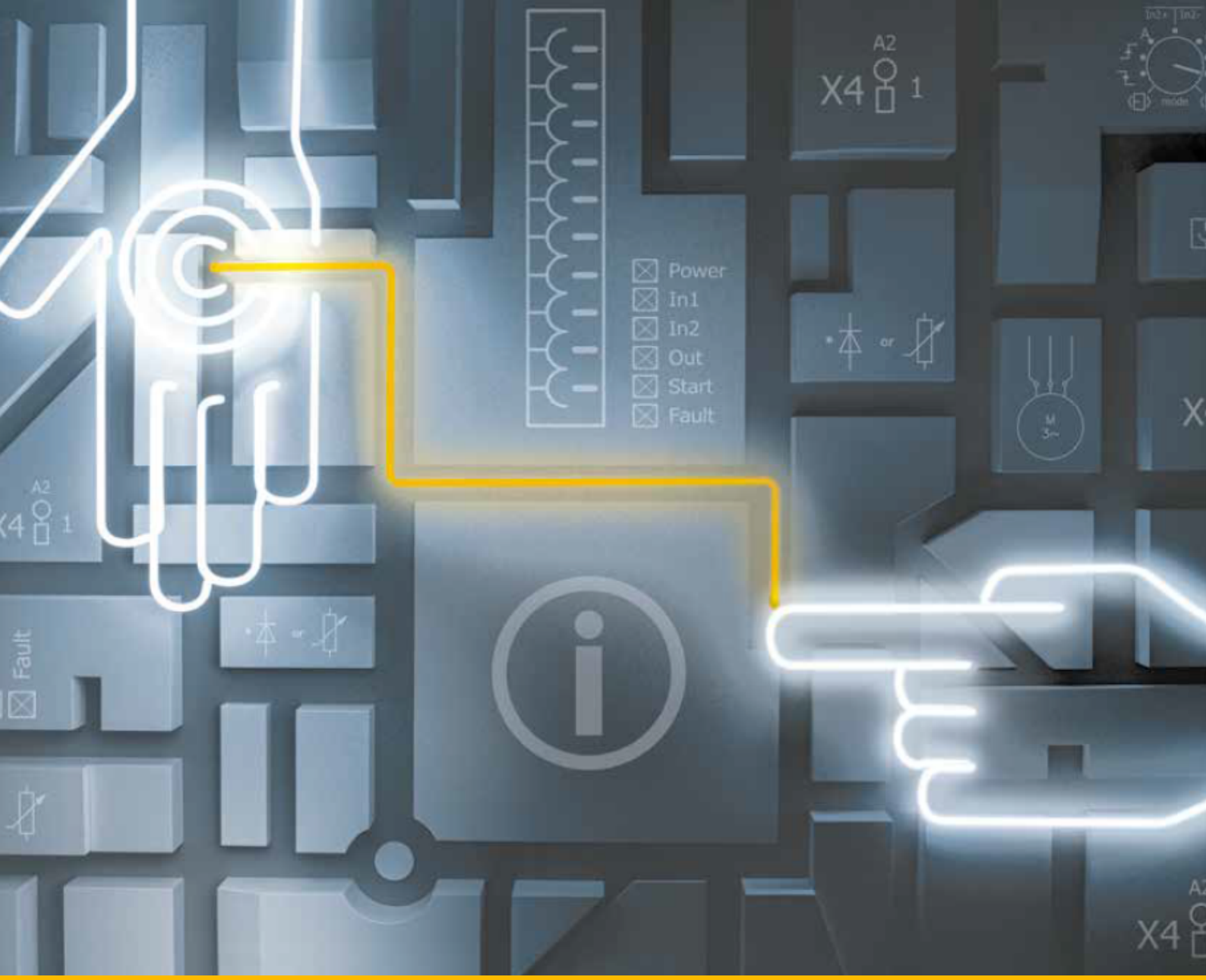


PDP67 PN 8FDIO 4IOLS

PILZ
THE SPIRIT OF SAFETY

Operating Manual-1006758-EN-03
- Decentralised field devices




This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PDP67 PN 8FDIO 4IOLS from Version HW 1.0, FW 1.0.0 .

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.

1.4 Symbols used on the product

	Caution hot surfaces This symbol indicates that the product may be hot. Only touch the product using suitable protective measures (e.g. wear protective gloves).

1.5 Abbreviations used

PII	Process image of inputs
PIO	Process image of outputs
IOL	Standard IO-Link
IOL**S**	IO-Link **S**afety
IOLD	IO-Link Device
IODD	IO Device Description, electronic device description of an IO-Link Device
PQI	Port Qualifier Information
DIO (SIO Mode)	Digital Input Output (SIO Mode) (SIO Mode) = Operating mode of an IO-Link port in compliance with the digital inputs and outputs defined in IEC 61131-2.

2 Overview

2.1 Product features

Application of the product PDP67 PN 8FDIO 4IOLS:

Device with IO ports and IO-Link Safety ports for use in a rugged industrial environment up to protection type IP69K, to connect the system to PROFINET with PROFIsafe profile.

The product has the following features:

- PROFINET interface with PROFIsafe profile
- PROFINET Conformance Class C
- Supports IRT/ RT
- Data set I&M 0-4
- Shared Device
- MRP
- Web application with the following functions:
  - Display device information
  - Display diagnostics
  - Display and configure network settings
  - Perform a wiring test
  - Perform a firmware update
- Optional PDP67 removable data medium for a microSD card to store the device project and naming data
- Reset button
  - For original reset
  - For warm reset
  - For bootloader mode (a firmware update can be performed)
  - To transfer the naming data and/or device project from the microSD card to the device memory
- LEDs for:
  - Switch status per input/output
  - IO-Link communication display
  - Device status display
- LEDs for:
  - PROFINET status
  - PROFIsafe status

IO ports

- Up to 8 type 1/3 FS inputs in accordance with IEC 61131-2 distributed over 4 ports (X01 … X04) when ports are configured as FS inputs (default configuration)

- Up to 8 1-pole digital FS outputs distributed over 4 ports (X01 … X04) when ports are configured as FS outputs
- Up to 8 1-pole ST outputs distributed over 4 ports (X01 … X04) when ports are configured as ST outputs
- Properties of FS inputs:
  - Configurable input filter time: 0 … 10.0 ms
  - Configurable pulse stretching: 0 … 255 ms
  - Configurable discrepancy monitoring 10 … 30000 ms
  - Configurable switch-on delay time 0 … 5000 ms
  - Configurable bounce monitoring time 1 … 30 s
- Properties of test pulse outputs:
  - Current load capacity: 0.5 A
  - Semiconductor technology
  - Overload-proof
  - Configurable max. test pulse duration: 0.3 … 10.0 ms
  - Short circuit proof
  - Can be configured either as:

    Test pulse outputs (default configuration)

    ST outputs

    Voltage outputs (24 VDC)

    Switched-off outputs (HiZ)
- Properties of ST outputs:
  - Current load capacity per output: 0.5 A
  - Semiconductor technology
  - 1-pole
  - Positive-switching
  - Short circuit proof
- Properties of 1-pole FS outputs:
  - Current load capacity per output: 2 A
  - Semiconductor technology
  - 1-pole
  - Positive-switching
  - Short circuit proof
  - Overload-proof
  - Configurable switch-off delay
  - Configurable on/off tests
  - Configurable repetition time of the on tests

IO-Link Safety ports

- IO-Link Master in accordance with the specification "IO-Link Interface and System V1.1.3" IO-Link Safety in accordance with the specification "IO-Link Safety System Extensions V1.1.4 (issued June 2024)"
- 4 IO-Link (Safety) ports (X05 … X08) for connecting 4 IO-Link (Safety) devices or 4 sensors / 4 actuators respectively
- Voltage outputs L+/L- for sensor and actuator supply
- Supported transmission rates:
  - COM1 (4.8 kBd)
  - COM2 (38.4 kBd)
  - COM3 (230.4 kBd)
- Up to 32 bytes of process data per port
- Device configuration saved in the master
- The following IO-Link operating modes [📖 21] are supported

NOTICE

Up to 25 Bytes of safe process data can be transferred with IO-Link Safety.

Ensure that the higher level controller (PROFIsafe F-Host) supports the transfer of at least as many "Bytes of safe process data" as the IO-Link Device with the most safe process data.

2.2 Front view

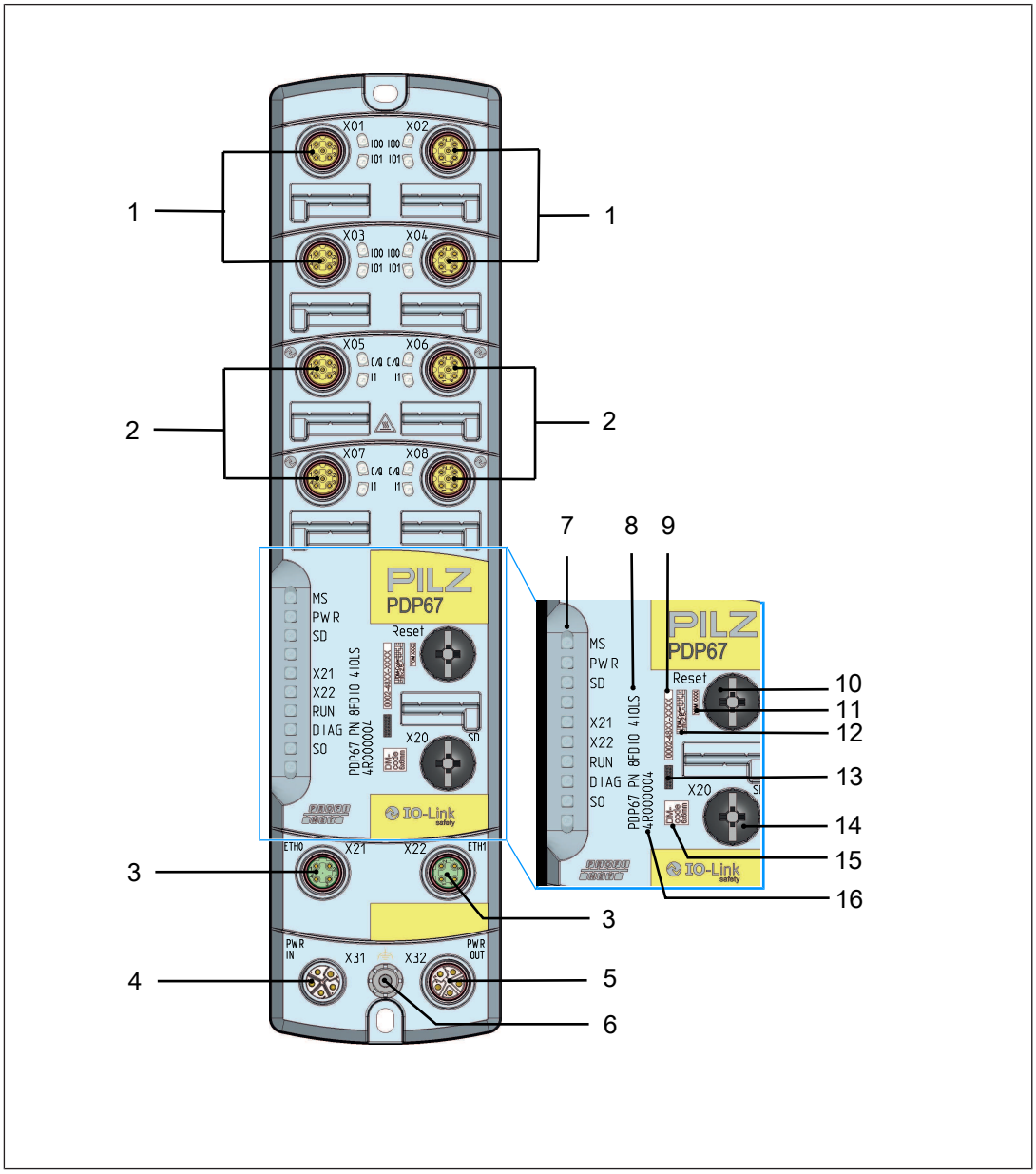


Fig.: PDP67 PN 8FDIO 4IOLS

Legend

1 Hybrid ports X01, X02, X03, X04
- FDIO type: 2 FS inputs or 2 FS outputs, 1-pole
- SDO type: 2 ST outputs

2 Ports X05, X06, X07, X08
- IOLS type: IO-Link Safety port

3 Ports X21, X22
- ETH0 / ETH1 type: Fieldbus interface for PROFINET with PROFIsafe profile

4 Port X31
- PWR type: Supply voltage connection

5 Port X32
- PWR type: Connection for forwarding the supply voltage

6 Functional earth connection

7 Status LEDs

8 Product name

9 Field for MAC address

10 Reset button

11 Field for year of manufacture

12 Field for 2D code 11x2.5 mm

13 Field for serial number

14 Connection for PDP67 removable data medium

15 Field for 2D code 5x5 mm

16 Order number

2.3 Scope of supply

- PDP67 device PDP67 PN 8FDIO 4IOLS with:
  - End cap for the PDP67 removable data medium connection (installed)
  - End cap for the reset button (installed)
  - 2 x M4 locking washers for the functional earth (installed)
  - 1 x M4 screw for the functional earth (installed)
  - Grounding strap (enclosed)
  - Protective sleeve (for safety during transportation) for connector X31 (installed)

3 Safety

3.1 Intended use

The device PDP67 PN 8FDIO 4IOLS is suitable for use in a rugged industrial environment up to protection type IP67/IP69K. It may not be used in a potentially explosive area.

Protection type IP65/IP67/IP69K is only guaranteed when the following conditions are met:

- The housing is not damaged.
- Open plugs/sockets are closed using circular connectors or end caps (the circular connectors/end caps must conform to the corresponding IP class).
- The circular connectors or end caps are tightened with the specified torque.

The device is intended for use in

- Safety-related applications with
  - PROFINET with PROFIsafe profile
  - IO-Link sensors and actuators with IO-Link Safety
- Non-safety-related applications with
  - PROFINET
  - IO-Link sensors and actuators

For safety-related applications with IO-Link, the following must be guaranteed:

- The IO-Link Safety port must be operated in the operating mode IO-Link Safetycom (see IO-Link Safety port configuration [60]).
- The connected IO-Link device (sensor or actuator) must support IO-Link Safety.

Intended use includes making the electrical installation EMC-compliant. The device is designed for use in an industrial environment. Interference may occur if used within a domestic environment.

The following is deemed improper use in particular

- Any component, technical or electrical modification to the device,
- Use of the device outside the areas described in this operating manual,
- Any use of the device that is not in accordance with the technical details.

The product PDP67 PN 8FDIO 4IOLS may only be used in applications where the de-energised state represents the safe state.

With reference to the standard IEC 61131-2 the values stated in the technical details for ambient temperature are reduced at heights >2000 m operating height above sea level (see Supplementary data [144]).

Guidelines for UL approval

UL Markings

- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Only for use in LAN, not for connection to telecommunication circuits.

3.1.1 Third-party manufacturer licence information

The product contains open source software, whose terms of use could further limit the product's application area. It is essential that you observe the third-party manufacturer licence information.

More detailed information is available by calling up the menu ***Support → Third-party manufacturer licences*** in the web application of the PDP67 PN 8FDIO 4IOLS.

3.2 Excluded environmental conditions

- Water or fluids with more stringent conditions than IP65/IP67/IP69K
- Chemicals
- Harmful substances
- Vandalism

3.3 Safety regulations

3.3.1 Safety assessment

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

3.3.2 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, decommissioned and maintained by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

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 the section entitled Safety
- Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.3.3 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 or

- Operating personnel are not suitably trained.

3.3.4 Disposal

- In safety-related applications, please comply with the mission time T_M stated 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).

3.4 System requirements

INFORMATION

The device is supported by

- PASconfig from version 6.1.0
  - We recommend that you always use the latest version (download from www.pilz.com).

4 Security

To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall industrial security concept that is state of the art.
Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures with care. If necessary, seek advice from Pilz Customer Support.

4.1 Implemented security measures

- The web application is protected against unauthorised access by a password prompt.
- The password is saved in an encrypted format.
- If a password is changed, you will be prompted to enter the old password for authentication.
- A user will automatically be logged out of the web application after 10 minutes of inactivity.
- Defend against CSRF attacks (Cross-Site Request Forgery) by assigning a unique token to a session.
- No firmware downgrades are allowed. This prevents outdated firmware with vulnerabilities from being loaded onto the product.
- The firmware is signed.
- Security entries are displayed in the diagnostics (e.g. login/logout, password changes…).

4.2 Required security measures

- The configuration computer that accesses the product has to be protected from attacks by a firewall or other suitable measures. We recommend that a virus scanner is used on this configuration computer and updated regularly.
- If necessary, protect the configuration computer and the product from unauthorised use by assigning passwords and taking further measures if required. We also recommend that the user logged on to this configuration computer does not have administrator rights.
- Protect the product from unauthorised data exchange via the network by using a firewall or providing other appropriate measures. Only allow the data exchange that’s required for the application. Any data exchange that is not required for the application must be prevented by the firewall.
- Only assign strong passwords and handle the passwords carefully. Be guided by generally accepted guidelines such as NIST 800-63b for example.
- As soon as possible, install firmware updates that Pilz provides for the product.
- Log data may contain personal data. Only store exported logs on a storage medium that is adequately protected.
- Use only one USB memory from a secure source. A manipulated USB memory could compromise the system.
- Only use SNTP Servers (Simple Network Time Protocol) from a secure source to receive the time/date. A manipulated SNTP Server could compromise the system.
- Only use IODDs from a secure source (e.g. the website www.io-link.com, or the website of the company supplying the IO-Link Device).

- Before disposal, the product must be safely decommissioned. To do this, all the data must be deleted from the device.
  - Set the configuration back to its default settings or delete the configuration.
  - Switch off the product.
  - If the product includes a removable data medium, remove it and format it at the computer. Do not carry out a quick formatting. Alternatively, you can use a program to safely delete data or destroy the memory mechanically.

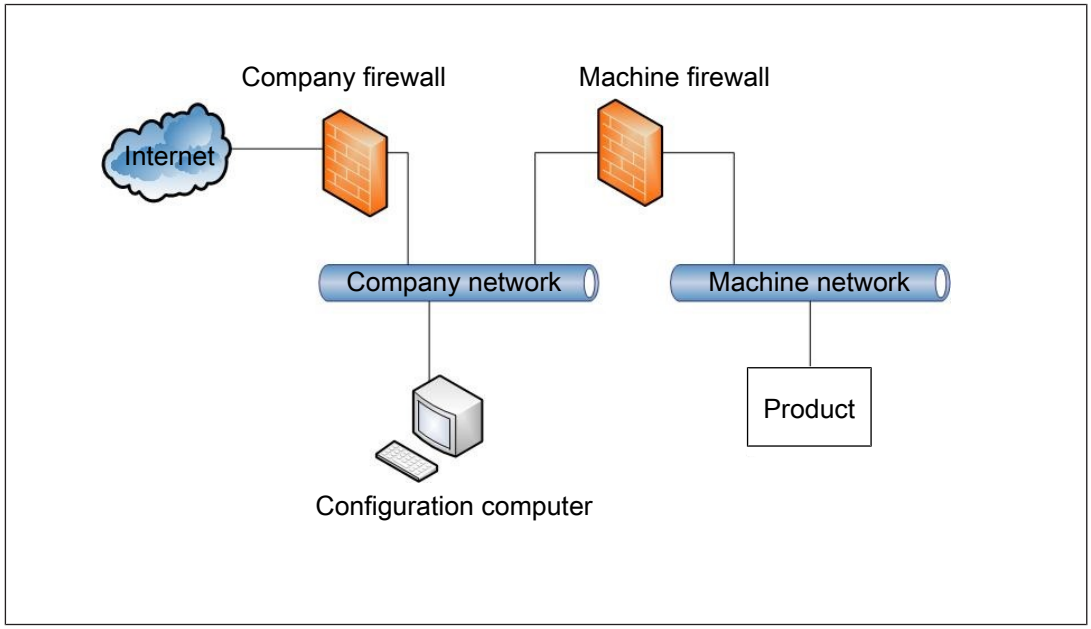


Fig.: Example network topology

- Note the network data [143] for risk analysis and the security measures.

5 IO-Link/IO-Link Safety basics

IO-Link Safety is based on IO-Link technology, standardised in IEC 61131-9. It specifies a single-drop digital interface (SDCI) for sensors, actuators and mechatronics. It extends the traditional switching inputs and outputs, as defined in IEC 61131-2, to include a point-to-point communication connection using coded switching.

IO-Link Safety is an extension of IO-Link. It provides an additional safety communication layer on both the master and device side, which therefore become the "IOLS Master" and "IOLS Device".

Further information on IO-Link and IO-Link Safety is available at www.io-link.com.

5.1 IO-Link basics

5.1.1 IO-Link overview

An IO-Link system basically consists of the following components:

- IO-Link Master

  The IO-Link Master establishes the connection between the IO-Link Devices and the automation system. As part of a peripheral system, the IO-Link Master is installed either in the control cabinet or as remote I/O, with protection type IP65/67/69K, directly in the field. The IO-Link Master communicates via various fieldbuses or product-specific back-plane buses. An IO-Link Master can have several IO-Link ports (channels). An IO-Link Device can be connected to each port (point-to-point communication). IO-Link is therefore a point-to-point communication and not a fieldbus.

- IO-Link Device

  e.g. sensors, RFID readers, valves, motor starters, IO modules

- Unshielded 3- or 5-wire standard cables (connection of devices to Master max. 20 m)

  M12 plug-in connectors, among others, are defined for the connection technology.

  Sensors usually have a 4-pin connector and actuators a 5-pin connector.

- Engineering tool for IO-Link configuration and parameter setting

5.1.2 IO-Link interface

IO-Link is a serial, bidirectional point-to-point connection for signal transmission and power supply under any networks, fieldbuses and backplane buses.

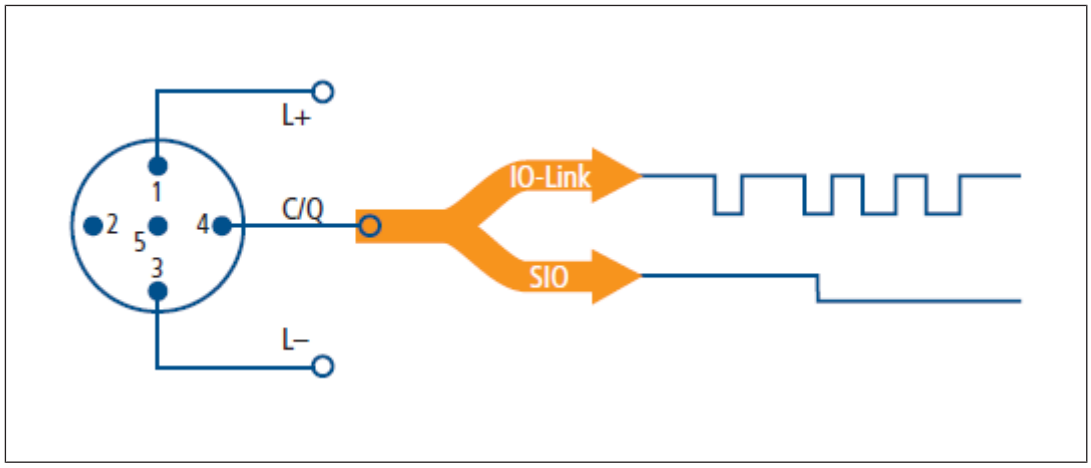


Fig.: Standardised (IEC 60974-5-2) pin assignment of IO-Link Device

Legend

1	Pin 1: 24 V
3	Pin 3: 0 V
4	Pin 4: Switching and communication line (C/Q)

Besides the IO-Link communication, these three pins are also used to supply the device.

Port types

The specification for IO-Link Master distinguishes between two types of ports:

Port Class A (Type A)

With this type, the functions of pins 2 and 5 are not specified. These functions are defined by the manufacturer. Pin 2 is usually assigned an additional digital channel.

