSS SB BUSCABLE LC	Cable, shielded, 1 - 100 m	311074
PSS67 I/O Cable	Cable, 1 - 30 m	380 320
PSS67 Cable M8sf M12sm	Cable, straight M12 connector, straight M8 socket, 4-pin, 3 m	380 200
PSS67 Cable M8sf M12sm	Cable, straight M12 connector, straight M8 socket, 4-pin, 5 m	380 201
PSS67 Cable M8sf M12sm	Cable, straight M12 connector, straight M8 socket, 4-pin, 10 m	380 202
PSS67 Cable M8sf M12sm	Cable, straight M12 connector, straight M8 socket, 4-pin, 30 m	380 203
PSS67 Cable M8af M12sm	Cable, straight M12 connector, angled M8 socket, 4-pin, 3m	380 204
PSS67 Cable M8af M12sm	Cable, straight M12 connector, angled M8 socket, 4-pin, 5 m	380 205
PSS67 Cable M8af M12sm	Cable, straight M12 connector, angled M8 socket, 4-pin, 10 m	380 206

Product type	Features	Order no.
PSS67 Cable M8af M12sm	Cable, straight M12 connector, angled M8 socket, 4-pin, 30 m	380 207
PSS67 Cable M12sf M12sm	Cable, straight M12 connector, straight M12 socket, 5-pin, 3m	380 208
PSS67 Cable M12sf M12sm	Cable, straight M12 connector, straight M12 socket, 5-pin, 5 m	380 209
PSS67 Cable M12sf M12sm	Cable, straight M12 connector, straight M12 socket, 5-pin, 10 m	380 210
PSS67 Cable M12sf M12sm	Cable, straight M12 connector, straight M12 socket, 5-pin, 20 m	380 220
PSS67 Cable M12sf M12sm	Cable, straight M12 connector, straight M12 socket, 5-pin, 30 m	380 211
PSS67 Cable M12af M12am	Cable, angled M12 connector, angled M12 socket, 5-pin, 3m	380 212
PSS67 Cable M12af M12am	Cable, angled M12 connector, angled M12 socket, 5-pin, 5 m	380 213
PSS67 Cable M12af M12am	Cable, angled M12 connector, angled M12 socket, 5-pin, 10 m	380 214
PSS67 Cable M12af M12am	Cable, angled M12 connector, angled M12 socket, 5-pin, 30 m	380 215
PSEN op cable axial M12 5-pole 3m	Cable, straight, M12, 5-pin, open-ended socket, 3 m	630310
PSEN op cable axial M12 5-pole 5m	Cable, straight, M12, 5-pin, open-ended socket, 5 m	630311
PSEN op cable axial M12 5-pole 10m	Cable, straight, M12, 5-pin, open-ended socket, 10 m	630312
PSEN op cable axial M12 5-pole 20m	Cable, straight, M12, 5-pin, open-ended socket, 20 m	630298
PSEN op cable axial M12 5-pole 30m	Cable, straight, M12, 5-pin, open-ended socket, 30 m	630297

Order reference: Adapters		

Product type	Features	Order no.
PSEN ma adapter	Adapter for connection to safety switch PSENmag	380 300
PSEN cs adapter	Adapter for connection to safety switch PSENcode	380 301
PSEN sl adapter	Adapter for connection to safety switch PSENslock	380 325

Order reference: Connectors		

Product type	Features	Order no.
PSS67 M12 connector	Connector, M12, straight, 5-pin, A-coded	380 308
PSS67 M12 connector	Socket, M12, straight, 5-pin, A-coded	380 309
PSS67 M12 connector	Connector, M12, angled, 5-pin, A-coded	380 310
PSS67 M12 connector	Socket, M12, angled, 5-pin, A-coded	380 311
PSS67 M8 connector	Connector, M8, straight, 4-pin	380 316
PSS67 M8 connector	Socket, M8, straight, 4-pin	380 317
PSS67 M8 connector	Connector, M8, angled, 4-pin	380 318
PSS67 M8 connector	Socket, M8, angled, 4-pin	380 319

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

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