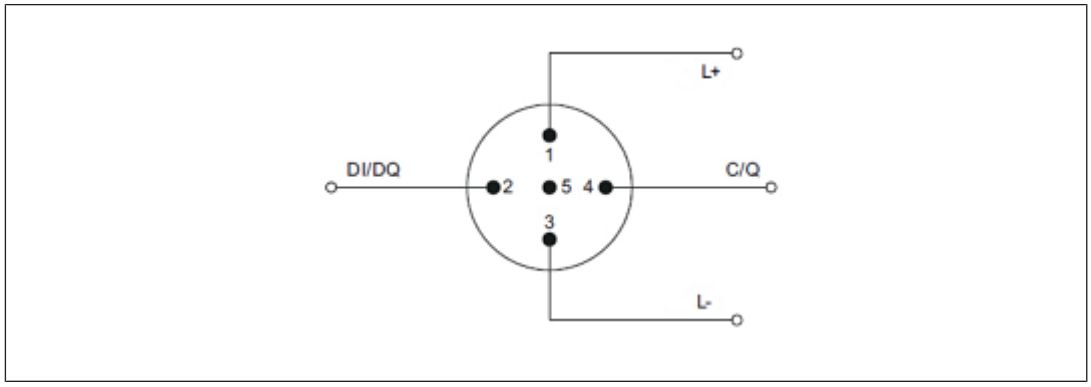


Fig.: Pin assignment Port Class A with M12 plug-in connector

Port Class B (Type B)

This type provides additional supply voltage and is suitable to connect devices that have an increased power requirement. Pins 2 and 5 provide an additional (galvanically isolated) supply voltage. A 5-core standard cable is required in order to use this additional supply voltage.

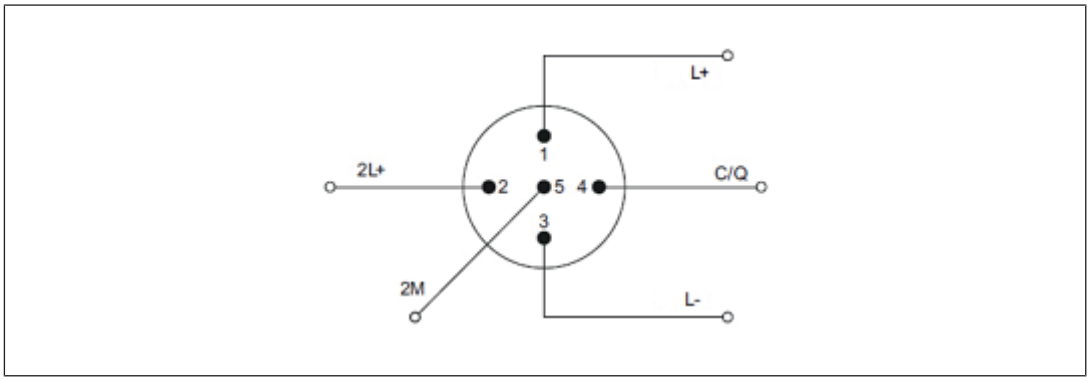


Fig.: Pin assignment Port Class B with M12 plug-in connector

5.1.3 IO-Link operating modes

Operating modes of the IO-Link Safety ports

The IO-Link Safety ports can be operated in the following **Operating modes**:

- **Deactivated**

  The port is not used.

- **IO-Link Manual**

  The IO-Link Master only accepts IO-Link Devices that match the set "Vendor ID" and "Device ID".

- **IO-Link Autostart**

  The IO-Link Master accepts any connected IO-Link Device.

- **SIO Digital Input (DI)**

  The port works as a standard digital input.

- **SIO Digital Output (DO)**

  The port works as a standard digital output.

- **IO-Link Safetycom**

  The port transfers IO-Link Safety process data.

Communication speed

The IO-Link Specification V1.1 specifies three data transfer rates (baud rates) for the IO-Link operating mode:

- COM 1 = 4.8 kBaud
- COM 2 = 38.4 kBaud
- COM 3 = 230.4 kBaud (optional in accordance with Specification V1.0)

An IO-Link Device supports only one of the defined data transfer rates. In accordance with Specification V1.1, the IO-Link Master supports all data transfer rates and automatically adapts to the data transfer rate supported by the device.

Reaction time of the IO-Link system

The reaction time of the IO-Link system provides information about the frequency and speed of data transfer between the device and Master. The reaction time depends on various factors.

A value for the device's minimum cycle time is stored in the device's device description file IODD[1]. This value indicates the time intervals in which the Master may address the device. The value greatly influences the reaction time. The Master also has an internal processing time, which is included when calculating the reaction time.

Devices with different minimum cycle times can be configured on one Master. The reaction time for these devices will vary accordingly.

- The reaction times for different devices on a Master can vary greatly.

In the Master's configuration, a fixed cycle time can also be specified in addition to the device-specific minimum cycle time stored in the IODD[1]. The Master then addresses the device in accordance with this specification. The typical reaction time for a device is therefore determined by the effective cycle time of the device and the typical internal processing time of the Master.

[1] IODD

IO Device Description, electronic device description

Transmission quality

IO-Link is a very robust communication system. This communication system operates at a 24 V level. If transmissions fail, the telegram is repeated two more times. Only when the second retry fails does the IO-Link Master detect a communication breakdown and signal this to the higher level controller.

5.1.4 Data exchange via IO-Link

An "IO-Link Master" and connected "IO-Link Devices" are required for IO-Link data exchange.

There is cyclical and acyclical data exchange.

Cyclical data exchange

Process data is usually transmitted cyclically.

In order to exchange the cyclical process data between an IO-Link Device and a controller, the IO-Link data from the IO-Link Master is placed in the previously set address ranges. The user program on the controller uses these address to access and then process the process values. Cyclical data exchange from the controller to the IO-Link Device (e.g. IO-Link actuator) is performed in reverse.

The devices' process data is transmitted cyclically in a data telegram, whereby the size of the process data is specified by the device. Process data from 0 to 32 Bytes per device is possible (each input and output). The consistency width of the transmission is not fixed and is thus dependent on the Master.

Acyclical data exchange

Diagnostic data, configuration data and events (e.g. faults, error messages) are usually transmitted acyclically.

Acyclical data is exchanged using a specified index and sub-index range. The controller uses system mechanisms to access it (e.g. for online functions such as reading the status). Use of the index and subindex range allows targeted access to the device data (e.g. to reset the parameters of the device or Master during operation).

5.1.5 Starting the I/O system

Starting the I/O system

If the port on the Master is set to IO-Link mode, the IO-Link Master attempts to communicate with the connected IO-Link Device. To do so, the IO-Link Master sends a defined signal (wake up pulse) and waits for the IO-Link Device to respond.

Initially the IO-Link Master attempts to communicate at the highest defined data transfer rate. If unsuccessful, the IO-Link Master then attempts to communicate at the next lowest data transfer rate. The Device always supports only one defined data transfer rate.

When the Master receives a response, communication begins. The Master and Device exchange the necessary communication partners. If necessary, the parameters stored in the Master are transferred to the Device. The cyclical exchange of process data then begins.

5.1.6 Profile for IO-Link

Device profiles are currently defined for:

- Binary switching sensors

  The profiles for switching sensors are suitable for simple switching applications such as presence detection.

- Digital measuring sensors

  The digital measurement profiles are designed for measuring sensors that can provide values based on a physical unit such as temperature or pressure. These profiles allow IO-Link sensors to be integrated without particular knowledge of the sensor used.

- Devices with uniform system behaviour

  The device profile for uniform system behaviour defines minimum device identification, diagnostic and event data. IO-Link Devices that support this profile offer a uniform minimum level of system integration into the controller. This profile is also the basis for all other device profiles.

5.1.7 IODD and engineering

An electronic device description, the IODD file (IO Device Description), is available for each device. The IODD provides a wide range of information for system integration:

- Communication properties
- Device parameters with value range and default value
- Identification, process and diagnostic data
- Device data
- Text description

- Picture of the device
- Manufacturer’s logo

The structure of the IODD is the same for all devices from all manufacturers. The IO-Link configuration tools of the Master manufacturers always display the structure of the IODD in the same way. This guarantees that all IO-Link Devices are handled in the same way, regardless of the manufacturer.

Two different IODD versions are available for devices that support both V1.0 and V1.1 functionality.

IODDfinder

The IODDfinder is a cross-manufacturer, centralised IODD database. It provides the current IODDs from device manufacturers and offers users an information and download platform. The IODDfinder can be called up using any current browser at the following address: https://ioddfinder.io-link.com.

IO-Link Configuration Tool

Configuration tools are required to configure the IO-Link system. The IO-Link configuration tools of the Master manufacturers are able to read IODDs. The main tasks of the IO-Link Configuration Tool include:

- Assignment of devices to the Master’s ports
- Address assignment (I/O addresses of the process data) of the ports within the Master’s address range
- Setting the parameters of the IO-Link Devices

The connected devices also have diagnostic capability.

The IO-Link configuration tool therefore allows the IO-Link system to be represented transparently up to field level.

5.2 IO-Link Safety basics

5.2.1 IO-Link Safety principle

Safe communication via the standardised fieldbus protocol (FSCP) follows the "black channel" principle. This fieldbus is used as a carrier for a special type of message containing safety data and an additional safety code. The purpose of the safety code is to reduce the probability of residual error in the data transfer to the level required by the relevant safety standards such as IEC 61784-3, or better. The messages are processed on the fieldbus in the safety communication layer (SCL).

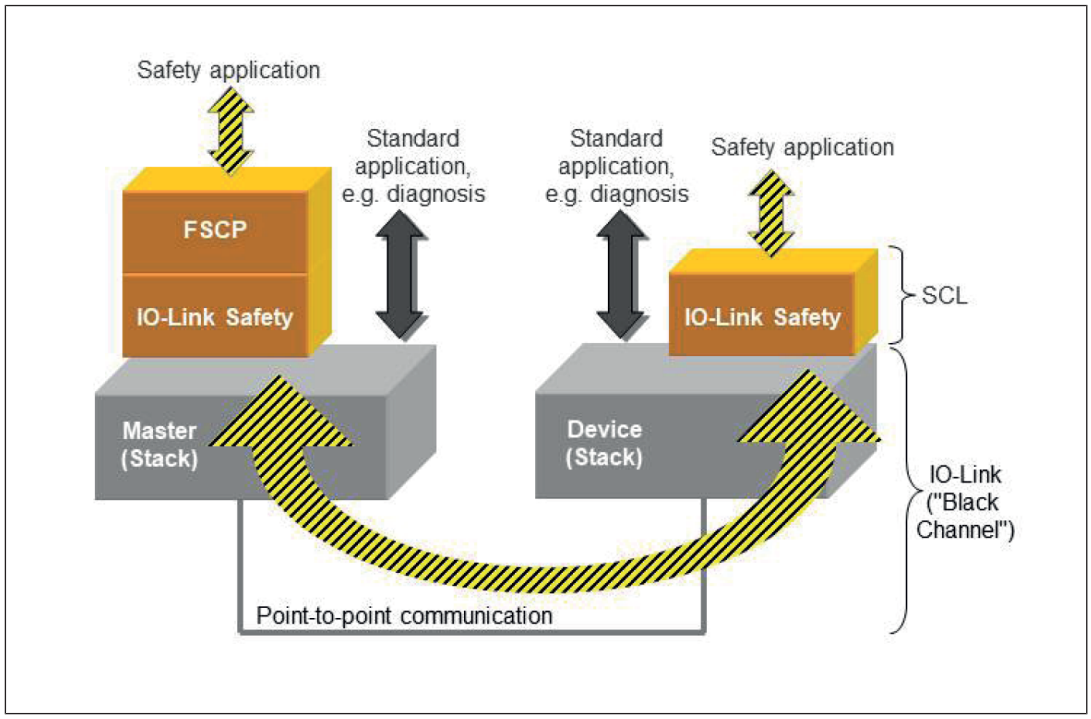


Fig.: IO-Link Safety principle

Legend

FSCP	Functional Safety Communication Profile Standardised safe fieldbus protocol (e.g. PROFINET with PROFIsafe profile)
SCL	Safety Communication Layer Safety communication layer
Stack	A stack is a protocol stack with a conceptual architecture of communication protocols. The data is transmitted over the network and processed by the stack's network protocol one by one.
Black channel	Communication channel without available evidence of design or validation according to IEC 61508 [IEC 61784-3] Principle: Procedure in which the integrity of a non-safety-related transmission channel is continuously monitored by a higher-level (functionally) safe protocol. For this purpose, a safety protocol is usually integrated between the safety application and the "non-safety-related" standard communication channel.

5.2.2 IO-Link Safety communication

Safety objectives

The residual error rate must be determined for three main characteristics of safe communication:

- Timeliness (data arrives in time)
- Authenticity (data from correct sender)
- Integrity (data is current and correct)

Numerous errors can occur when transmitting messages between the IOLS Master and IOLS Device. The following safety measures have been selected to reduce the probability of residual error during transmission to the level required by relevant standards, such as IEC 61784-3, or better. IO-Link Safety communication can therefore be used for safety functions up to SIL 3 or PL e.

Safety measures

The safety measures include:

- Numbering of messages between IOLS Master and IOLS Device. The IOLS Master uses a cyclical 3-bit counter. The IOLS Device has its own counter, synchronised when the protocol starts It responds with a one’s complement value.
- Time expectation with acknowledgment via "watchdog", which is incremented with a new count value each time an IO-Link Safety message arrives.
- Authentication at protocol start-up: IOLS Device is connected to the correct IOLS Master (unique FSCP connection ID) and correct IOLS Master Port ("PortNum"). Only "PortNum" is checked as part of each cycle.
- CRC signature (cyclic redundancy check) across process data and safety code.

IO-Link Safety uses the so-called explicit transmission of safety measures.

Formats and data types

Messages from the IOLS Master and IOLS Device consist of two parts:

- Process data (PD), optional, not safety-related process data
- Safety Protocol Data Unit (SPDU), contains safety-related process data

From IOLS Master to IOLS Device →

Process data (PD)	**Safety Protocol Data Unit (SPDU)**			
	Safety code			
Output PD	CRC signature	Control byte	PortNum	FS-PDaus
	Signature via FS-PDaus, Port-Num, and control & count	Contains 3-Bit counter	IOLS Master Port number	0 to 3 octet/ 0 to 25 octet
32 to 0 octet	2/4 octet	1 octet	1 octet	3/25 octet

← From IOLS Device to IOLS Master

Safety Protocol Data Unit (SPDU)				Process data (PD)
	Safety code			
FS-PDein	PortNum	Status byte	CRC signature	Input PD
	Port number inverted	Contains 3-Bit counter inverted	Signature via FS-PDein, PortNum, and control & count	
3/25 octet	1 octet	1 octet	2/4 octet	32 to 0 octet

Safety Protocol Data Unit (SPDU)

Safe input or output data (FS-PDaus/FS-PDein) can be coded as follows:

- BooleanT(Bits)
- IntegerT(16)
- IntegerT(32)

Most significant octets and/or bits are sent first. Padding bits are "0".

IO-Link Safety has two formats. One is intended for short process data, such as bits from shutdown operations, which need to be processed quickly. A maximum of 3 octets are available for this purpose. The other is intended for longer process data, such as measurement and setpoint values. A maximum of 25 octets are available for this purpose.

- **PortNum safety code (1octet)**

  This contains the port number that the IOLS Master knows, and one that the IOLS Device received during commissioning.

- **Control byte/status byte safety code (1octet)**

  This contains control and status bits to influence and synchronise protocol activities, as well as 3-bit cyclical counter values.

- **CRC signature safety code**

  This contains the CRC signature. For short SPDUs, a 16-bit CRC signature (2 octets) is sufficient; longer ones need a 32-bit CRC signature (4 octets).

Services

SPDU transmitters and receivers are located in layers above the "Black Channel" communication stack, see IO-Link Safety principle [📖 24]). The main components of the layer are specified as state machines. They control the regular cyclical processing of SPDUs and the exceptions, such as startup, power off/on and CRC errors.

More detailed information can be found in the IO-Link Safety System Description, see www.io-link.com.

5.2.3 Technology parameters

IODD (IO Device Description)

The IO-Link device description file (IODD) is the usual place where parameters and their range limits for a certain IOLS Device technology, such as light curtains, laser scanners, proximity switches… are described. They should carry the prefix "FST_". The user employs an IOLS Master Tool to assign parameter values during commissioning and testing.

The device description file for Pilz devices can be downloaded from the website www.pilz.com or generally from the IO-Link homepage.

5.3 Example system overview with IO-Link Safety

In the IO-Link Safety System it is possible to "communicate safely at field level":

- with IO-Link Safety Master
- and Devices for field level

As IO-Link Safety Master, the PDP67 PN 8FDIO 4IOLS handles communication via PROFINET/PROFIsafe to the higher-level controller. The following devices can be connected, for example:

- Standard IO-Link Devices, see IO-Link Safety ports [📖 60]
  - Info: Standard IO-Link Devices and IO-Link Safety Devices are connected to ports 05 … X08, only the configuration is different.
- IO-Link Safety Devices, safety sensors and control devices, see IO-Link Safety ports [📖 60]
  - Info: IO-Link Safety Devices and Standard IO-Link Devices are connected to ports 05 … X08, only the configuration is different.
- Safety switch, see IO ports (hybrid) [📖 44]
  - Info: The hybrid IO port X01 … X04 can be used as an FS input or FS output, depending on the configuration.

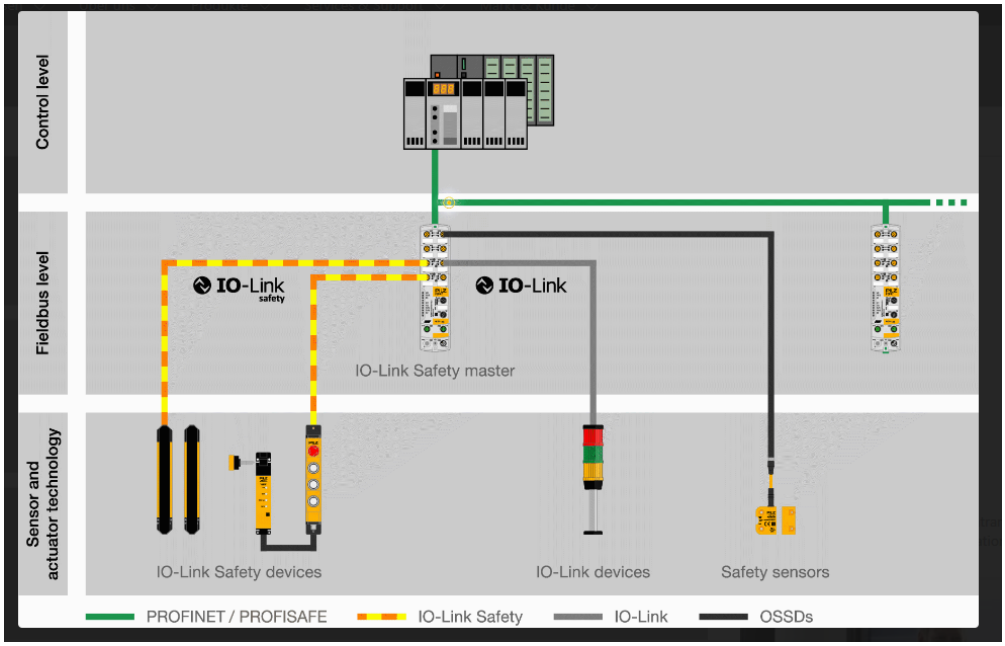


Fig.: System overview, by way of example

Legend

Control level	Higher-level PLC controller
Fieldbus level	**IO-Link Safety Master:**
	Pilz: PDP67 PN 8FDIO 4IOLS
Sensor and actuator technology	**Standard IO-Link Devices**
	e.g. indicator light unit
	IO-Link Safety Devices
	Pilz: safety light curtain: PSENopt II advanced IOLS
	Pilz: pushbutton unit: PITgatebox IOLS – on safety gate system PSENmlock
	Safety sensors
	Pilz: coded safety switch PSENcode

6 Function description

6.1 Device

6.1.1 Structure of device

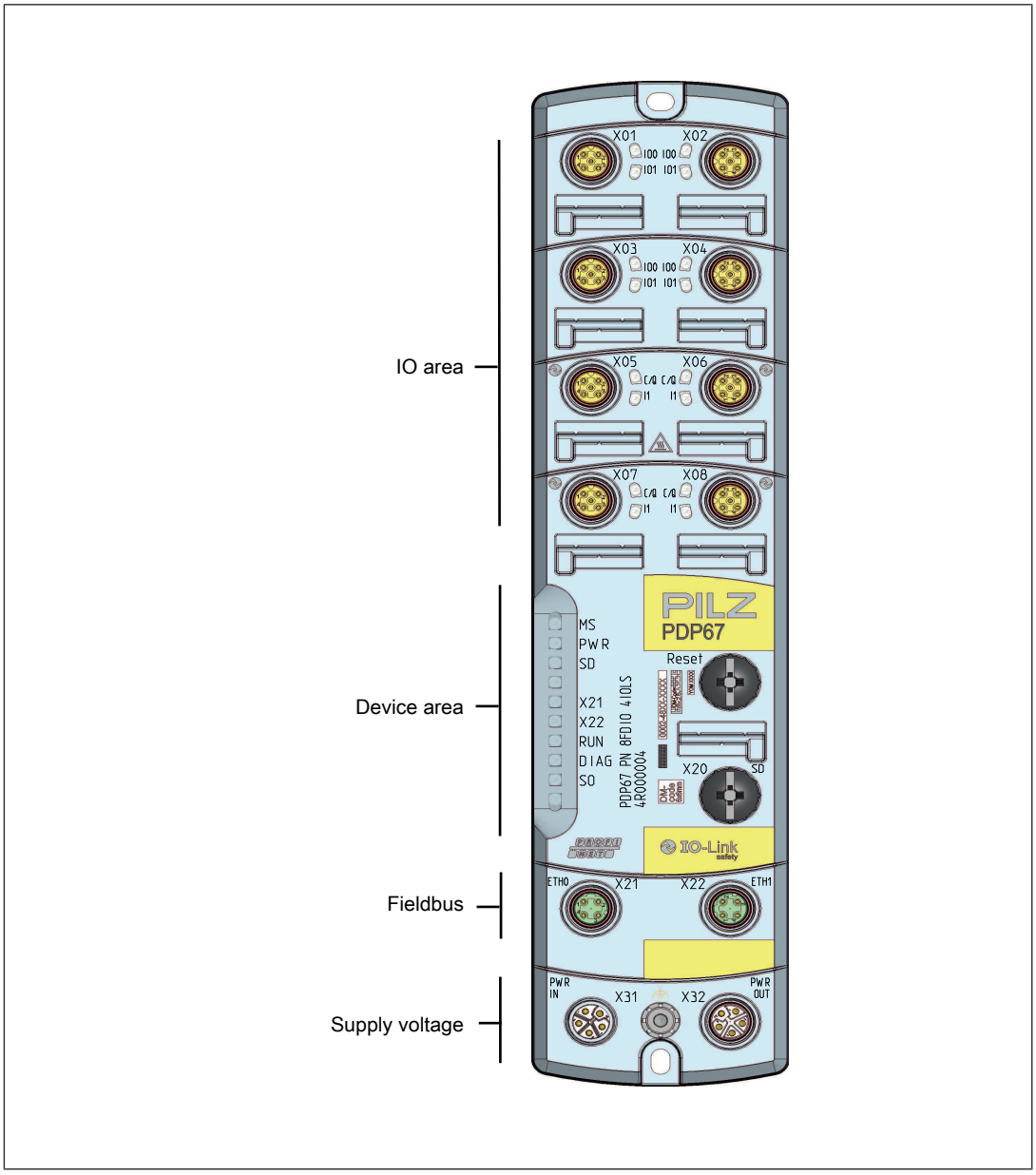


Fig.: Structure of PDP67 PN 8FDIO 4IOLS

- IO area [📖 44]:
  - **I/O ports (X01 ... X04)**
  - Status LEDs of IO ports
  - Replaceable inscription labels for the IO ports

- IO area [📖 44]
  - **IO-Link Safety ports (X05 … X08)**
  - Status LEDs on the IO-Link Safety ports
  - Replaceable inscription labels for the IO-Link Safety ports
- Device area [📖 31]:
  - Reset button with label
  - Port for connecting the PDP67 removable data medium (X20)
  - Device status LEDs
  - Replaceable inscription label for the device
- PROFINET with PROFIsafe [📖 65]:
  - 2 PROFINET ports (X21, X22)
- Supply voltages [📖 35]:
  - 1 port to feed the supply voltage (X31)
  - 1 port to distribute the supply voltage (X32)
  - Functional earth connection

6.1.2 Device area

6.1.2.1 Integrated protection mechanisms

The device has the following protection mechanisms:

- Multi-channel architecture
- Cyclical self tests
- Potentially isolated **PROFINET** interface
- Potentially isolated processor area
- Short circuit proof outputs
- Cyclical output tests
- Tests for shorts between a port's outputs
- Test pulse signals are always buffered for 20 ms.
- Supply voltage:
  - Polarity protection
  - Voltage monitoring

6.1.2.2 Reset button

The reset button is sealed with an end cap. To achieve protection type IP67/IP69K, the end cap must be fastened with a torque setting of 0.6 Nm. We recommend you use a torque screwdriver with PH3 bit.

Carrying out a warm reset (restart)

A warm reset is used to restart the device.

Procedure:

- Press the reset button for less than 5 seconds.

Performing a cold start/reboot command initiates the following procedure:

- Processing is aborted

  All LEDs are switched off.
- System is initialised

  Device is ready for operation and the "MS" LED flashes green.
- System switches to "Operational" state

  Device is in operation and the "MS" LED lights up green.
- Entry is made in the diagnostic log

Impact after a restart:

- Inputs retain their current input values
- Substitute values are used for the outputs until the connection to the controller has been re-established.

Transfer device project from the PDP67 removable data medium to the device

Prerequisites

- A PDP67 removable data medium with a microSD card must be installed on the device.
- The microSD card may not be empty or defective.
- The device project on the microSD card must match the product type.

Procedure:

- Press the reset button for more than 5 seconds. The SD LED flashes yellow.
- Release the reset button, then press and release it again within 10 seconds.
- The device project is transferred from the microSD card to the device.
- Once the device project has been transferred the device has the IP address 0.0.0.0.

If the required files are not on the microSD card, the device exchange scenario is not performed and an entry is written in the diagnostic log.

If no microSD card is inserted, an original reset is performed.

Performing an original reset

Procedure:

- Press the reset button for more than 5 seconds. The SD LED flashes yellow.
- Release the reset button, then press and release it again within 10 seconds. If the reset button is not pressed and released within 10 seconds, then the reset request is rejected.
- The device preforms an original reset.

If the microSD card contains a valid configuration then this will be transferred through the original reset (see Transfer device project).

Effects of the original reset:

- ST and FS configuration data is deleted.
- PROFINET Factory Reset is performed.
- Diagnostic log is not deleted.

- Device restarts automatically.

Bootloader mode

In bootloader mode, a firmware update can be performed via PASconfig with signed firmware versions. The status LEDs indicate bootloader mode (see display elements, Module status [123]).

After a failed firmware update, bootloader mode can be started in order to perform another firmware update.

Start bootloader mode

(The device must be switched off.)

Procedure:

- Press and hold the reset button
- Switch on the device at the same time (device supply 0V -> 24 V)
- Release the reset button when the MS-LED flashes yellow

Exit bootloader mode

- Warm reset (restart)

6.1.2.3 PDP67 removable data medium (available as an option)

Fig.: PDP67 removable data medium

The PDP67 removable data medium is available as an accessory (order number: 4R000002). It can be used to store the configuration data on the supplied microSD card.

- Scope of delivery:
  - PDP67 removable data medium
  - MicroSD card with 512 MB

Installing the PDP67 removable data medium

Ensure that the microSD card is inserted correctly before tightening the end cap. If the end cap is tightened when the microSD card is positioned incorrectly, the microSD card or PDP67 removable data medium may be destroyed.

- Switch off the power to the device to avoid losing data.
- Hand-tighten the end cap to ensure protection type IP65/67. The end cap should not be opened and closed more than 10 times so as not to lose protection type IP65/67.
- Using a torque wrench (width across flats 13 mm), tighten the PDP67 removable data medium to 0.6Nm at port X20 to ensure protection type IP65/67 (torque wrench: Conec 36-000200 for example).

The PDP67 removable data medium can be installed and removed at least 100 times without losing contact security and protection type IP65/67.

Removing the PDP67 removable data medium

- Switch off the power to the device to avoid losing data.
- Unscrew the PDP67 removable data medium using a wrench with 13 mm width across flats.

Inserting the microSD card

- Turn the microSD card so that the contacts on the microSD card are facing upwards when you insert it into the PDP67 removable data medium.
- Slide the microSD card into the slot on the PDP67 removable data medium until you hear it lock into position.

If you use the optional removable data medium, then data that is relevant for the device exchange will be stored on the data medium.

NOTICE

The microSD card includes safety data. Ensure that the microSD card is plugged in before commissioning. After commissioning, use PASconfig to check the system's FS check sum on the microSD card. It must match to the FS check sum of the configured system. To ensure that final data is stored on the data medium, do not remove the microSD card before completing the check.
Protect the microSD card from unauthorised access.

When a device is changed, the stored data can be copied over using the reset button (see Reset button [📖 31]).

Removing the microSD card

- Unscrew the end cap. If you are using several devices with end caps, make sure that you don't mix up the labelled end caps.
- Press lightly on the microSD card until it releases and then use your fingers to pull the microSD card out of the PDP67 removable data medium.

Labelling the PDP67 removable data medium

You can label the PDP67 removable data medium on the labelling strip provided.

6.1.3 Supply voltages

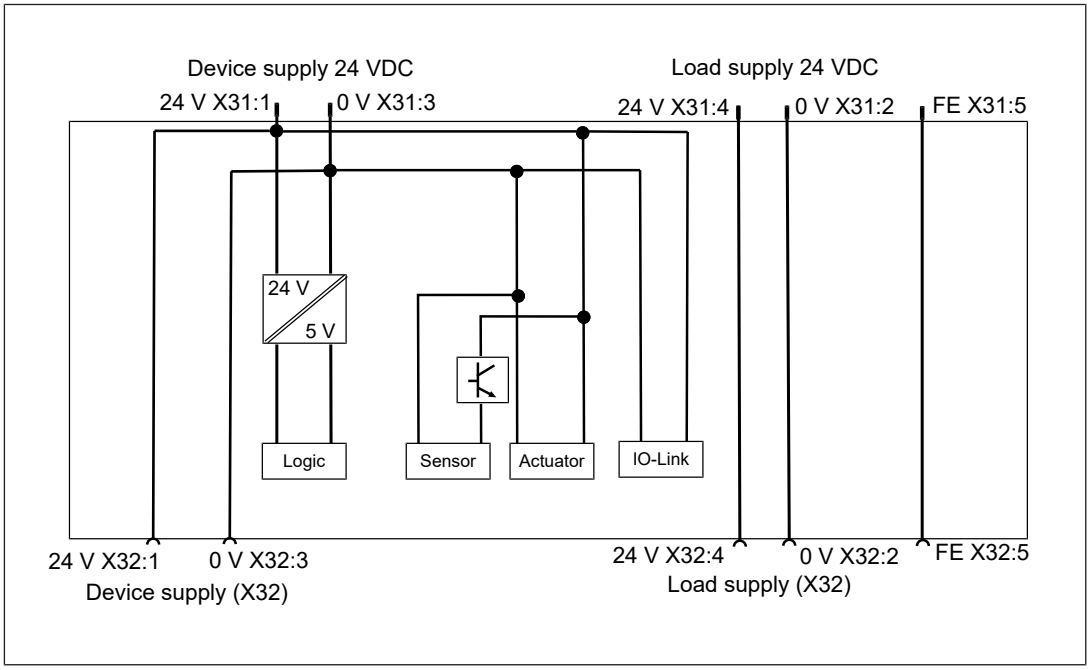


Fig.: Supply voltage

Device supply and load supply

The supply voltages are fed in at port X31 (for assignment see Connecting the supply voltage [📖 114]). Port X32 is used to forward the supply voltage to other devices.

- Device supply

  The voltage to supply the device is generated internally from the device supply.

  The sensor supply potentials of the IO ports (X01 … X04) are buffered independently of each other so that power failures of up to 20 ms can be bridged. The buffering is designed for the input currents.

- Load supply

  The load supply is not used internally.

- The potentials for the device supply and load supply are galvanically isolated within the device.

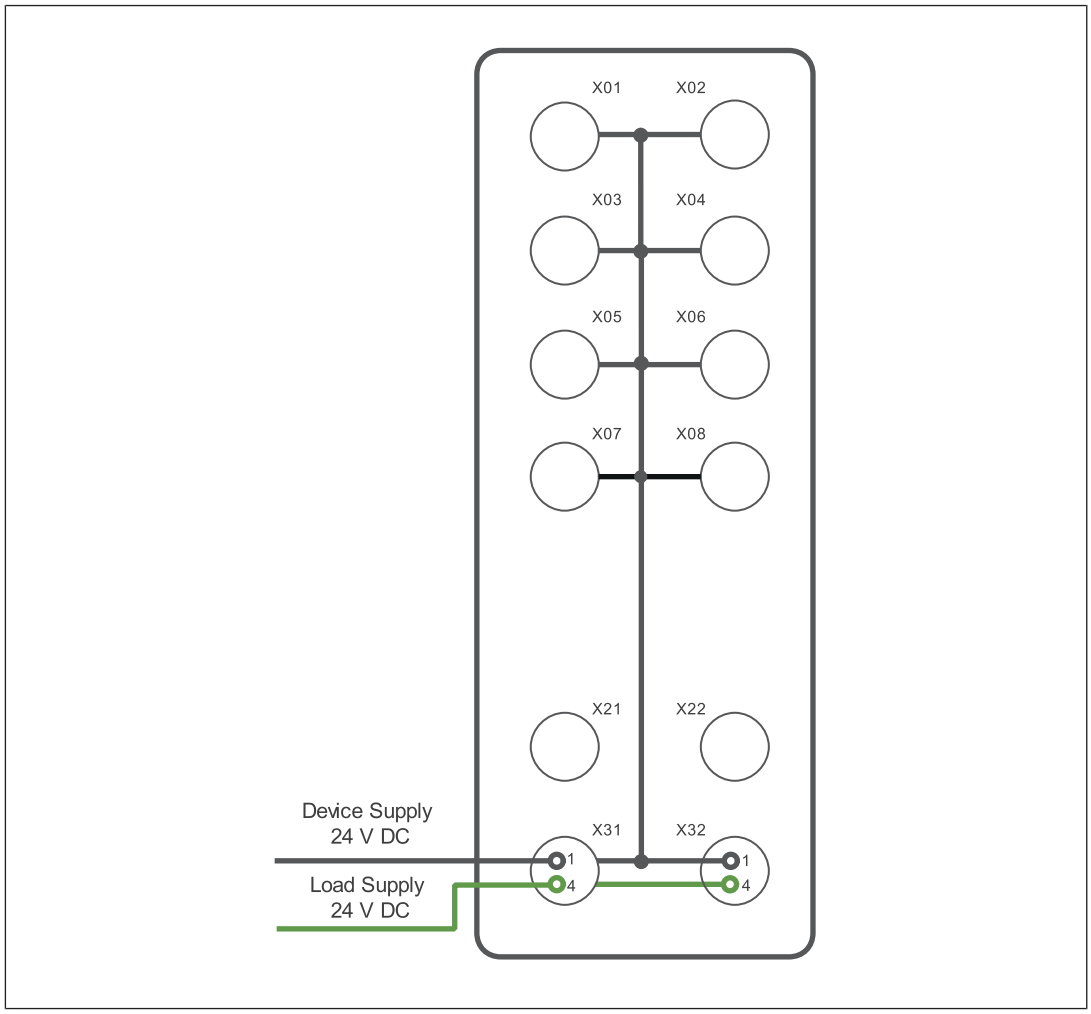


Fig.: Supply voltage per plug-in connector

6.1.4 Derating diagram

The relationship between the load current at the device supply and the operating temperature is illustrated in the following derating diagram. The device supply is limited to a maximum of 16 A.

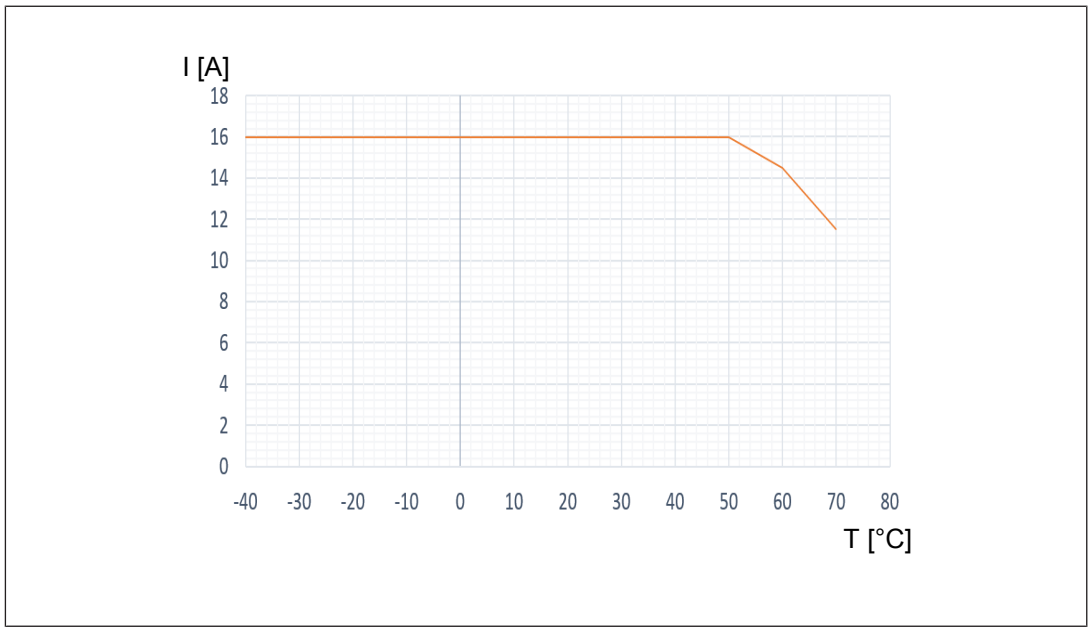


Fig.: Derating diagram for the device supply

6.1.5 Derating values for UL approval

UL Markings

Current derating for UL application

	Temperature up to	40 °C	50 °C
Device Supply (DS)	Maximum current of outputs connected to DS	9 A	6 A
	Maximum input current over X31	10.2 A	7.2 A

6.1.6 Reaction times

6.1.6.1 General

Calculating the reaction times of a safety function:

$$SFRT = \sum_{i=1}^{n} WCDT_i + \max\left(WDTime_i - WCDT_i\right)$$

Fig.:

Legend

SFRT	Safety Function Response Time Reaction time of a safety function
$WCDT_i$	Worst Case Delay Time Maximum processing time of an entity involved in the data flow
$WDTime_i$	Watchdog Time Maximum time from the moment an error occurs in an entity until the next entity in the data flow continues processing with safe substitute values. For multi-channel entities, the WDTime usually corresponds to the OFDT.
$OFDT_i$	One Fault Delay Time Maximum time from the moment an error occurs in an entity until the entity provides safe substitute values to the next entity in the data flow.

Minimum pulse duration

To ensure that a signal is safety read in and processed in the processing entity, it must be present at the input at least during the minimum pulse duration. The minimum pulse duration corresponds to the SFRT of the entities involved in the data flow, from the input up to and including the entity in which the data is processed.

6.1.6.2 PROFIsafe

The following device-specific parameters (PDP67 PN 8FDIO 4IOLS), needed for the PROFINET transfer, are required in order to determine the values for WCDT and WDTime:

- DAT

  Device Acknowledge Time

- $WCDT_{PN\_PDP67}$

  Worse Case Delay Time for the transfer of PROFINET process data in the PDP67 PN 8FDIO4IOLS

The WCDT_PN_Delay must be taken into account in both the transmit and receive directions.

6.1.6.2.1 DAT

DAT_{FDIO}

DAT for process data from FDIOs

(FDIOs: digital FS inputs, 1-pole FS outputs)

DAT_{FDIO} = 4 ms

DAT_{IOLS}

DAT for process data from IOLS devices

DAT_{IOLS} = 7 ms

6.1.6.2.2 WCDT_PN_Delay

WCDT_PN_Delay = 6 ms

6.1.6.3 FS inputs

FDI

Calculation of the processing times for dual-channel signals.

Worst Case Delay Time (WCDT) input

Calculation of the time between a signal changing at the input and the signal being available at the fieldbus interface:

$WCDT_{Input} = 7\ ms + t_{TestPulse} + t_{SW\text{-}Filter} + t_{Discr} + t_{Delay} + t_{Bounce}$

$t_{TestPulse}$: Configured test pulse duration

$t_{SW\text{-}Filter}$: Configured software filter time (see "Software filter time" in the Technical details [📖 131])

t_{Discr}: Configured discrepancy time

t_{Delay}: Configured switch-on delay

t_{Bounce}: Configured bounce time

- When test pulses are deactivated

  $t_{TestPulse} = 0$

- When discrepancy monitoring is deactivated

  $t_{Discr} = t_{Delay} = t_{Bounce} = 0$

- When discrepancy monitoring is activated and discrepancy behaviour is "Set value to zero"

  Signal changes from "1" to "0":

  $t_{Discr} = t_{Delay} = t_{Bounce} = t_{TestPulse} = 0$

  Signal changes from "0" to "1":

  t_{Discr}: Configured discrepancy time

  t_{Delay}: Configured switch-on delay

  t_{Bounce}: Configured bounce time

- When discrepancy monitoring is activated and discrepancy behaviour is "Keep last valid value"

  Signal changes from "1" to "0"

  $t_{Delay} = t_{Bounce} = 0$

  t_{Discr}: Configured discrepancy time

  Signal changes from "0" to "1":

  t_{Discr}: Configured discrepancy time

  t_{Delay}: Configured switch-on delay

  t_{Bounce}: Configured bounce time

One Fault Delay Time (OFDT) input

Calculation of the time between a signal changing at the input and the signal being available at the fieldbus interface when a fault occurs:

$OFDT_{Input} = WCDT_{Input}$

6.1.6.4 FS outputs

FDO

Calculation of the processing times for dual-channel signals.

Worst-Case Delay Time (WCDT) output

Calculation of the time between the signal being received at the fieldbus interface and the output switching:

$WCDT_{Output}$ = 5 ms + t_{Out_Delay}

t_{Out_Delay}: Output's configured switch-off delay

One Fault Delay Time (OFDT) output

Calculation of the time between the signal being received at the fieldbus interface and the output switching when a fault is present:

$OFDT_{Output}$ = $WCDT_{Output}$

6.1.6.5 IO-Link

6.1.6.5.1 FSP_Watchdog

The time expectation of IO-Link Safety is monitored by a watchdog (FSP_Watchdog). To achieve maximum system availability, the watchdog's time value must be calculated as follows and written to the corresponding ports and device parameters.

It is possible to set a lower value to improve the reaction times. Setting a lower value can impair the availability of the IO-Link system; safety remains guaranteed.

The time value is calculated as follows:

FSP_Watchdog = 1.1 * (11 * MCT + DPT)

FSP_Watchdog: Time value for the IO-Link Safety watchdog

MCT: Master cycle time

DPT: Device processing time, value of the FSP_Watchdog parameter in the IODD of the IO-Link Device

6.1.6.5.2 MPT

MPT = 4 * MCT

MPT: Master processing time, corresponds to the maximum processing time of the IO-Link Safety Master, from the time that safety-related data is received from the IO-Link Safety Device (SPDU), to the time that new safety-related data (SPDU) is sent to the IO-Link Safety Device.

MCT: Master cycle time

6.1.6.6 IO-Link Input

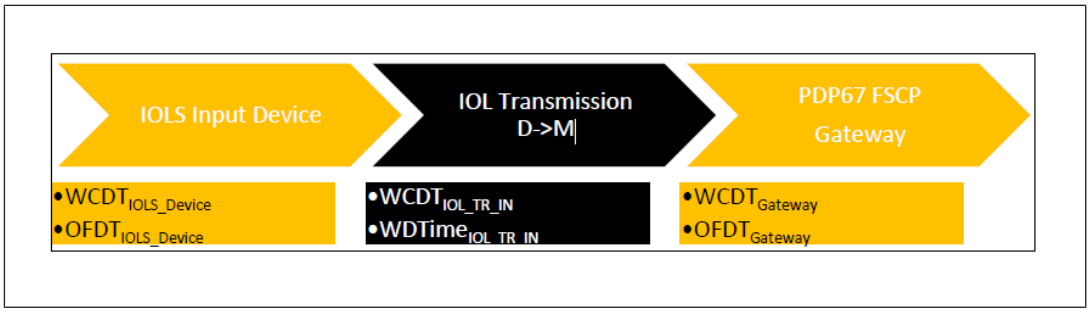


Fig.: IO-Link Input reaction times

6.1.6.6.1 WCDT_IOLS_Device

From the operating manual of the IO-Link Safety Device.

6.1.6.6.2 OFDT_IOLS_Device

From the operating manual of the IO-Link Safety Device.

6.1.6.6.3 WCDT_IOL_TR_IN

WCDT_IOL_TR_IN = 4 MCT + FSP_Watchdog + 2 ms

6.1.6.6.4 WDTime_IOL_TR_IN

WDTime_IOL_TR_IN = 2 FSP_Watchdog + 8 MCT + 2 ms

6.1.6.6.5 WCDT_Gateway

WCDT_Gateway = 7 ms

6.1.6.6.6 OFDT_Gateway

WCDT_Gateway = 7 ms

6.1.6.7 IO-Link Output

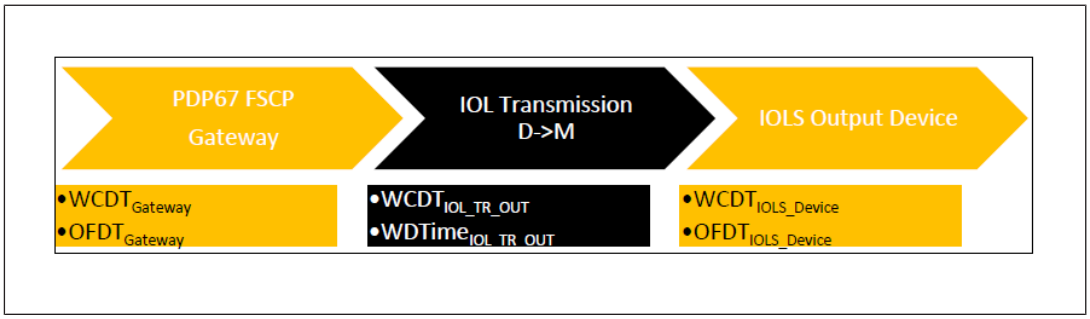


Fig.: IO-Link Output reaction times

6.1.6.7.1 WCDT_Gateway

WCDT_Gateway = 7 ms

6.1.6.7.2 OFTD_Gateway

OFTD_Gateway = 7 ms

6.1.6.7.3 WCDT_IOL_TR_OUT

WCDT_IOL_TR_OUT = 3 MCT + FSP_Watchdog + 2 ms

6.1.6.7.4 WDTime_IOL_TR_OUT

WDTime_IOL_TR_OUT = 2 FSP_Watchdog + 3 MCT + DPT + 2 ms

6.1.6.7.5 WCDT_IOLS_Device

From the operating manual of the IO-Link Safety Device.

6.1.6.7.6 OFDT_IOLS_Device

From the operating manual of the IO-Link Safety Device.

6.1.7 Firmware update

- The firmware update can be performed via the web application [89] or via the configuration tool (PASconfig). The firmware is signed.
  - Update was successful
    The product adopts the firmware and informs the initiator of the firmware update that it has been completed successfully.
  - Update was unsuccessful
    The product informs the initiator of the firmware update that the update has failed and issues an error message.
    The product does not adopt the firmware and, at the next reset, restarts with the original firmware. Alternatively, you can switch to bootloader mode to perform another firmware update (see Reset button [31]). The firmware update in bootloader mode can only be performed via PASconfig.

6.2 IO area

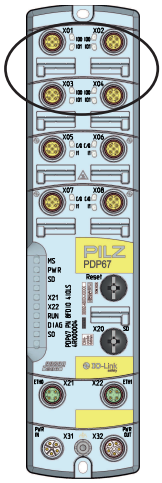
The device has 4 hybrid IO ports and 4 IO-Link Safety ports.

6.2.1 IO ports (hybrid)

The device has 4x 2 FS inputs in its default configuration.

The IO ports named X01 … X04 can be used as an FS input or FS output, depending on the configuration. These IO ports are called hybrid IO ports.

The digital hybrid ports have the following configuration options

PDP67 PN 8FDIO 4IOLS	IO ports (hybrid)	Configuration options
	X01 X02 X03 X04	2 FS inputs (default configuration) Plus optional: 2 ST outputs (see Test pulse outputs [📖 53]) (configuration as FS inputs, test pulses can be used as 24 VDC ST outputs if they are not assigned to an input)
		2 FS outputs, 1-pole

6.2.1.1 Digital FS inputs

Depending on the configuration, the device has up to 8 type 1/3 FS inputs in accordance with IEC 61131-2, distributed over 4 IO ports. Contact-based sensors (e.g. safety gate switches) or electronic sensors with 24 V semiconductor outputs can be connected to the inputs.

The device can detect the following errors at the inputs:

- Shorts between the inputs and short circuits to 24 V (see Test pulse outputs [📖 53])
- Discrepancy error

Signal requirements at the inputs:

- The signals must be present at the input for longer than the hardware filter time + the configured software filter time.

Functions

Configuration options for the FS inputs

Configurable properties	Configurable values	Default value
Pin state	▸ Activated ▸ Deactivated	Activated
Software filter time	0 … 10 ms	1 ms
Pulse stretching	0 … 255 ms	0 ms
Use discrepancy monitoring	▸ Activated ▸ Deactivated	Deactivated
Reintegration after discrepancy time	▸ With restart interlock ▸ Without restart interlock	With restart interlock
Sensor type	▸ Non-equivalent ▸ Equivalent	Non-equivalent
Discrepancy behaviour	▸ Set value to zero ▸ Keep last valid value	Set value to zero
Discrepancy time	30 … 30000 ms	100 ms
Switch-on delay time	0 … 5000 ms	0 ms
Bounce monitoring time	1 … 30 s	5 s
Test pulse	▸ T0 ▸ T1	▸ I0: T0 ▸ I1: T1

Pin state

A digital input can be deactivated. If the digital input is deactivated, then the input will not be read. The process image of inputs for the deactivated input and the valid bit have the value FALSE "0". The LEDs for the input are switched off.

Software filter time

The software filter time can be configured for the inputs. At the input, the value read in will not be forwarded to the process image of inputs until the filter time has elapsed.

Pulse stretching

The device stretches a "1" signal or "0" signal at the pins to the configured pulse stretch time $t_{stretch.}$ If the signal is longer than the pulse stretch time, then it is not stretched any further.

Signal requirements at the inputs:

The 0-signal and the subsequent 1-signal together must be present at the input for longer than twice the configured pulse stretch time $t_{stretch}$.

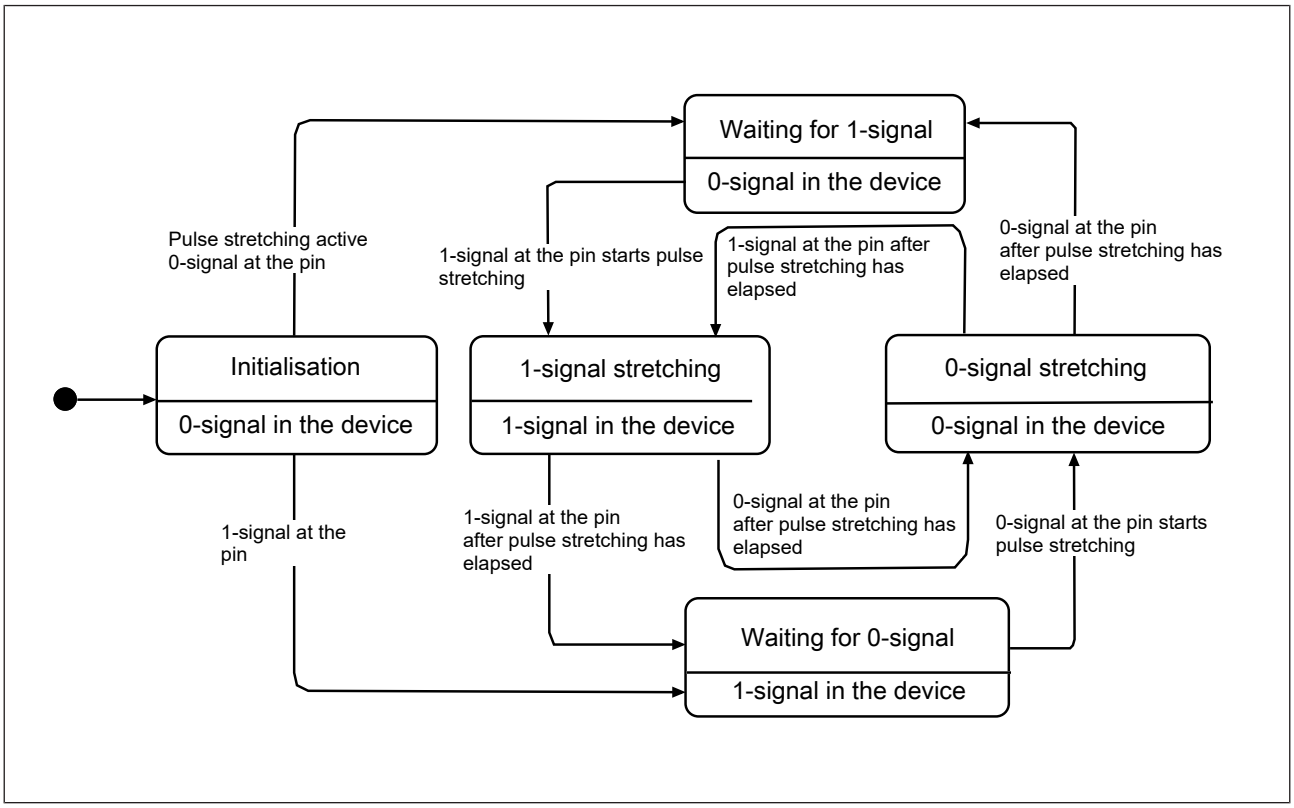


Fig.: States for pulse stretching

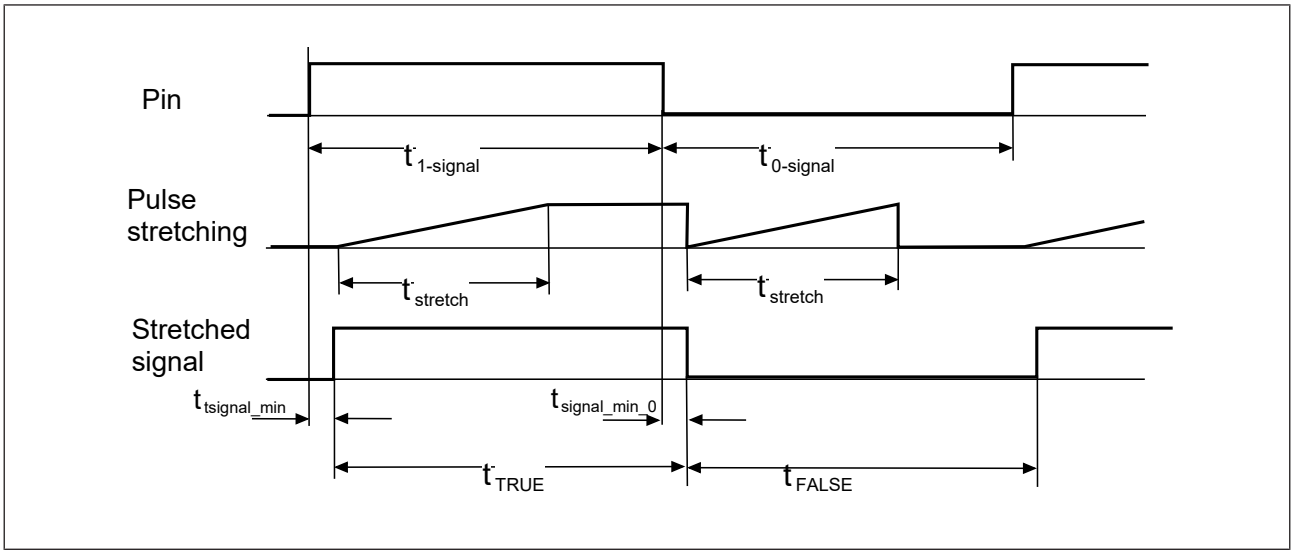


Fig.: Timing diagram: pulse stretching ≤ signal duration of 1-signal

Legend

Pin	Signal at the input (pin)
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching

$t_{signal\_min\_0}$ Time for which a 0-signal must be present in order to be detected safely

t_{signal_min} Time for which a 1-signal must be present in order to be detected.

t_{TRUE} Stretched 1-signal in the device

t_{FALSE} Stretched 0-signal in the device

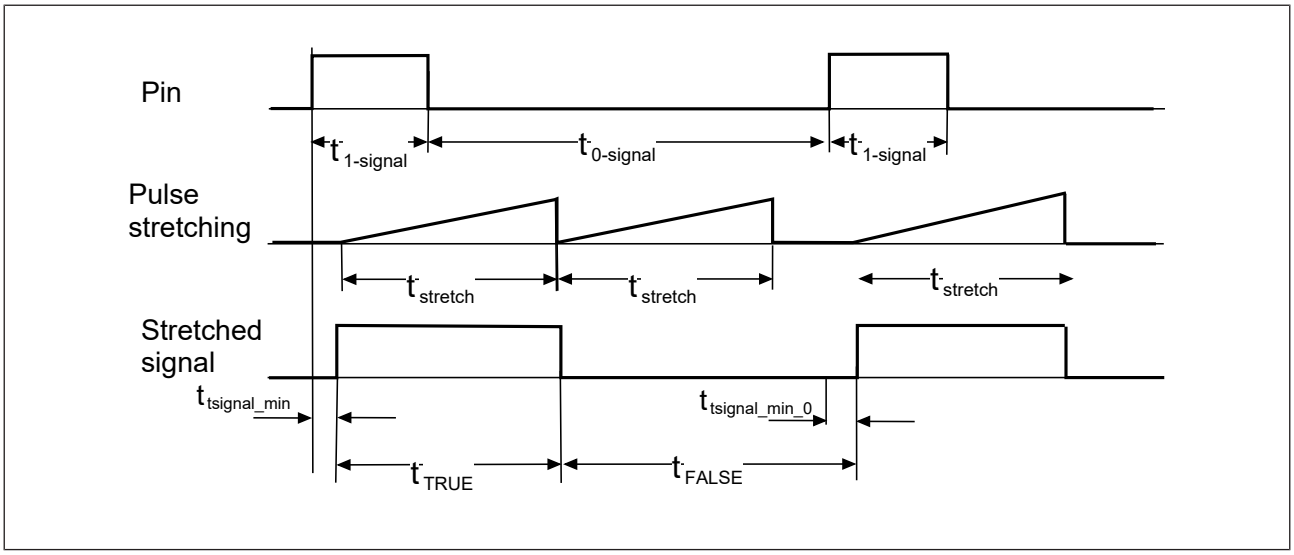


Fig.: Timing diagram: pulse stretching > signal duration of 1-signal

Legend

Pin Signal at the input (pin)

Pulse stretching Pulse stretching

Stretched signal Stretched signal

$t_{1\text{-signal}}$ Duration of 1-signal

$t_{stretch}$ Duration of pulse stretching

$t_{signal\_min\_0}$ Time for which a 0-signal must be present in order to be detected safely

t_{signal_min} Time for which a 1-signal must be present in order to be detected.

t_{TRUE} Stretched 1-signal in the device

t_{FALSE} Stretched 0-signal in the device

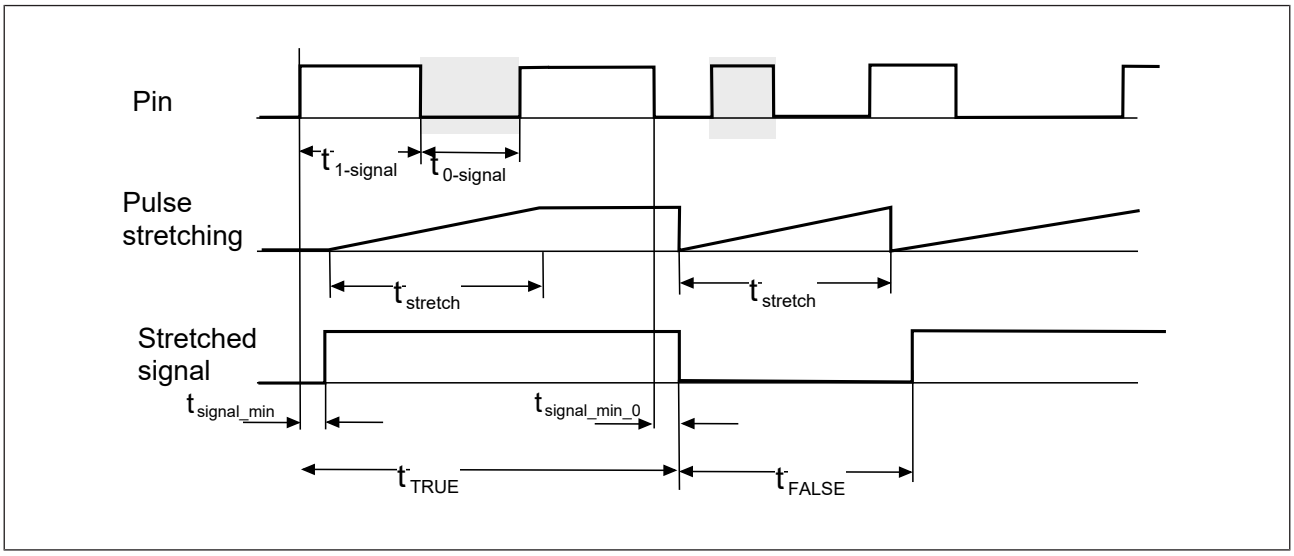


Fig.: Timing diagram: pulse stretching with variable signal duration

Legend

Pin	Signal at the input (pin)
Pulse stretching	Pulse stretching
Stretched signal	Stretched signal
$t_{1\text{-signal}}$	Duration of 1-signal
$t_{stretch}$	Duration of pulse stretching
$t_{signal\_min\_0}$	Time for which a 0-signal must be present in order to be detected safely
t_{signal_min}	Time for which a 1-signal must be present in order to be detected.
t_{TRUE}	Stretched 1-signal in the device
t_{FALSE}	Stretched 0-signal in the device

Discrepancy monitoring

With discrepancy monitoring, two individual FS inputs can be linked to a 2-channel FS input. Only inputs situated on an IO port may be used for discrepancy monitoring. Discrepancy monitoring evaluates the two input signals on a 2-channel sensor and forwards the result to the user program as a boolean safety enable signal via the process image of inputs.

An input pair always consists of the two inputs I0 and I1 on a port. 2-channel equivalent or non-equivalent sensors can be connected.

Signals with equivalent sensors:

Input	Sensor operated (safety demand)	Sensor not operated (enable)	Invalid signal 1	Invalid signal 2
I0	0	1	0	1
I1	0	1	1	0

Signals with non-equivalent sensors:

Input	Sensor operated (safety demand)	Sensor not operated (enable)	Invalid signal 1	Invalid signal 2
I0	0	1	0	1
I1	1	0	0	1

Discrepancy time

The configurable maximum duration of discrepancy monitoring (t_{conf_discr}) is used to determine how long a discrepant signal at the inputs will be tolerated before a discrepancy error is reported. If the configured duration has elapsed and the expected signals are not present, then a discrepancy error is reported. During this time the process image of inputs depends on the configured discrepancy behaviour.

Discrepancy behaviour

The process image during discrepancy can be configured.

- Set the value for the input pair in the PII to "0".

  The value "0" is provided in the PII as soon as a discrepancy is detected. The reaction time is not determined by the time t_{discr}.

- Retain the last valid value in the PII.

  The value that is evaluated is the last valid value for the lower order input of an input pair (in this example input I0) before the discrepancy arose. This value stays in the PII until the two input signals are as expected or until the time t_{discr} has elapsed and a discrepancy error has been detected. The reaction is extended by the configured time t_{discr}.

Example:

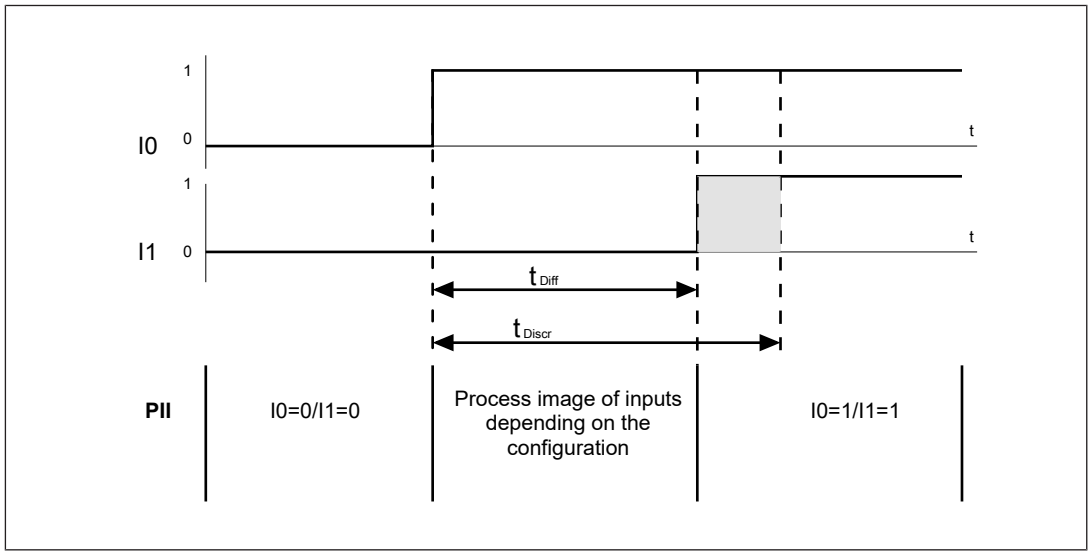


Fig.: Example for discrepancy monitoring of equivalent signals

Legend

I0	Input I0
I1	Input I1
PII	Process image of inputs
t_{discr}	Discrepancy time Discrepancy monitoring is restarted as soon as both signals are as expected. The PII during this time depends on the configuration: ▸ Keep last valid value: I0=0 (I1 is not evaluated) ▸ Set value to "0": I0=0/I1=0
t_{conf_discr}	Configurable maximum duration of discrepancy monitoring

Behaviour in the event of a discrepancy error

An error message is issued for each input of a terminal pair. Both errors take into account the last valid state of both inputs before the discrepancy time elapsed.

Reintegration after a discrepancy error

After an error, discrepancy monitoring will either start automatically as soon as there is no longer a discrepancy or it will start with a restart interlock, depending on the configuration.

- ***Without restart interlock*** (no acknowledgement required)

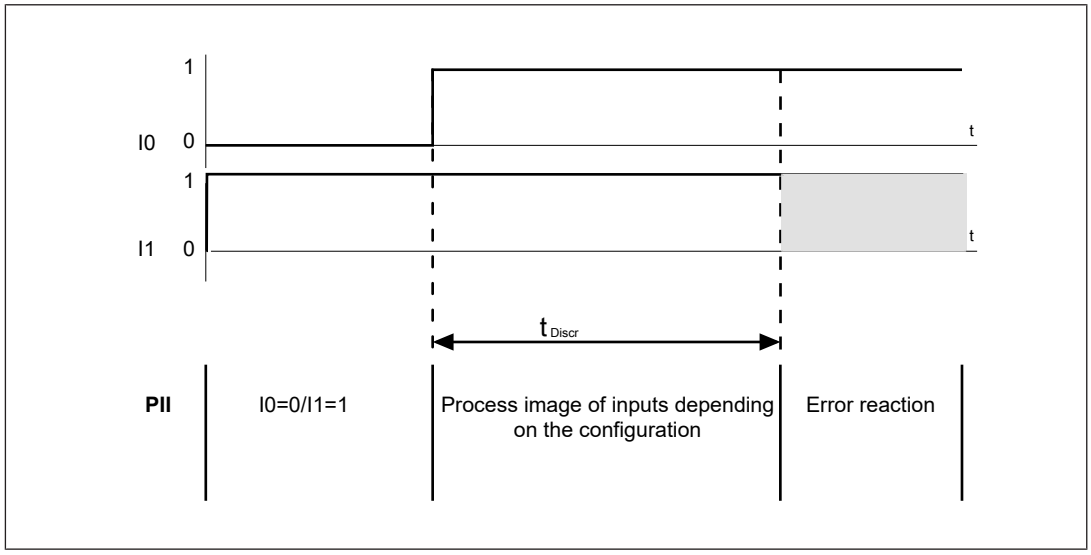
  As soon as there is no longer a discrepancy, monitoring begins again

- ***With restart interlock*** (acknowledgement required)
  - Equivalent sensor:

    A "0" signal must be present at both inputs in a discrepancy group in order to start a new monitoring task.
  - Non-equivalent sensor:

Within a discrepancy group, a "0" signal must be present at input I0 and a "1" signal at input I1.

Example 1: Sensor type is configured as "non-equivalent".



Legend

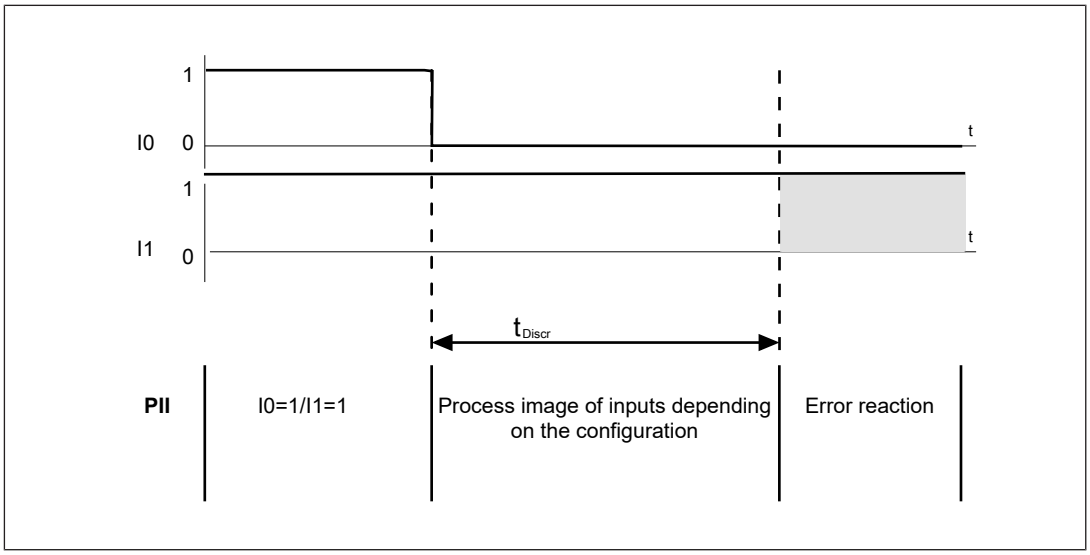
I0	Input I0
I1	Input I1
PII	Process image of inputs
t_{Discr}	Maximum duration of discrepancy monitoring The PII during this time depends on the configuration: ▸ Keep last valid value: I0=0 (I1 is not evaluated) ▸ Set value to "0": I0=0/I1=0

Error messages:

Input I0: Discrepancy error. Signal at input I0 is "1"

Input I1: Discrepancy error. Signal at input I1 is "1"

Example 2: Sensor type is configured as "equivalent".



Legend

I0 Input I0

I1 Input I1

PII Process image of inputs

t_{Discr} Maximum duration of discrepancy monitoring

During this time the process image of inputs depends on the configuration:

- Keep last valid value: I0=1 (I1 is not evaluated)
- Set value to "0": I0=0/I1=0

Error messages:

Input I0: Discrepancy error. Signal at input I0 is "0"

Input I1: Discrepancy error. Signal at input I1 is "1"

Switch-on delay time

Switch-on delay time can be used to suppress the bounce from 2-channel contact-based sensors. This prevents the safety demands being triggered ("0" signal with equivalent sensors) due to bounce from contact-based sensors (e.g. when closing a safety gate).

- The switch-on delay time starts as soon as there is an enable signal ("1" signal with an equivalent sensor) at both inputs.
- If the enable signal is still present at both inputs after the switch-on delay time has elapsed and bounce monitoring time has not yet elapsed, then the enable signal is forwarded to the user program via the process image of inputs.

Bounce monitoring time

The bounce monitoring time is used to determine the maximum length of time permitted between the discrepancy analysis no longer detecting a safety demand from the sensor ("0" signal at an equivalent sensor) and the discrepancy analysis detecting a stable enable signal from the sensor ("1" signal at an equivalent sensor) (i.e. maximum permitted bounce of a 2-channel sensor).

- The bounce monitoring time starts as soon as there is an enable signal ("1" signal at an equivalent sensor) at one of the two inputs.
- The bounce monitoring time is only active and effective if a value other than 0 is set for the switch-on delay. The bounce monitoring time is configurable.

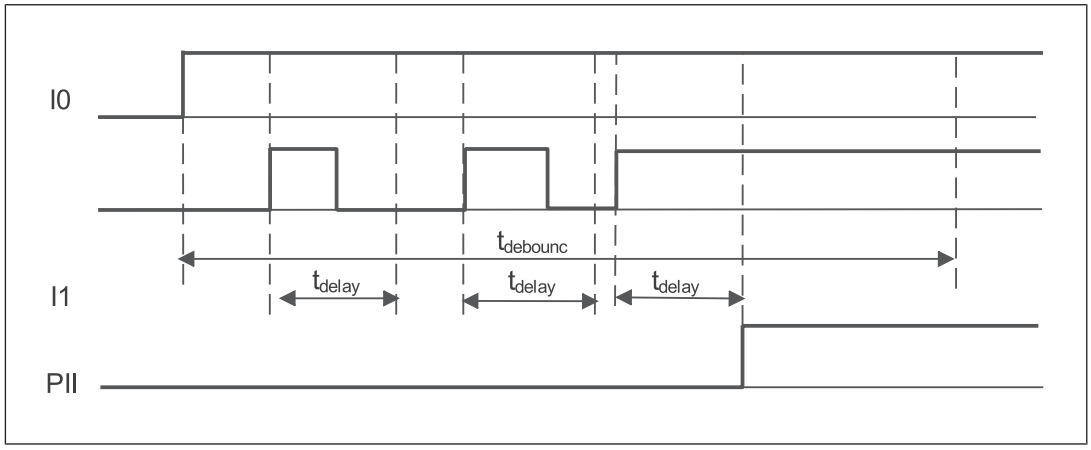


Fig.: Example of the switch-on delay time and bounce monitoring time on equivalent signals

Legend

I0	Input I0
I1	Input I1
PII	Process image of inputs
$t_{debounc}$	Bounce monitoring time
t_{delay}	Switch-on delay time

6.2.1.1.1 Test pulse outputs

The test pulses are used to detect shorts between the inputs and to detect short circuits to 24 V.

- Shorts between the cables of a 2-channel contact-based sensor are detected if:
  - Both test pulse outputs and both inputs are on the same device.
  - Both test pulse outputs are switched on, the test pulses are configured differently (T0, T1) and the emitted test pulses are assigned to the inputs.

  Shorts across contacts are not detected on an electronic sensor. The sensor must detect the short circuit (2-channel OSSD).
- Short circuits to 24 V are detected on a contact-based sensor if:
  - The test pulse output and the input are on the same device.
  - The test pulse output is switched on and the test pulse output is assigned to the input.

  Shorts to 24 V are not detected on an electronic sensor. The sensor must detect the short circuit (1-channel OSSD).
- The test pulses are assigned to the following inputs in the default setting:
  - T0: I0
  - T1: I1

- Inputs may only be wired to test pulses of the same IO port.

Additional configuration options for the test pulses

- ***24V*** option: 24 VDC is available at the test pulse outputs if they are not assigned to an input.
- ***High impedance HiZ*** option: The test pulse outputs can be switched off if they are not assigned to an input. The test pulse outputs are then high impedance to the device supply.
- ***ST output*** option: The test pulse outputs can be used as 24 VDC ST outputs if they are not assigned to an input.
- The maximum test pulse duration can be configured: 0.3 … 10.0 ms

  Default setting: 3 ms.

6.2.1.2 Digital outputs

Digital outputs can be used to switch actuators.

6.2.1.2.1 ST outputs

Unused test pulse outputs can be configured as ST outputs. If all test pulse outputs are configured as ST outputs, then **8** 1-pole ST outputs are available, distributed over **4** ports.

Configuration options for the ST outputs

If the output does not receive a process image of outputs, then substitute values are used for the process data. The value that is to be used as the substitute value can be configured.

Configurable properties	Configurable values	Default value
Substitute value	▸ Output switched off ▸ Output switched on ▸ Last valid value	Output switched off

6.2.1.2.2 1-pole FS outputs

The device has up to 8 1-pole FS outputs distributed over 4 ports when the ports (X01 … X04) are configured as FS outputs.

Signals at the output

- "0" signal (0 V) at the output:
  - Output is high impedance
  - No current to the load
- "1" signal (+24 V) at the output:
  - Output is low impedance
  - Current is supplied to the load

The device can detect the following errors at the outputs:

- Shorts across contacts and short circuits
- Overload

General guidelines:

- The max. capacity at an output depends on the load (see Output capacitance C). Connecting a higher capacity may lead to an error.
- Operation with electronic contactors has not been tested and may lead to errors. Please contact our Customer Support team if you are using electronic contactors.

Configuration options for the 1-pole FS outputs:

Configurable properties	Configurable values	Default value
Pin state	▸ On ▸ Off	Off
Switch-off delay	0 … 65535 ms	0 ms
Off test	▸ Activated ▸ Deactivated	Activated
On test	▸ Activated ▸ Deactivated	Activated
Max. test duration	0.1 … 12.7 ms	3.0 ms
Repetition of the on test in error-free operation	▸ 0 … 255 s	0 s
Repetition of the on test in the event of an error	▸ 0 … 255 s	30 s
Repetition of the off test	▸ 0 … 255 s	0 s

Pin state

A 1-pole FS output can be deactivated. In this case the output can no longer be set in the process image of outputs. The LEDs for the output are switched off.

Switch-off delay

Output tests

Outputs that are switched on are checked via regular **off tests**.

- Off tests are run in each test cycle.
- The maximum duration of the off test can be configured (default value: 3 ms).
- Outputs that are switched on are switched off for the duration of the off test.
- The load must not switch off because of the test.
- An off test detects the following errors:
  - Shorts between the outputs.
  - Short circuit to the actuator supply voltage, if the actuator supply voltage is not galvanically isolated.

Outputs that are switched off are checked via regular **on tests**.

- Outputs that are switched off are switched on for the duration of the on test.
- The load must not switch on because of the test.
- An on test is considered successful when the switching on of the output has been fed back within the configured maximum duration of the on test.
- The maximum duration of the on test can be configured (default value: 3 ms).

- On tests are run based on the configured repetition time. If a repetition time has not been configured, then on tests are run in each test cycle. If a repetition time has been configured, then the on test will not be run for the configured time.
- If an output can no longer be switched on due to an error, then the error will be detected within the repetition of the on test in the event of an error, as set in the configuration.
- An on test detects the following errors:
  - Shorts between the outputs.
  - Short circuit to the actuator supply voltage, if the actuator supply voltage is not galvanically isolated.

Exclude individual outputs from the output test

If a plant is particularly sensitive to the output test, the output test may be switched off for individual outputs. The test must be replaced by other measures, depending on the safety requirement.

When output tests are switched off:

- The correct switch state is always checked.
- The output's ability to switch will not be detected until the next time the output is switched on/off. That is why the outputs must be switched regularly during normal operation, so that safety and characteristic safety values are not reduced.
- For applications in accordance with Category 4, PL e and SIL 3, detection of shorts between contacts must be guaranteed either via the on/off test or through other measures (e.g. asynchronous switching). A short between contacts must be simulated during commissioning.

WARNING!

When wiring an output with capacitance it is essential to note the test duration and repetition period of the on test, otherwise the load may switch on unintentionally.

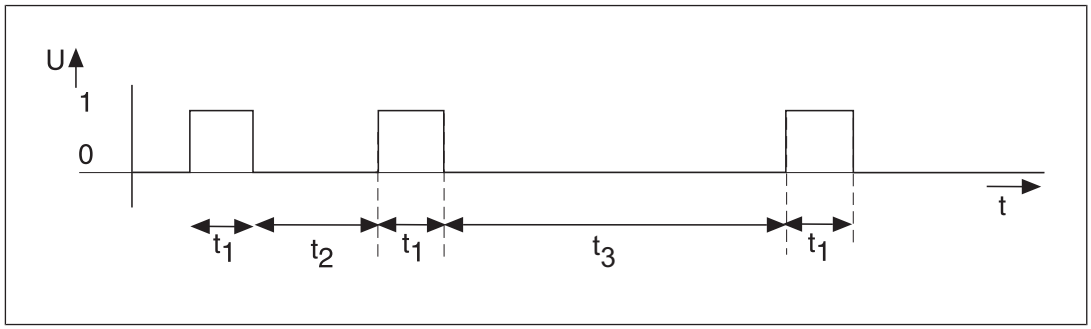


Fig.: On test for 1-pole outputs

Legend

t_1 Configurable max. test duration (default value: 3 ms)

t_2 Configurable repetition time of the on test in error-free operation. Defines the waiting time between two on tests. (Default value: 0 s. The test is run in each test cycle).

t_3 Configurable repetition time of the on test in the event of an error (default value: 30 s)

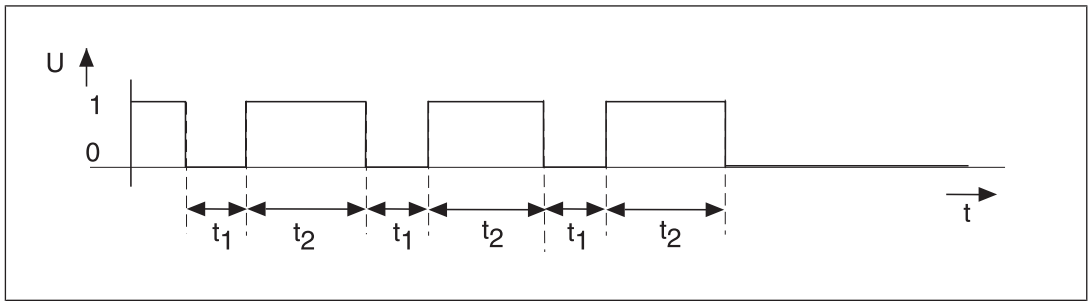


Fig.: Off test for 1-pole outputs

Legend

t_1 Configurable max. test duration (default value: 3 ms)

t_2 Configurable repetition time of the off test in error-free operation. Defines the waiting time between two off tests. (Default value: 0 s. The test is run in each test cycle).

Maximum test duration

Defines the maximum duration t_1 of the on and off test. If the output has failed to switch on or off after the configured time, then the current output test has been unsuccessful. The output may be read back incorrectly for the configured time. An error is registered once the configured time has elapsed.

Output capacitance C

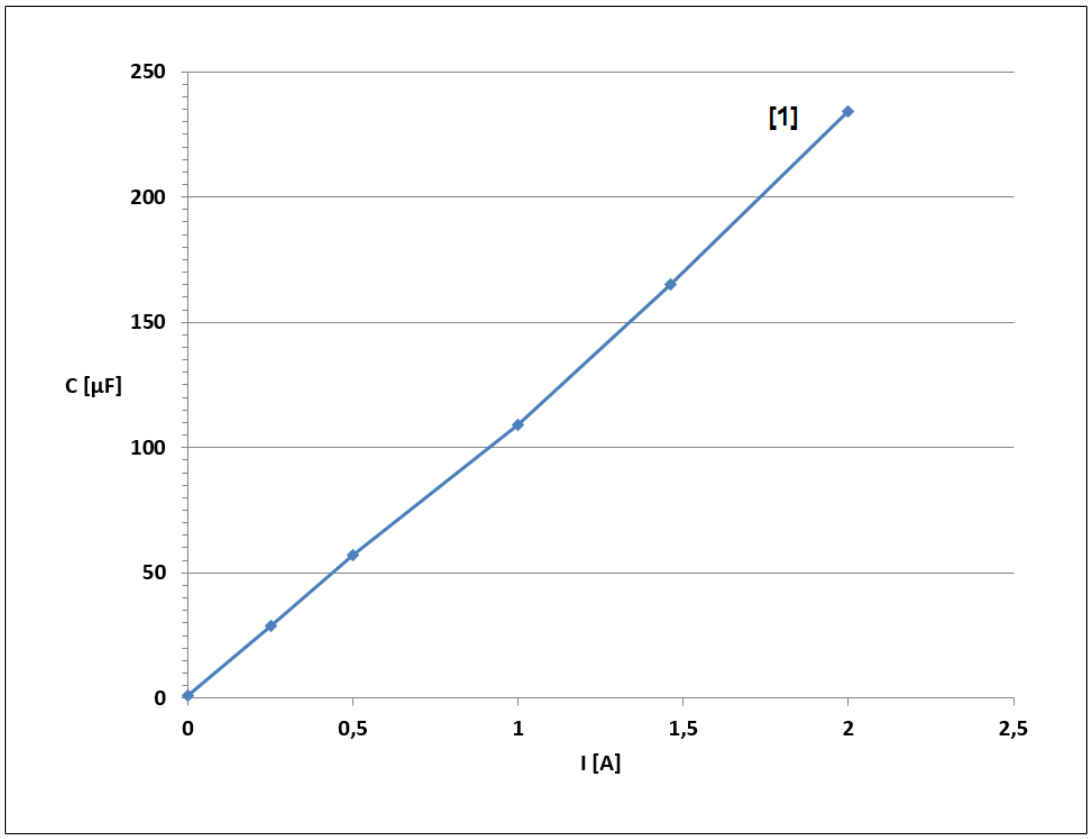


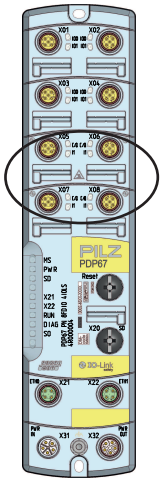
Fig.: Output capacitance C dependent on load current I

Legend

[1] Max. test duration 3 ms

6.2.2 IO-Link Safety ports

The following configuration options are available for the IO-Link Safety Ports

PDP67 PN 8FDIO 4IOLS	IO-Link Safety Ports	Configuration options
	X05 X06 X07 X08	IO-Link inputs ▸ 1 Byte input data ▸ 2 Bytes input data ▸ 4 Bytes input data ▸ 8 Bytes input data ▸ 16 Bytes input data ▸ 32 Bytes input data
		IO-Link inputs and outputs ▸ 1 Byte input and 1 Byte output data ▸ 2 Bytes input and 2 Bytes output data ▸ 4 Bytes input and 4 Bytes output data ▸ 8 Bytes input and 8 Bytes output data ▸ 16 Bytes input and 16 Bytes output data ▸ 32 Bytes input and 32 Bytes output data
		IO-Link outputs ▸ 1 Byte output data ▸ 2 Bytes output data ▸ 4 Bytes output data ▸ 8 Bytes output data ▸ 16 Bytes output data ▸ 32 Bytes output data
		IO-Link Safety inputs and outputs ▸ 3 Bytes input and 3 Bytes output data ▸ 11 Bytes input and 11 Bytes output data ▸ 25 Bytes input and 25 Bytes output data
		Digital ST inputs/outputs ▸ As 2 digital ST inputs or ▸ As 1 digital ST output Port DIO (SIO Mode)

6.2.2.1 IO-Link Safety port configuration

Operating modes:

Operating modes of the IO-Link Safety ports

The IO-Link Safety ports can be operated in the following **Operating modes**:

- **Deactivated**

  The port is not used.
- **IO-Link Manual**

  The IO-Link Master only accepts IO-Link Devices that match the set "Vendor ID" and "Device ID".
- **IO-Link Autostart**

  The IO-Link Master accepts any connected IO-Link Device.
- **SIO Digital Input (DI)**

  The port works as a standard digital input.
- **SIO Digital Output (DO)**

  The port works as a standard digital output.
- **IO-Link Safetycom**

  The port transfers IO-Link Safety process data.

The IO-Link Safety ports can be set for the following "**Validation and Backup"**:

- **No Device Check**

  The device parameters are not backed up in the Master.
- **Type Compatible Device V1.0**

  Setting in accordance with the IO-Link specification V1.0, without data backup option
- **Type Compatible Device V1.1**

  Setting in accordance with the IO-Link specification V1.1, without data backup option
- **Type Compatible Device V1.1 Backup + Restore**

  Each time the device parameters are changed, this data is automatically backed up in the Master
- **Type Compatible Device V1.1 Restore**

  The device parameters are not backed up automatically in the Master.

The IO-Link ports can be set for "**Pin 2 operating mode"** as follows:

- **Not supported**

  Pin 2 is not used.
- **Digital Input**

  Pin 2 is used as an additional digital input.

IO-Link Safety specific port parameters

The following parameters are configured:

- Input current via C/Q (Pin 4) as DI (PortMode = 3)
  - 2 mA
  - 5 mA **(Default)**

- "PortCycleTime" parameter (ArgBlockID: 0x8100 Offset: 5)
  - 0: As fast as possible **(default)**
  - 1 … 255: User defined cycle time

If an IOLS port is operated in the FS operating mode IO-Link Safetycom, the following parameters from the FSPortConfigList are included in the calculation of the PDP67 PN 8FDIO 4IOLS FS-CRC:

- PortMode
- FSP_Port
- FSP_AuthentCRC
- FSP_IO_StructCRC
- FSP_TechParCRC
- FSP_PortParCRC

For each IOLS port, the size of the process data can be configured individually in each direction:

- Port [n] PII_Length [Byte]: 0 … 32 (default 0 Byte)
- Port [n] PIO_Length [Byte]: 0 … 32 (default 0 Byte)
- Port [n] FPII_Length [Byte]: 0 … 25 (default 0 Byte)
- Port [n] FPIO_Length [Byte]: 0 … 25 (default 0 Byte)

The IO-Link Configurator sets the process data size for the PDP67 PN 8FDIO 4IOLS to the process data size of the connected IO-Link Devices.

PASconfig/IO-Link Configurator set the process image sizes in accordance with the following rules:

- If Port [n].mode = **IO-Link Autostart**, then
  - Port[n].PII_Length = 32 (optional: the user configures)
  - Port[n].PIO_Length = 32 (optional: the user configures)
  - Port[n].FPII_Length = 0
  - Port[n].FPIO_Length = 0
- If Port [n].mode = **IO-Link Manual**, then
  - Port[n].PII_Length = IOLD.InputDataLength
  - Port[n].PIO_Length = IOLD.OutputDataLength
  - Port[n].FPII_Length = 0
  - Port[n].FPIO_Length = 0
- If Port [n].mode = **IO-Link Safetycom**,
  - Port[n].PII_Length = IOLD.InputDataLength
  - Port[n].PIO_Length = IOLD.OutputDataLength
  - Port[n].FPII_Length = IOLD.SPDUInLength
  - Port[n].FPIO_Length = IOLD.SPDUOutLength

– or

– Port[n].PII_Length = 0

– Port[n].PIO_Length = 0

– Port[n].FPII_Length = 0

– Port[n].FPIO_Length = 0

6.2.2.2 Supply

- The device supply provides the voltage for the actuator/sensor supply at the terminals L+/L-.
- The actuator/sensor supply L+/L- provides voltage to the IO-Link devices, sensors and actuators.
- The actuator/sensor supply L+/L- is protected against short circuit.

6.3 Configuration

An IO-Link system is configured in several steps. In step one, the device PDP67 PN 8FDIO 4IOLS (IO-Link Master) is integrated into the automation system and configured (PROFINET with PROFIsafe). The IO-Link Devices are configured in step two.

6.3.1 Step 1

Integration into the automation system

In the configuration of the automation system, the IO-Link System is represented by the IO-Link Master (the device PDP67 PN 8FDIO 4IOLS) and integrated through the corresponding device description (e.g. GSD file PROFINET with PROFIsafe). The device itself can be a fieldbus subscriber or part of a modular IO system that is connected to the fieldbus. In both cases, the number of ports, the address range and the module properties are described in the device description of the IO-Link Master.

Example configuration in STEP7 TIA Portal see Configuration examples in the TIA Portal [📖 76]

The input and output address ranges for exchanging cyclical data (process data) are defined by IO-Link in the hardware configuration’s device view.

6.3.2 Step 2

Set the device's module properties using the configuration tool PASconfig

Here the system architecture can be represented in full, right down to the IO-Link Device, and configured in detail.

In addition to setting the IO-Link Master ports, it is also easy to set the parameters for the IO-Link Devices using the IODD (IO-Link Device Description) supplied by the device manufacturer. It is possible to display in detail the diagnostic states and process values of the IO-Link Devices.

PASconfig displays the IO-Link Master PDP67 PN 8FDIO 4IOLS configured in the project. The required IO-Link Devices can be assigned to the IO-Link ports.

Address range of the ports

In addition to assigning the IO-Link Devices to the IO-Link Safety ports, it is also possible to change the ports' pre-set address ranges. Within these address ranges, the IO-Link Master transmits the process values it receives from the IO-Link Device and makes them available to the higher-level automation system.

The address range can be set on the "Addresses" tab.

Set device parameters

Adapting the devices to the respective application task requires specific parameter settings. Parameters and setting values are contained in the device's IODD and can be set.

The parameters can be saved and printed.

NOTICE

Configuration

To configure the device, only **one** of the following active connections may be present at a time:

- between the device and the configuration tool PASconfig
- between the device and the web application

An error message is displayed if there is more than one connection. The device will prompt you to terminate the existing connection.

6.3.3 Safety guidelines for configuration

NOTICE

Each time the configuration is changed

- the user must ensure that the check sums for the configuration in the PASconfig, the device and the removable data medium (if present) are identical.
- the user must check all the device's safety-related functions to ensure that the intended configuration change is effective and that no unintended configuration change has been made.

6.4 PROFINET with PROFIsafe

The device has a PROFINET interface with PROFIsafe profile with the following properties:

- PROFINET Conformance Class C
- IRT/RT
- Data set I&M 0-4
- Shared Device
- MRP

Default values:

- IP address: 0.0.0.0
- Subnet mask: 0.0.0.0
- Gateway address: 0.0.0.0
- Device name: "" (empty)

6.4.1 Shared Device

A maximum of two PROFINET controllers can be assigned to each PDP67 PN 8FDIO 4IOLS using PROFINET Shared Device.

The assignment to the controllers is slot-granular. This means that a slot's subslots must always be assigned to the same controller.

6.4.2 PROFINET MRP (Media Redundancy Protocol)

The PDP67 PN 8FDIO 4IOLS supports PROFINET MRP with a maximum of one MRC ring (no MRP Interconnection Protocol).

6.4.3 MAC addresses

The device MAC address is lasered on to the front of the device. For "neighbourhood discovery" via the Link Layer Discovery Protocol (LLDP), PROFINET does not need the device MAC address but the MAC address of the physical Ethernet port, through which the device is connected to PROFINET. The device has an integrated switch with 2 physical Ethernet ports. Both ports use the two MAC addresses that follow the device MAC address; i.e. a device has 3 consecutive MAC addresses.

- MAC address for port X21 corresponds to the device MAC address printed on the device + 1
- MAC address for port X22 corresponds to the device MAC address printed on the device + 2

6.4.4 Setting the IP address

On delivery the device has no IP address (default value 0.0.0.0). The IP address is needed for communication within the Ethernet network. You can set the IP address in the engineering tool for the PROFIsafe Master (e.g. TIA).

6.4.5 Setting the F-address

The device has 1 to 5 F-addresses, depending on the configuration.

An F-address is required for each module/submodule that transports "safety process data".

The F-address can be set using PASconfig (see online help for PASconfig). The F-address in the engineering tool (e.g. TIA) must match the F-address configured in PASconfig, otherwise error-free operation is impossible. The default address for the PDP67 device (Slot.Subslot 11.1) is 1.

INFORMATION

Each F-address on PROFINET with PROFIsafe must be unique.

Further information on the F-address: Establishing the F-address (PROFINET with PROFIsafe) [📖 145]

6.4.6 Deactivation and reactivation

PROFINET-Slot 11

Passivation/reactivation is channel-granular.

- Channel-granular passivation:

  In the event of an error on an FS input or FS output:

  – The affected FS input or output is disabled

  – The VALID bit of the affected FS input or output is set to "0"

  – The process image of the affected FS input or output is set to the safe value (= zero). Substitute values are emitted (see Substitute values [📖 67]).

IO-Link Safety ports (IOLS ports) submodules

In the case of an error on the IOLS port:

- The process image of inputs and outputs are set to the safe value (= zero). Substitute values are emitted (see Substitute values [📖 67]).
- The PROFIsafe status signal "FV_Activated_DS" is set.

Reintegration after an error

If the error is no longer present, the passivated channels can be reintegrated. This is called reactivation. Automatic or manual reintegration can be configured for reactivation in the engineering tool for the PROFIsafe Master (e.g. TIA). Automatic reintegration may only be configured if it is permitted for the respective process in terms of safety.

- Behaviour after reactivation

  – The VALID bit becomes "1", provided there is no PROFIsafe malfunction.

6.4.7 Substitute values

If the valid bit has the value "0", then the process image is invalid and may not be used. If this is the case, the process image has a substitute value which is used instead of the device's process value. Substitute values can be configured for ST outputs. For all other FS inputs and outputs, the substitute value is the safe state ("0").

Situations that mean that substitute values are used and the valid bit has the value "0":

- Input error
- Output error
- Device error (e.g. drop in the supply voltage, device overheats)
- Communication is stopped (also during firmware update)

6.4.8 Projects

NOTICE

Up to 25 Bytes of safe process data can be transferred with IO-Link Safety.

Ensure that the higher level controller (PROFIsafe F-Host) supports the transfer of at least as many "Bytes of safe process data" as the IO-Link Device with the most safe process data.

To configure the device you will need the PASconfig software and the engineering software for the automation system with PROFINET/PROFIsafe, e.g. the TIA Portal software from Siemens. PASconfig can be called directly from the TIA Portal, for example. The system data can be transferred to the device with PASconfig via the PROFINET interfaces X21 or X22.

Please note the following:

- The user must test the application in order to avoid programming and configuration errors, as well as errors when transferring data to the devices. Safety-related functions and their configuration must be successfully tested in full before the application is commissioned (e.g. test pulses, on/off tests).
- The application must be designed in such a way that an uncontrolled start-up of the plant is excluded after a safety function, restart or reset is requested.
- After each firmware update you must check that the new firmware is the desired firmware version.

6.4.9 Process image

This is where the assignment of the process data is described.

Device model

Each IO port is modelled as a virtual PROFINET module and has a PROFINET diagnostic address. The virtual modules occupy the following PROFINET slots in the device description file:

PROFINET slot	PROFINET module	IO port	Special features
0	DAP		
1	2FDIO	X01	Virtual PROFINET module without process data. The module is used only for diagnostics and is configured in PASconfig.
2	2FDIO	X02	Virtual PROFINET module without process data. The module is used only for diagnostics and is configured in PASconfig.
3	2FDIO	X03	Virtual PROFINET module without process data. The module is used only for diagnostics and is configured in PASconfig.
4	2FDIO	X04	Virtual PROFINET module without process data. The module is used only for diagnostics and is configured in PASconfig.
5	Empty/ IOL/ DIO (SIO Mode)	X05	PROFINET module with process data for IOL/IOLS. When configured with DIO (SIO mode), the ST process data in the container is transferred to slot 10.
6	Empty/ IOL/ DIO (SIO Mode)	X06	PROFINET module with process data for IOL/IOLS. When configured with DIO (SIO mode), the ST process data in the container is transferred to slot 10.
7	Empty/ IOL/ DIO (SIO Mode)	X07	PROFINET module with process data for IOL/IOLS. When configured with DIO (SIO mode), the ST process data in the container is transferred to slot 10.
8	Empty/ IOL/ DIO (SIO Mode)	X08	PROFINET module with process data for IOL/IOLS. When configured with DIO (SIO mode), the ST process data in the container is transferred to slot 10.
9	RESERVED		
10	8DI/12DO		Standard container for ST process data (of the digital inputs/outputs)

PROFINET slot	PROFINET module	IO port	Special features
11	PROFIsafe container		FS container for FDIO data with channel-granular passivation

The FS process data of the digital inputs/outputs is transferred in a PROFIsafe container on slot 11.

The ST process data of the digital inputs/outputs is transferred in an ST container on slot 10.

6.4.9.1 Process data module 8DI 12DO (slot 10)

ST input data in the process image of inputs, slot 10 (1 Byte)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	P8.I1 (X8:2)	P8.I0 (X8:4)	P7.I1 (X7:2)	P7.I0 (X7:4)	P6.I1 (X6:2)	P6.I0 (X6:4)	P5.I1 (X5:2)	P5.I0 (X5:4)

ST output data in the process image of outputs, slot 10 (2 Bytes)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	P4.O1 (X4:5)	P4.O0 (X4:1)	P3.O1 (X3:5)	P3.O0 (X3:1)	P2.O1 (X2:5)	P2.O0 (X2:1)	P1.O1 (X1:5)	P1.O0 (X1:1)
1	FALSE	P8.O0 (X8:4)	FALSE	P7.O0 (X7:4)	FALSE	P6.O0 (X6:4)	FALSE	P5.O0 (X5:4)

6.4.9.2 Process data, PROFIsafe container (slot 11)

FS input data in the process image of inputs, slot 11 (3 Bytes)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	P4.I1 (X4:2)	P4.I0 (X4:4)	P3.I1 (X3:2)	P3.I0 (X3:4)	P2.I1 (X2:2)	P2.I0 (X2:4)	P1.I1 (X1:2)	P1.I0 (X1:4)
1	Valid bit from P4.I1	Valid bit from P4.I0	Valid bit from P3.I1	Valid bit from P3.I1	Valid bit from P2.I1	Valid bit from P2.I0	Valid bit from P1.I1	Valid bit from P1.I0
2	Valid bit from P4.O1	Valid bit from P4.O0	Valid bit from P3.O1	Valid bit from P3.O0	Valid bit from P2.O1	Valid bit from P2.O0	Valid bit from P1.O1	Valid bit from P1.O0

FS output data in the process image of outputs, slot 11 (1 Byte)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	P4.O1 (X4:2)	P4.O0 (X4:4)	P3.O1 (X3:2)	P3.O0 (X3:4)	P2.O1 (X2:2)	P2.O0 (X2:4)	P1.O1 (X1:2)	P1.O0 (X1:4)

6.4.9.3 Structure of the process image of digital inputs/outputs (slot 11)

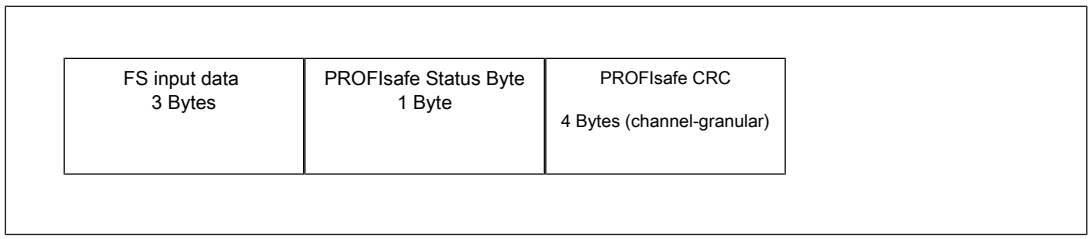


Fig.: Process image of inputs

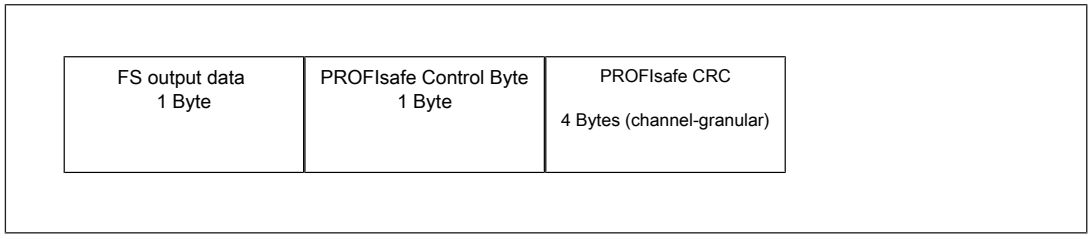


Fig.: Process image of outputs

6.4.9.4 Process data module IOL (slot 5, 6, 7, 8)

Using the device description file, the PDP67 PN 8FDIO 4IOLS must be integrated into a PROFINET project and configured, in the Siemens TIA Portal for example. The available virtual PROFINET modules and, depending on the configuration, submodules are made available via the device description file.

A PROFINET slot is assigned to each IO-Link (Safety) port.

- ST process data (IOL) from the connected IO-Link Device is transferred via the submodules in subslot 1.
- FS process data (IOLS) from the connected IO-Link Device is transferred via the submodules in subslot 2.

IOLS port	Process data	PROFINET address Slot	PROFINET address Subslot
X05	ST process data IOL	5	1
	FS process data IOLS		2
X06	ST process data IOL	6	1
	FS process data IOLS		2
X07	ST process data IOL	7	1
	FS process data IOLS		2
X08	ST process data IOL	8	1
	FS process data IOLS		2

Modules and submodules available in the TIA Portal, by way of example

Modules	Description
Port IOL (Port IOL_1 … Port IOL_4)	The port is used as an IO-Link port and corresponding submodules for IO-Link/IO-Link Safety must be selected.
Port DIO (SIO Mode) (Port DIO (SIO Mode)_1 … Port DIO (SIO Mode)_4)	(SIO Mode) = Operating mode of a port in accordance with the digital inputs and outputs defined in IEC 61131-2. All IO-Link ports can be used as digital standard inputs/ outputs.

Module Port IOL

Submodule	Data length
PROFINET submodules for IO-Link ST input data In subslot 1	
IOL_I1_PQI	1 Byte input data + 1 Byte Port Qualifier Information
IOL_I2_PQI	2 Bytes input data + 1 Byte Port Qualifier Information
IOL_I4_PQI	4 Bytes input data + 1 Byte Port Qualifier Information
IOL_I8_PQI	8 Bytes input data + 1 Byte Port Qualifier Information
IOL_I16_PQI	16 Bytes input data + 1 Byte Port Qualifier Information
IOL_I32_PQI	32 Bytes input data + 1 Byte Port Qualifier Information
PROFINET submodules for IO-Link ST output data In subslot 1	
IOL_O1_PQI	1 Byte output data + 1 Byte Port Qualifier Information
IOL_O2_PQI	2 Bytes output data + 1 Byte Port Qualifier Information
IOL_O4_PQI	4 Bytes output data + 1 Byte Port Qualifier Information
IOL_O8_PQI	8 Bytes output data + 1 Byte Port Qualifier Information
IOL_O16_PQI	16 Bytes output data + 1 Byte Port Qualifier Information

Submodule	Data length
IOL_O32_PQI	32 Bytes output data + 1 Byte Port Qualifier Information
PROFINET submodules for IO-Link ST input and output data In subslot 1	
IOL_IO1_PQI	1 Byte input data + 1 Byte Port Qualifier Information + 1 Byte output data
IOL_O2_PQI	2 Bytes input data + 1 Byte Port Qualifier Information + 2 Bytes output data
IOL_IO4_PQI	4 Bytes input data + 1 Byte Port Qualifier Information + 4 Bytes output data
IOL_IO8_PQI	8 Bytes input data + 1 Byte Port Qualifier Information + 8 Bytes output data
IOL_IO16_PQI	16 Bytes input data + 1 Byte Port Qualifier Information + 16 Bytes output data
IOL_IO32_PQI	32 Bytes input data + 1 Byte Port Qualifier Information + 32 Bytes output data
PROFINET submodules for IO-Link FS data In subslot 2	
IOLS_SP3	3 Bytes input data + 5 Bytes PROFIsafe Trailer + 3 Bytes output data + 5 Bytes PROFIsafe Trailer
IOLS_SP11	11 Bytes input data + 5 Bytes PROFIsafe Trailer + 11 Bytes output data + 5 Bytes PROFIsafe Trailer
IOLS_SP25	25 Bytes input data + 5 Bytes PROFIsafe Trailer + 25 Bytes output data + 5 Bytes PROFIsafe Trailer

Structure of the process image of the modules in subslots 2 (IOLS)

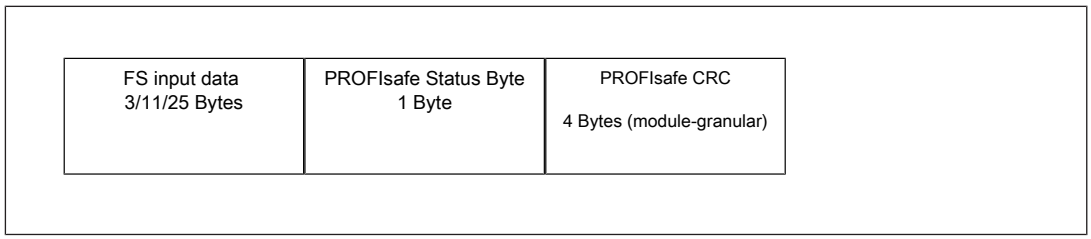


Fig.: Process image of inputs

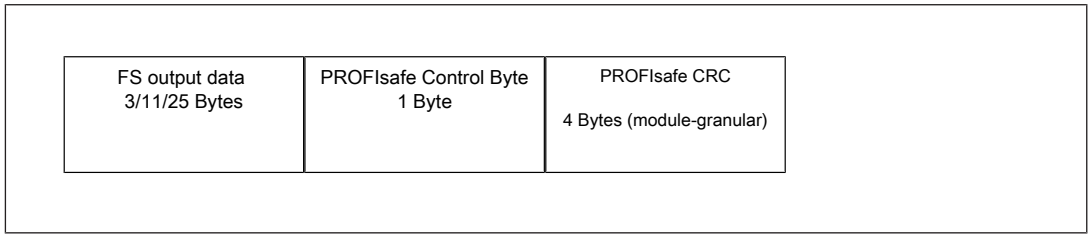
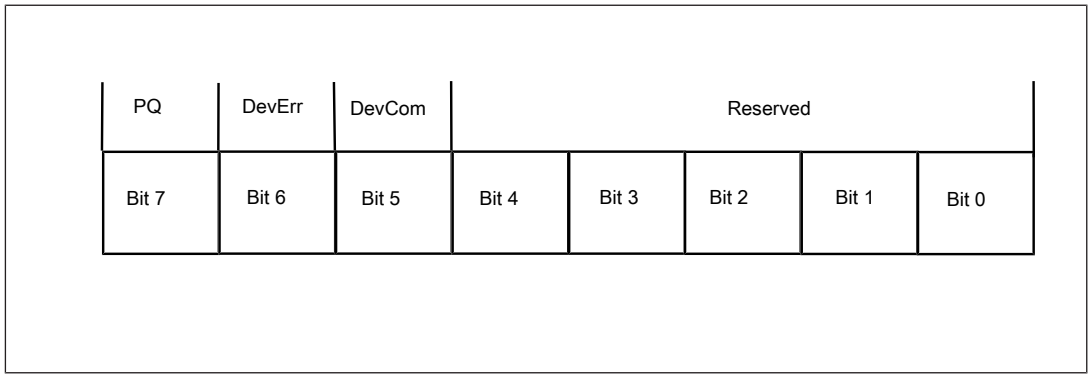


Fig.: Process image of outputs

6.4.9.4.1 IO-Link ST process data

Port Qualifier Information (PQI)



The status bit **DevCom** (Bit 5) signals the IO-Link communication status

0: No communication with IO-Link Device

1: The IO-Link Device is in the Preoperate or Operate state

The status bit **DevErr** (Bit 6) signals the error state of IO-Link port and IO-Link Device

0: IO-Link port and IO-Link Device is signalling neither a warning nor an error

1: IO-Link port or IO-Link Device is signalling either a warning or an error

The status bit **PQ** (Bit 7) signals the validity of the process data on the IO-Link Device

0: Process data on the IO-Link Device is invalid

1: Process data on the IO-Link Device is valid

The PDP67 PN 8FDIO 4IOLS maps the ST input data from the IO-Link port's process input data into the subslot's process input data, but only as much as fits into the subslot's process input data. The remaining process input data is rejected.

No diagnostics are performed because, when transferring the ST process data, the intention may be to process only part of the process input data.

The PDP67 PN 8FDIO 4IOLS maps the ST output data from the subslot's process output data into the IO-Link port's process output data, but only as much as fits into the IO-Link port's process output data. The remaining process output data is rejected.

No diagnostics are performed because all the process output data required by the port is processed.

6.4.9.4.2 IO-Link FS process data

The FS process data is mapped from one IO-Link port to exactly one process data container from PROFINET with PROFIsafe.

The FS process data is exchanged via the submodule in subslot 2 of the module in the slot assigned to the IO-Link port.

Submodules with different process data lengths are predefined for the FS process data (see Process data module IOL (slot 5, 6, 7, 8) [📖 71]).

6.4.10 IO-Link acyclical access (IOL_CALL)

The device PDP67 PN 8FDIO 4IOLS: supports IOL_CALL functionality. This function enables acyclical access to the data on an IO-Link Device via the PROFINET fieldbus.

Access is via the PROFINET controller using a special IOL_CALL block. The following parameters can be set:

- CAP (ClientAccessPoint): 0xB400 (reserved value for the PROFINET record index for IOL_CALL)
- IO-Link port number [1 … 255]: 1 for the product's first IO-Link port, 2 for the product's second IO-Link port, 3 for the…
- IO-Link index [0 … 7FFF]: Index for the IO-Link Device data
- IO-Link subindex [0 … FF]: Subindex for the IO-Link Device data

Constraint

The device PDP67 PN 8FDIO 4IOLS only supports the reading of acyclical data. The writing of acyclical data, and special port functions/methods are not supported. If an unsupported method is called, the error code 0x8055 is returned.

INFORMATION

Further information is available in the operating manuals of the respective controller manufacturer.

6.4.11 Configuration examples in the TIA Portal

The basic configuration for IO-Link Safety and the IO ports is carried out via the engineering tool for the PROFIsafe Master (e.g. TIA). This configuration can be transferred to PASconfig.

However, the configuration can also be created in PASconfig first and then transferred to the engineering tool (e.g. TIA).

For abbreviations used, see here [📖 8]

Configuration example 01 in the TIA Portal

All IO-Link Ports (X05 … X08) used as IO-Link port

IO-Link port X05:

- Only uses IOL (on subslot 5.1)
  - ST process data: 2 Bytes PII + 1 Byte PQI + 2 Bytes PIO

IO-Link port X06:

- Only uses IOL**S** (on subslot 6.2), **highlighted in yellow**)
  - ST process data: 1 Byte PQI
  - FS process data: 25 Bytes PII + 25 Bytes PIO (+ 5 Bytes each PROFIsafe Trailer)

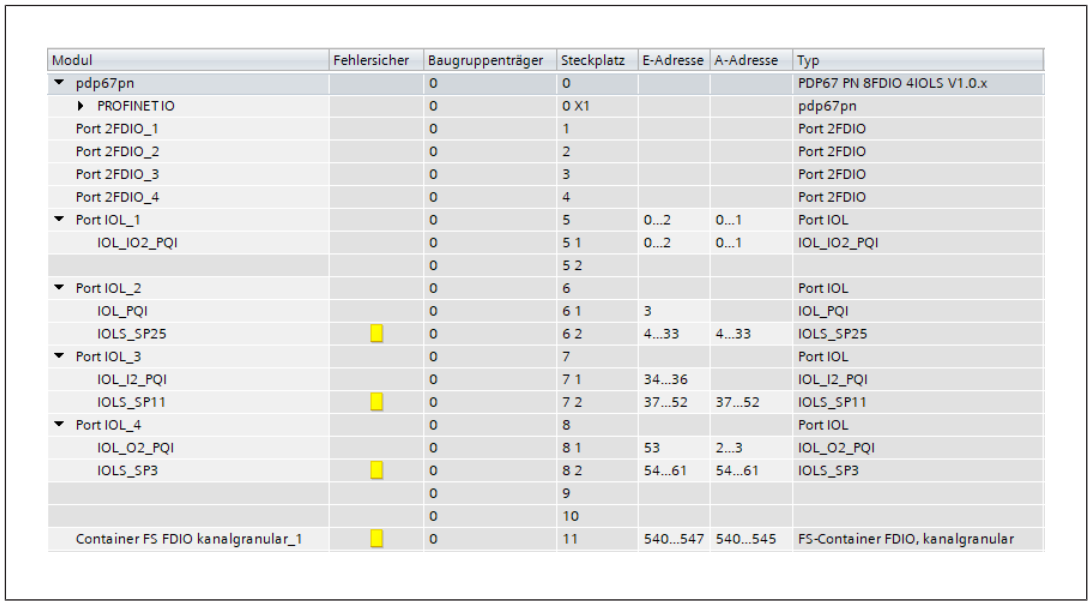
IO-Link port X07:

- Uses IOL (on subslot 7.1) and IOL**S** (on subslot 7.2, **highlighted in yellow**)
  - ST process data: 2 Bytes PII + 1 Byte PQI
  - FS process data: 11 Bytes PII + 11 Bytes PIO (+ 5 Bytes each PROFIsafe Trailer)

IO-Link port X08:

- Uses IOL (on subslot 8.1) and IOL**S** (on subslot 8.2, **highlighted in yellow**)
  - ST process data: 1 Byte PQI + 2 Bytes PIO
  - FS process data: 3 Bytes PII + 3 Bytes PIO (+ 5 Bytes each PROFIsafe Trailer)

TIA screenshot



Modul	Fehlersicher	Baugruppenträger	Steckplatz	E-Adresse	A-Adresse	Typ
pdp67pn		0	0			PDP67 PN 8FDIO 4IOLS V1.0.x
PROFINET IO		0	0 X1			pdp67pn
Port 2FDIO_1		0	1			Port 2FDIO
Port 2FDIO_2		0	2			Port 2FDIO
Port 2FDIO_3		0	3			Port 2FDIO
Port 2FDIO_4		0	4			Port 2FDIO
Port IOL_1		0	5	0...2	0...1	Port IOL
IOL_IO2_PQI		0	5 1	0...2	0...1	IOL_IO2_PQI
		0	5 2			
Port IOL_2		0	6			Port IOL
IOL_PQI		0	6 1	3		IOL_PQI
IOLS_SP25		0	6 2	4...33	4...33	IOLS_SP25
Port IOL_3		0	7			Port IOL
IOL_I2_PQI		0	7 1	34...36		IOL_I2_PQI
IOLS_SP11		0	7 2	37...52	37...52	IOLS_SP11
Port IOL_4		0	8			Port IOL
IOL_O2_PQI		0	8 1	53	2...3	IOL_O2_PQI
IOLS_SP3		0	8 2	54...61	54...61	IOLS_SP3
		0	9			
		0	10			
Container FS FDIO kanalgranular_1		0	11	540...547	540...545	FS-Container FDIO, kanalgranular

Fig.: Configuration example 01

Configuration example 02 in the TIA Portal

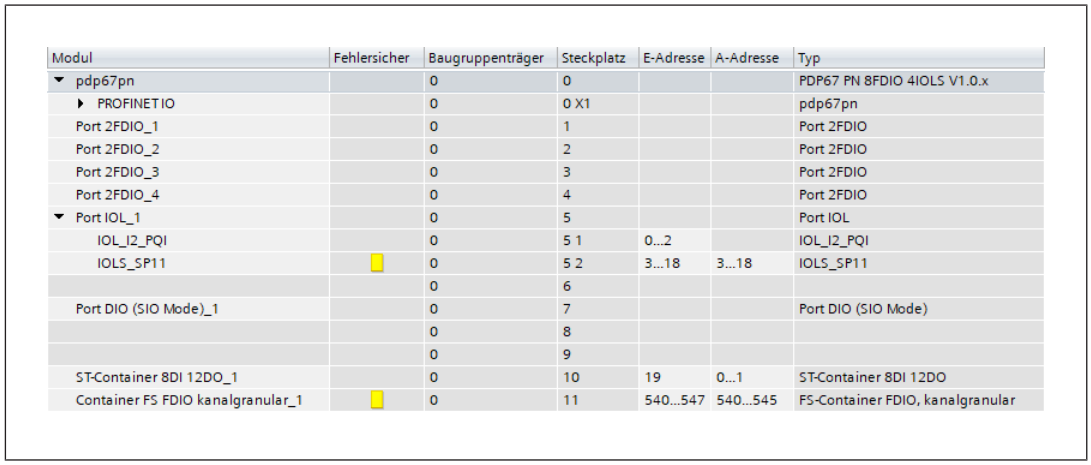
Uses IO-Link port (X05) and DIO (SIO Mode) port (X07)

IO-Link port X05:

- Uses IOL (on subslot 5.1) and IOL**S** (subslot 5.2, **highlighted in yellow**)
  - ST process data: 2 Bytes PII + 1 Byte PQI
  - FS process data: 11 Bytes PII + 11 Bytes PIO (+ 5 Bytes each PROFIsafe Trailer)

IO-Link port X07:

- Uses DIO (SIO Mode)
  - Requires additional module on slot 10:



Modul	Fehlersicher	Baugruppenträger	Steckplatz	E-Adresse	A-Adresse	Typ
pdp67pn		0	0			PDP67 PN 8FDIO 4IOLS V1.0.x
PROFINET IO		0	0 X1			pdp67pn
Port 2FDIO_1		0	1			Port 2FDIO
Port 2FDIO_2		0	2			Port 2FDIO
Port 2FDIO_3		0	3			Port 2FDIO
Port 2FDIO_4		0	4			Port 2FDIO
Port IOL_1		0	5			Port IOL
IOL_I2_PQI		0	5 1	0...2		IOL_I2_PQI
IOLS_SP11		0	5 2	3...18	3...18	IOLS_SP11
		0	6			
Port DIO (SIO Mode)_1		0	7			Port DIO (SIO Mode)
		0	8			
		0	9			
ST-Container 8DI 12DO_1		0	10	19	0...1	ST-Container 8DI 12DO
Container FS FDIO kanalgranular_1		0	11	540...547	540...545	FS-Container FDIO, kanalgranular

Fig.: Configuration example 02

6.4.12 Device identification

If a device identification is requested via the engineering tool for the PROFIsafe Master (e.g. TIA), the

- ***DIAG*** und ***RUN*** LEDs light up green for several seconds on the selected device.

Thereafter the LEDs switch back to their original states (see Display elements [📖 122]).

7 Web application (Web App)

The device has an integrated, browser-based web application. The web application enables device functions to be executed without using PASconfig and can be used for the following tasks:

- Call up device information
- List diagnostic information (error stack)
- Display and configure network settings
- Perform the wiring test
- Perform a firmware update
- Manage access data
- Activate time synchronisation via SNTP Server
- Set the web application (TLS certificate, activation)
- Call up support information

The following browsers have been tested with the web application and the operating system Microsoft Windows 10:

- Microsoft Edge: 130.0 (64-bit)
- Google Chrome: 130.0 (64-bit)
- Mozilla Firefox: 128.3 (64-bit)

NOTICE

Configuration

To configure the device, only **one** of the following active connections may be present at a time:

- between the device and the configuration tool PASconfig
- between the device and the web application

An error message is displayed if there is more than one connection. The device will prompt you to terminate the existing connection.

7.1 Pre-defined user name

Two default users are defined on the device; these cannot be changed (note that the user name is written in lower case):

- admin (administrator)
- guest (user with read rights)

Administrator applications (admin)

- Log in to the web application [80]
- Homepage [84]
- Display diagnostics [86]

- Configure network [88]
- Firmware update [89]
- Perform wiring test [92]
- Manage users [96]
- Settings [98]
- Support [103]

Applications of the user with read rights (guest)

- Log in to the web application [80]
- Homepage [84]
- Display diagnostics [86]
- Support [103]

7.2 Logging in to the web application

The web application can be called up as follows:

- Using a web browser via the device's IP address
- Using a web browser via the device's alias

NOTICE

Change password

After logging in to the web application, you will be prompted to change the password. Change the password promptly to protect the system from unauthorised access (see also Manage users [96]).

7.2.1 Call up web application via IP address

Prerequisites

- The device's IP address is configured and known.
- Your web browser allows the use of cookies.
- When you log in for the first time we recommend that you establish a point-to-point Ethernet connection between your computer and the PDP67 device. That way you can ensure that the certificate for the web application is all that is installed in your browser.
- Only one web browser may access the web application. Simultaneous access to the web application using several web browsers can lead to problems.
- The configuration tool PASconfig and a web browser may not access the device at the same time.

Procedure

- Enter the device's IP address in the form https://<Configured IP address> in your web browser's address bar. The login page is loaded. If you are using your computer to connect to the web application for the first time, then you should read the section entitled Notes on certificates [📖 82].
- User name

  Enter the user name here (see Pre-defined user name [📖 79]).
- Password

  Enter the password here.

  Default value (for "**admin**" and "**guest**" users): **PDP67**
- Language

  Select the user interface language here. After logging in, the language can no longer be switched. Log out to change the language. You will be redirected to the login page and you can switch the language there.

7.2.2 Call up web application via alias

Prerequisites

- The device's order number and serial number are known.
- Your web browser allows the use of cookies.
- When you log in for the first time we recommend that you establish a point-to-point Ethernet connection between your computer and the PDP67 device. That way you can ensure that the certificate for the web application is all that is installed in your browser.
- Only one web browser may access the web application. Simultaneous access to the web application using several web browsers can lead to problems.
- The configuration tool PASconfig and a web browser may not access the device at the same time.

Procedure

- Enter the device's alias in the form https://<pilz-OrderNumber-SerialNumber.local> in your web browser's address bar (for example: https://pilz-4r000004-1000057.local). The login page is loaded. If you are using your computer to connect to the web application for the first time, then you should read the section entitled Notes on certificates [📖 82].
- User name

  Enter the user name here (see Pre-defined user name [📖 79]).
- Password

  Enter the password here.

  Default value (for "**admin**" and "**guest**" users): **PDP67**
- Language

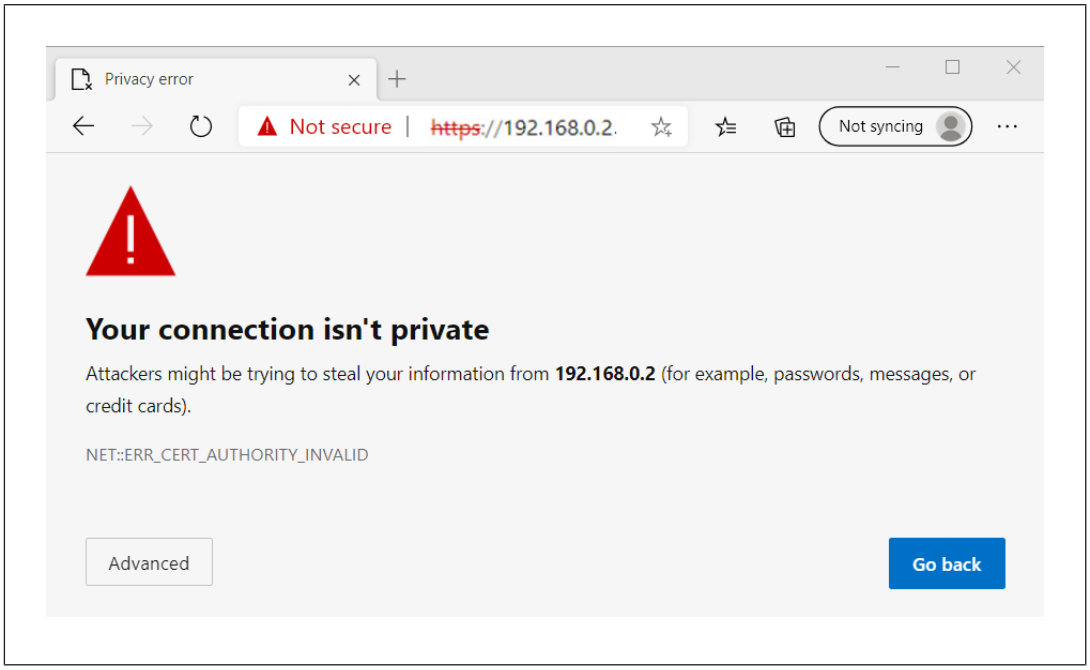
  Select the user interface language here. After logging in, the language can no longer be switched. Log out to change the language. You will be redirected to the login page and you can switch the language there.

7.2.3 Certificates

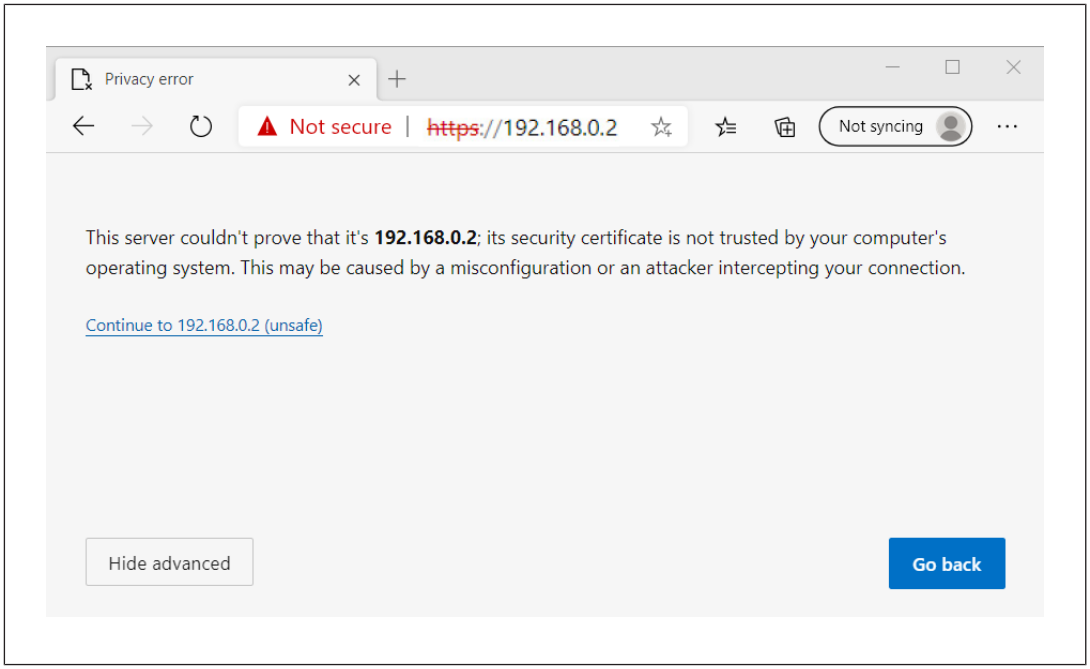
Notes on certificates

The web application establishes a safe connection (https) to your web browser. When you use your web browser to log in to the web application for the first time, the certificate for the web application is still unknown to the web browser. The web browser warns that the connection to the web application is not a safe connection. You need to create an exception rule in your web browser. This process varies depending on the web browser you are using. It is explained here based on Microsoft Edge.

▸ When you load the page the following message appears: ***Your connection isn't private***.



▸ Click on ***Advanced***.



- Click on ***Continue to <Your device's IP address> (unsafe)***. The login page is displayed.

CAUTION!

Risk of data manipulation and phishing

Adding exception rules to your web browser can lead to data manipulation and phishing. Do not create exception rules for unfamiliar websites.

INFORMATION

You can also use your own certificates, if your company uses its own certificate management for example. If this is the case, you can import your own certificate into the device (see also Managing certificates [📖 101]).

7.2.4 Automatic logout after inactivity

The logged in user is automatically logged out of the web application after 10 minutes of inactivity.

7.3 Start page

The start page appears following a successful login.

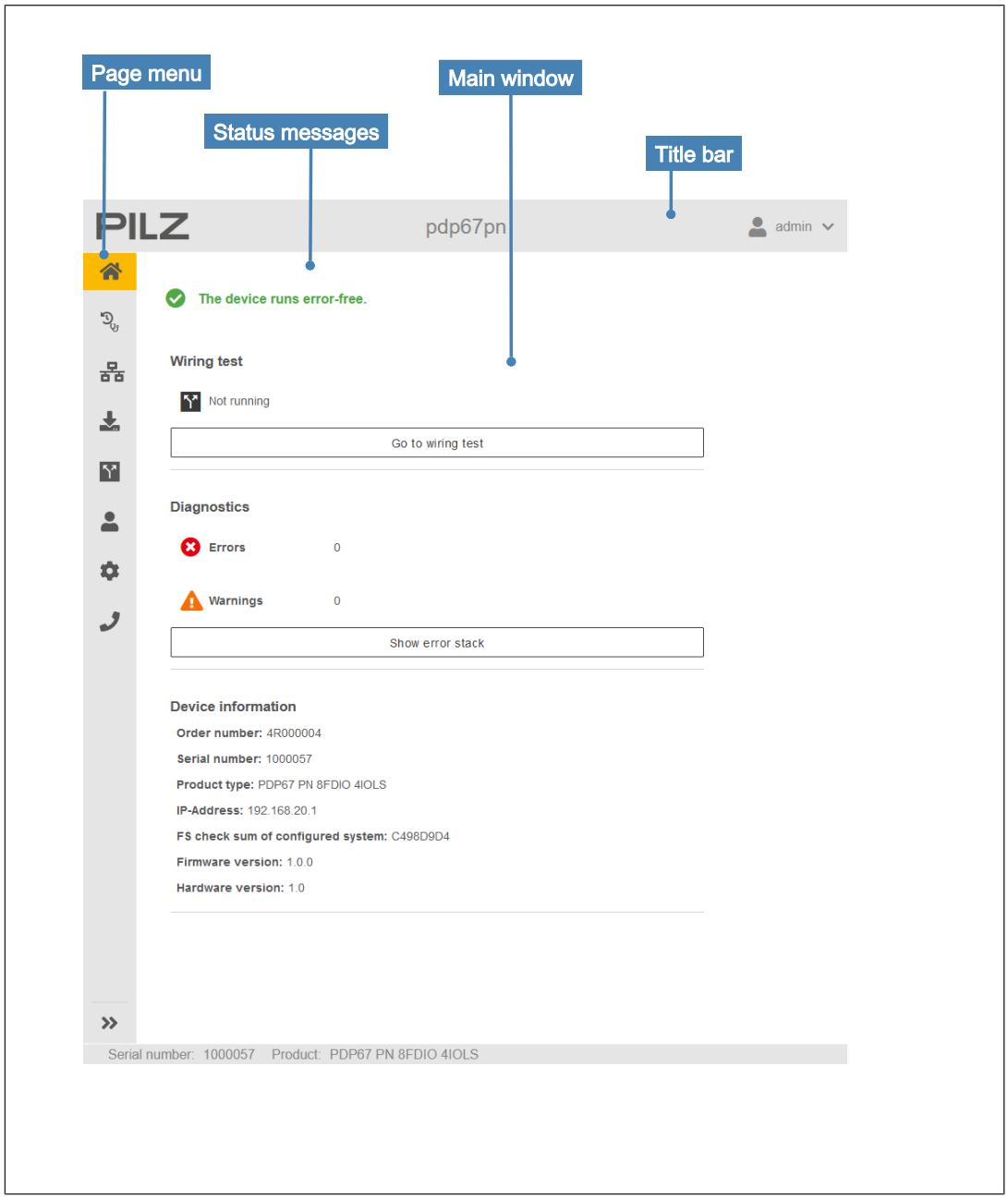


Fig.: Homepage

The web application's interface is subdivided into the following sections:

- Title bar

Besides the PILZ logo, the title bar also displays the IP address or PROFINET device name of the connected device and a button with the name of the logged in user. Click on this button and select ***Log out*** to log out of the web application.

- Status messages and notes

  Status messages appear in this area, as well as notes on a page's configurable properties.

- Page menu

  The page menu display depends on the screen size. The page menu can also be collapsed or expanded manually.

  Explanation of the icons (the icon for the current page has a yellow background):

Icon	Description
	Homepage
	Diagnostic information is displayed on this page.
	Network properties can be configured on this page.
	A firmware update can be performed on this page.
	The wiring test can be carried out on this page.
	The passwords for the default users can be changed on this page.
	Your own certificates can be transferred to the device on this page. The pre-defined security message for the homepage can also be adapted here, plus the web application can be deactivated. Time synchronisation via SNTP Server can also be activated on this page.
	Contact information and any third party manufacturer licences are displayed on this page.

- Main window

  The following information is displayed on the main window of the start page:

  – Status of the wiring test with a link to the wiring test page

  – Number of warning and error messages present, with a link to the diagnostic log

  – Device information

7.4 Display diagnostics

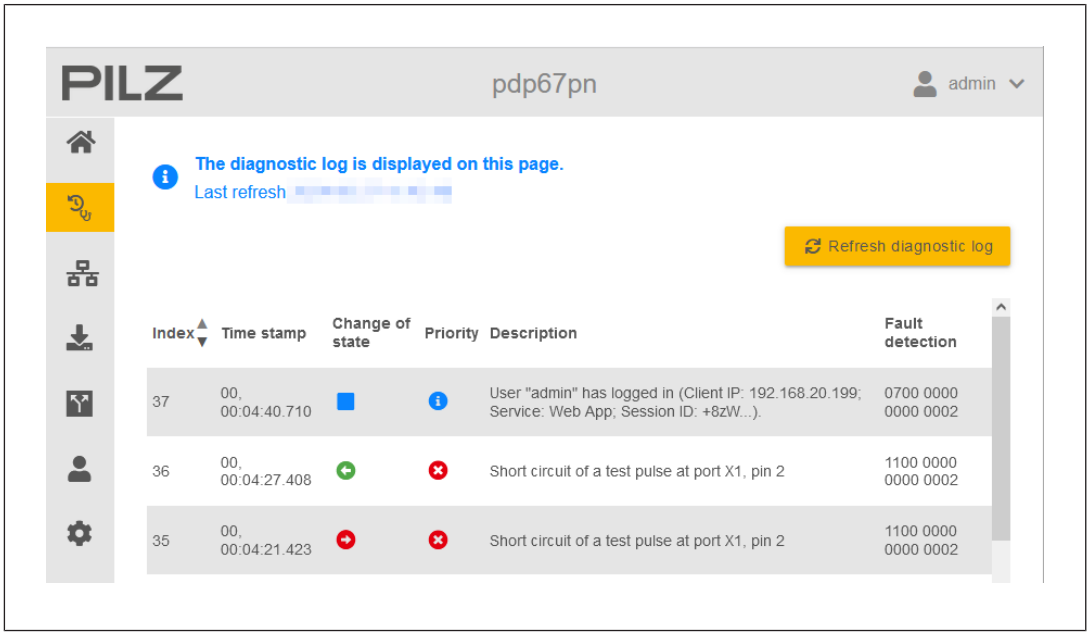


Fig.: Diagnostic page

Definition of icons:

Index column

Consecutive number

Time stamp column

- Unsynchronised time

  Operating time, time since last restart (day, hour, minute, second, millisecond)

- Synchronised time (configurable under Settings [98], SNTP Server)

  Local time zone of host computer (year, month, day, hour, minute, second, millisecond)

Change of state column

If an event is present (e.g. short circuit at an input), the diagnostic message becomes "active" (change of state: "arrived"). If the fault has been rectified, the diagnostic message becomes "inactive" (status change: "cleared").

Icon	Description
	Symbolises errors or warnings that have "arrived".
	Symbolises errors or warnings that have "cleared".
	Symbolises events Diagnostic messages that serve as information. Operation is not yet impeded or compromised.

Severity column

Diagnostic messages are differentiated according to their importance. They are divided into three levels of severity:

Icon	Meaning	Description
	Error	Diagnostic message to which the user must react immediately. This diagnostic message provides information on system conditions in which one or more functions have failed or are adversely affected.
	Warning	Diagnostic message which demands the user's attention. This diagnostic message warns the user about potential or imminent critical system conditions.
	Info	Diagnostic message which describes the current state of the process and/or system. This diagnostic message is provided for information; operation is neither impeded nor adversely affected.

Description column

Description of what has happened.

Fault detection column

Fault detection is used to uniquely identify a diagnostic message.

7.5 Configuring the network

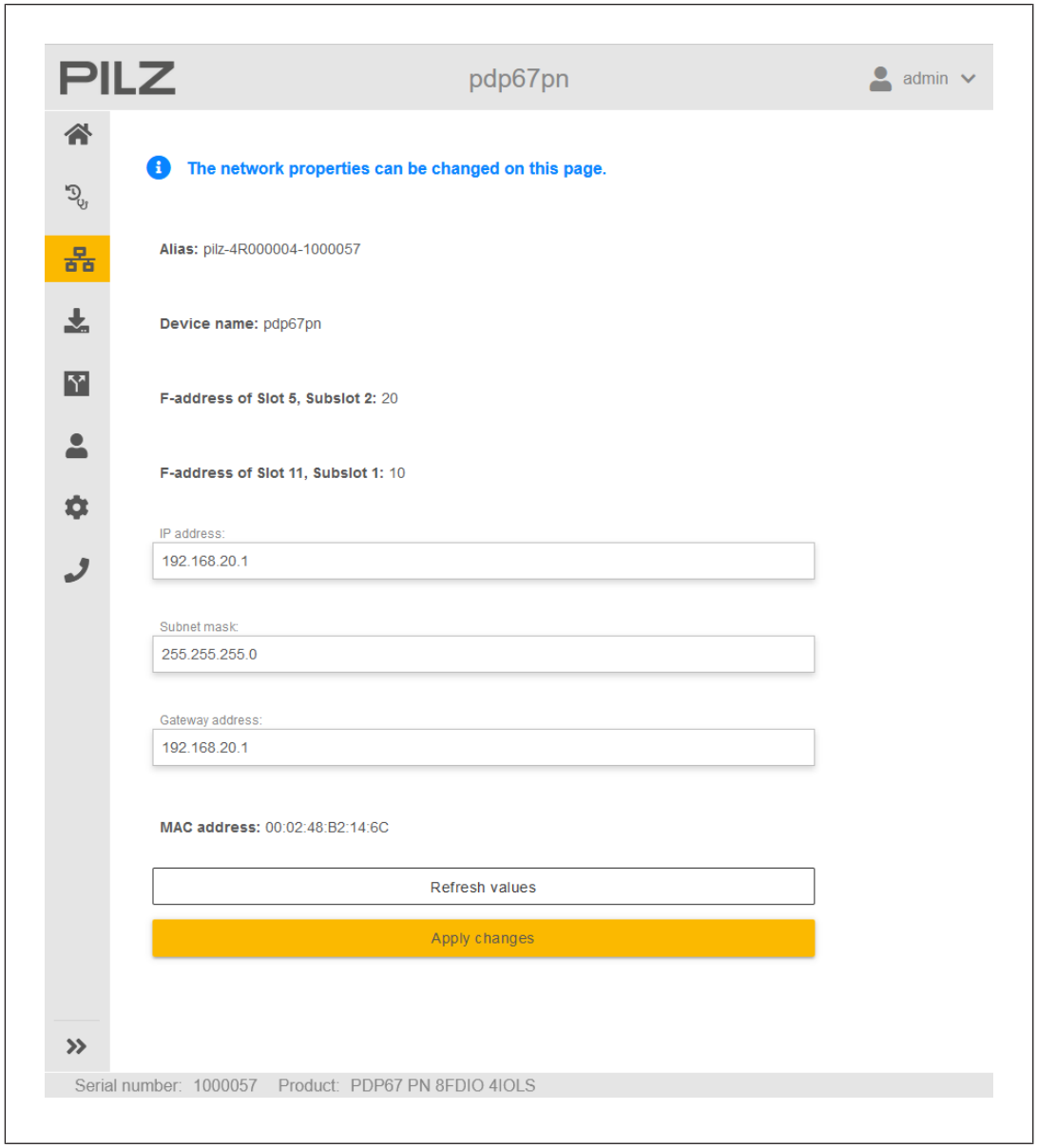


Fig.: Configure network

This is where the network settings are displayed and can be configured if necessary. Please note that a change to the configuration may mean that the device is no longer accessible in the network.

Procedure

- Click on ***Refresh values*** to retrieve the network configuration from the device.
- Change the network configuration and click on ***Apply changes*** to write the configuration to the device.

7.6 Firmware update

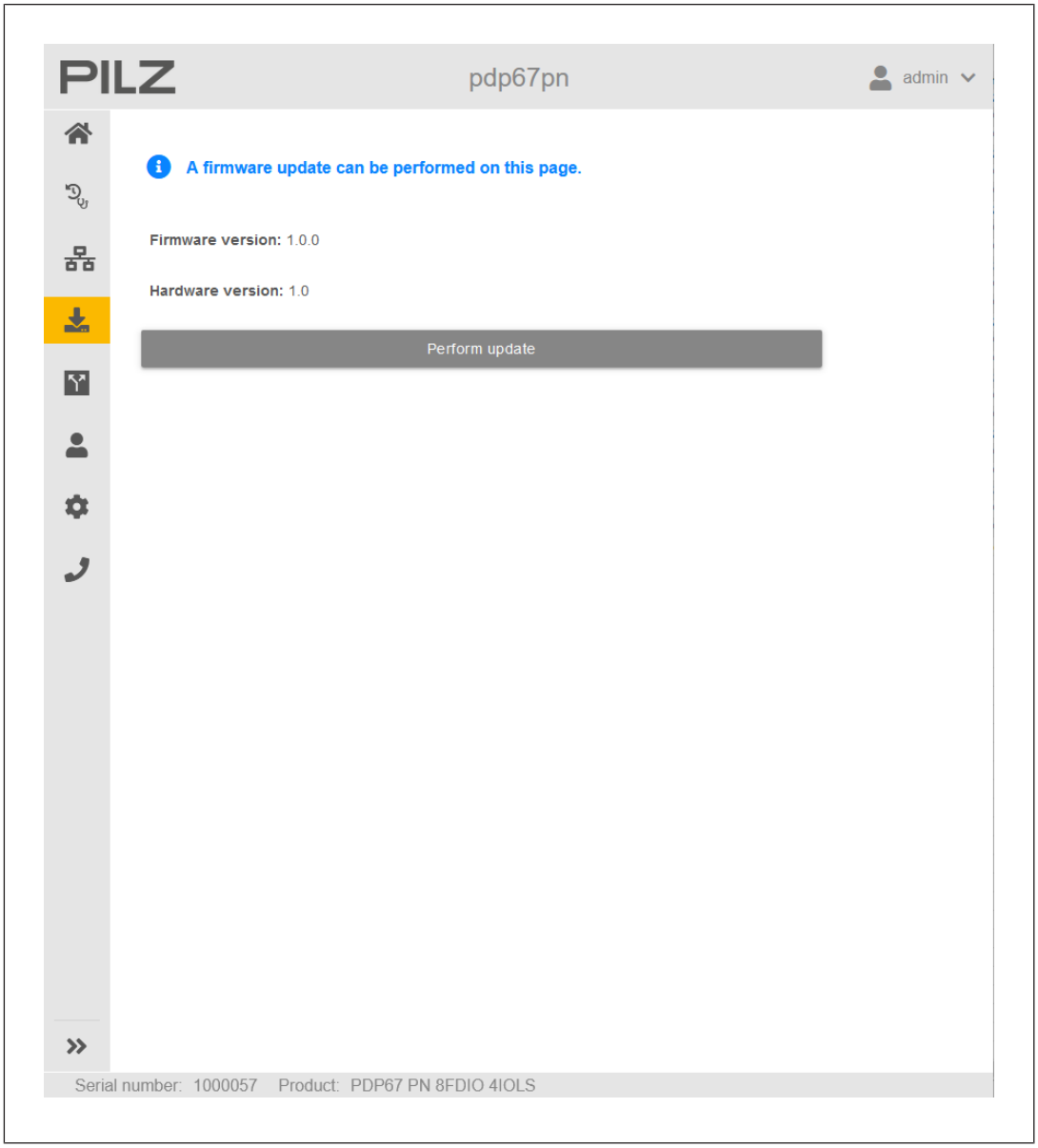


Fig.: Firmware update

A firmware update can be performed on this page.

The firmware version influences the product's configurable properties.

The firmware is signed in order to guarantee that only valid firmware files are used. The update can be performed via this web application or via the configuration tool PASconfig (see Online Help, Firmware Manager).

Firmware update in web application

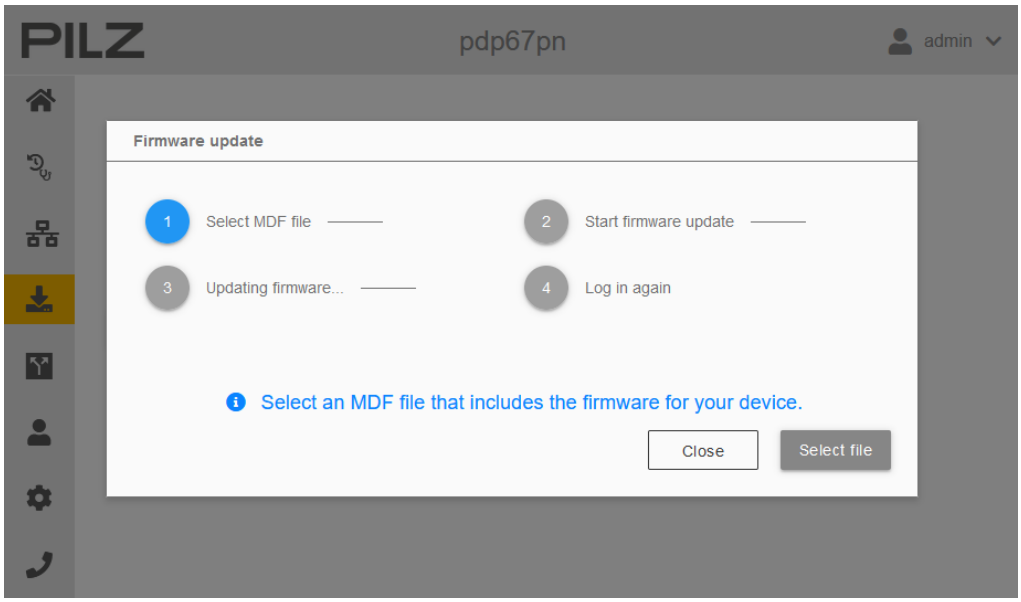
If you want to know what has changed in the firmware before performing the firmware update, you can view the product changes first (in the configuration tool PASconfig).

Prerequisites:

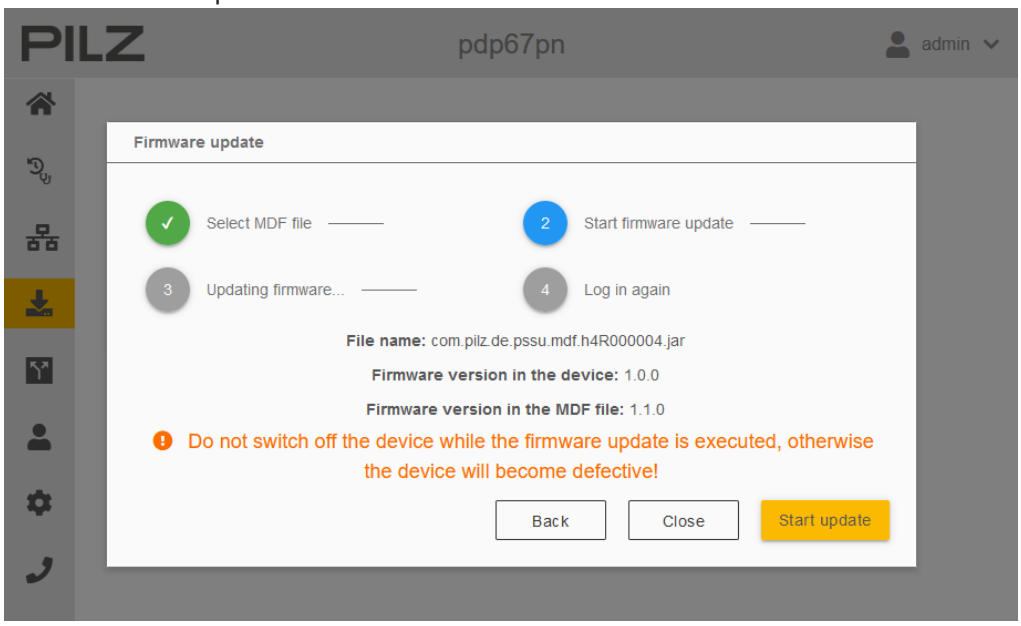
- There are several firmware versions for the product
- You are logged in as admin (administrator) (see Manage users [96]).

Procedure

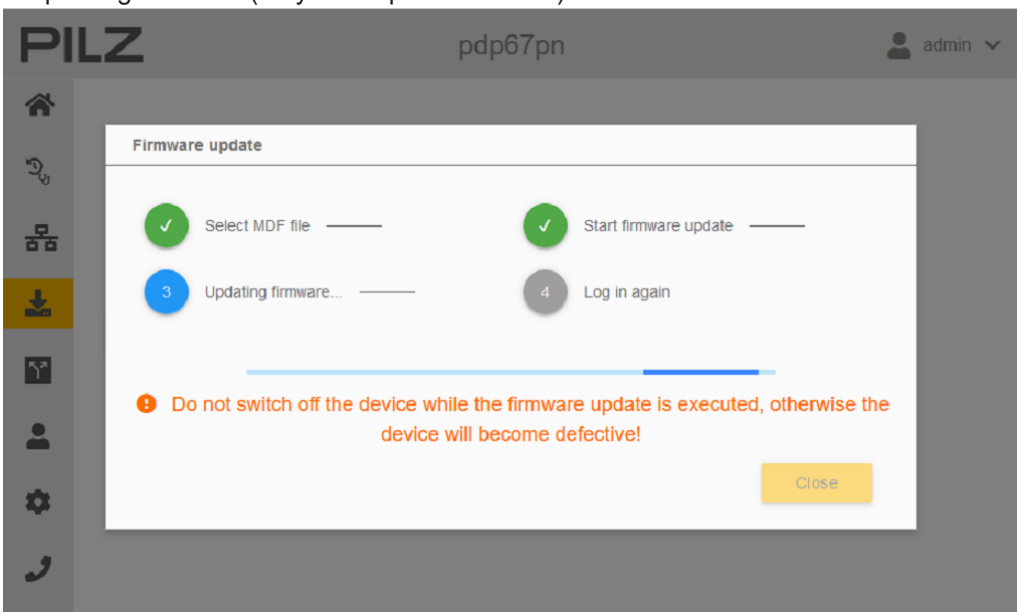
- Click on ***Perform update.***
- Follow the instructions in the web application.
  - 1 Select MDF file



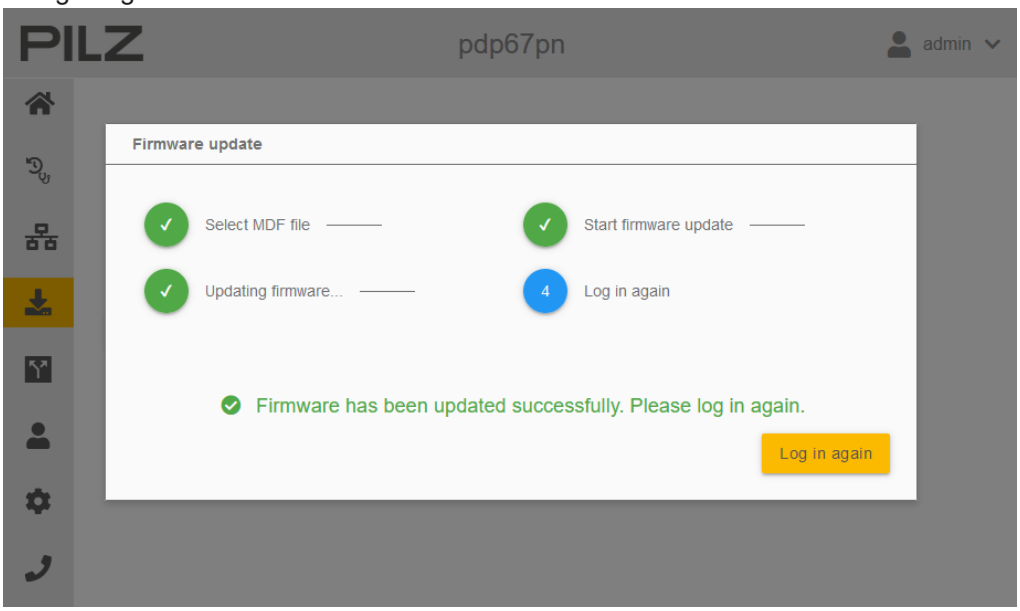
  - 2 Start firmware update



– 3 Updating firmware (may take up to 5 minutes)



– 4 Log in again



The device will restart automatically after the firmware update.

After changing the firmware version, the configured values remain.

Firmware update unsuccessful

If the firmware update was unsuccessful, you can use the reset button [31] to switch to bootloader mode and perform the firmware update again there.

7.7 Performing the wiring test

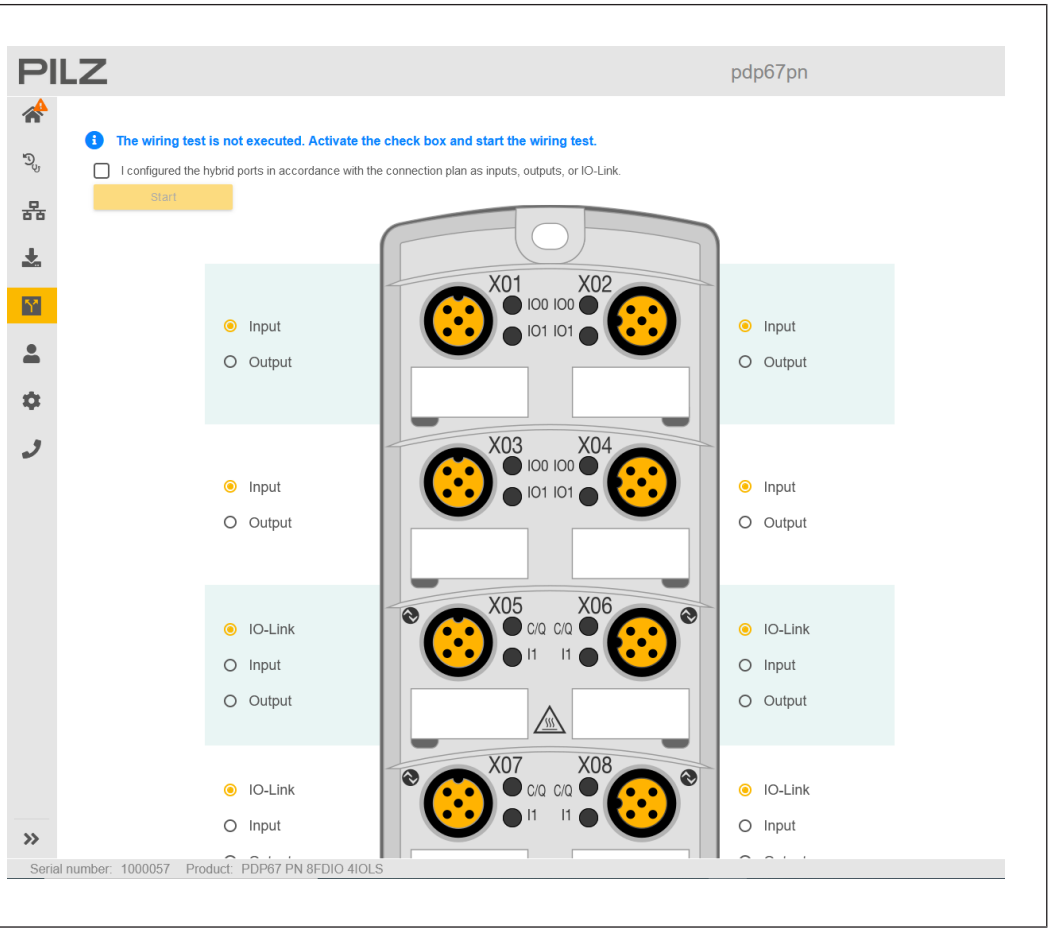


Fig.: Wiring test

The integrated wiring test provides the option to ensure the device is wired correctly. Wiring errors can be uncovered in this way, for example. The states of the inputs are displayed via the web application "Perform wiring test" and the outputs can be switched on and off.

Prerequisites

- You are logged in as admin (administrator).
- The device has a valid IP address.
- The device does not have a configuration.
- For the hybrid IO ports X01, X02, X03 and X04, it is necessary to confirm that they have been configured as an input or output in accordance with the wiring diagram.
  For the IO-Link Safety ports X05, X06, X07 and X08, it is necessary to confirm that they have been configured as SIO Digital Input (DI), SIO Digital Output (DO) or as IO-Link.

WARNING!

Risk due to the switching of outputs

The switching of outputs during the wiring test may cause hazardous states on the machine.

Ensure that nobody is endangered by switching outputs during the wiring test.

Procedure

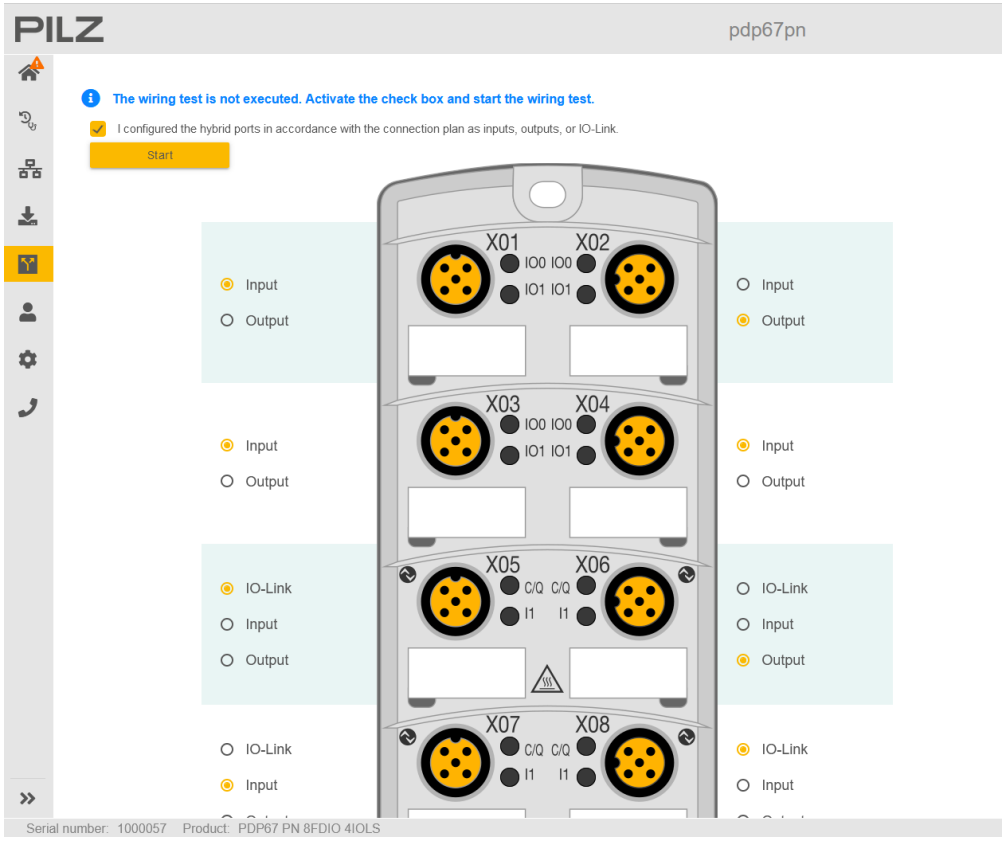


Fig.: Wiring test, confirmation that the configuration is in accordance with the wiring diagram.

- Confirm

  – that all hybrid IO ports X01, X02, X03 and X04,

  – as well as all IO-Link Safety ports X05, X06, X07 and X08

  have been configured in accordance with the wiring diagram and click on ***Start***. The device switches to wiring test mode and displays the current status of the inputs. When the wiring test is started, the outputs are deactivated.

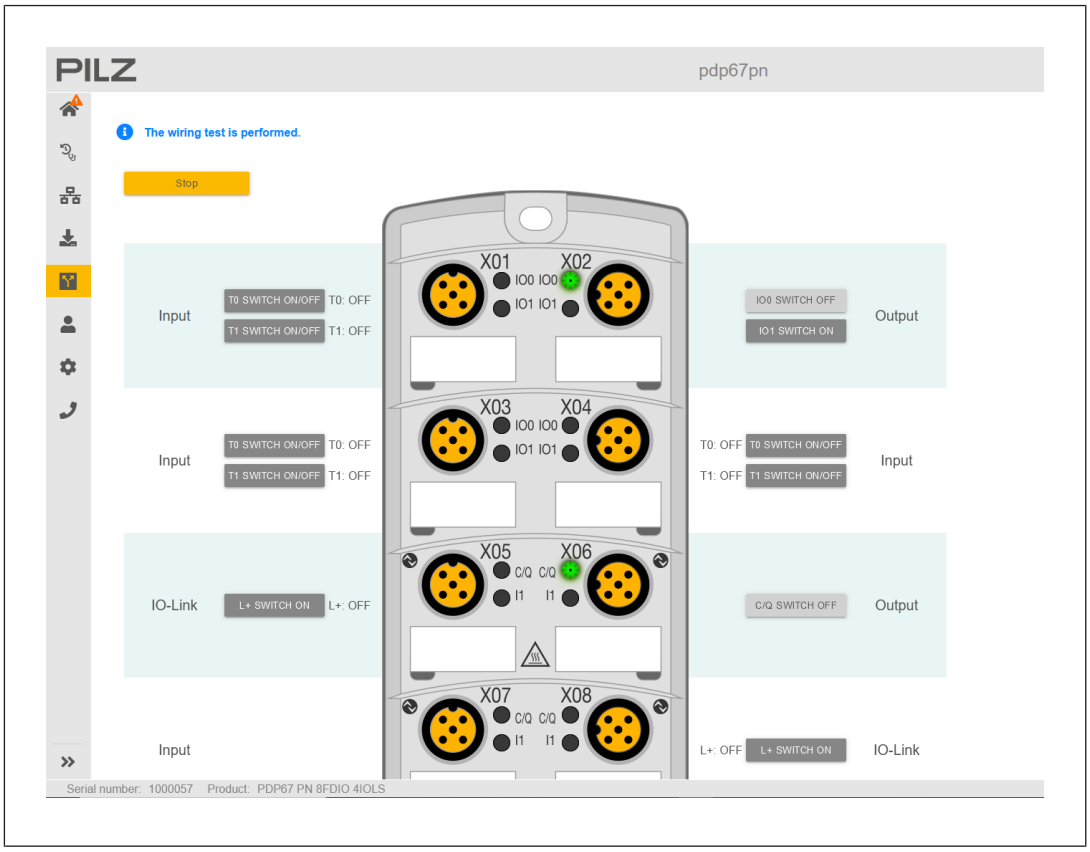


Fig.: Wiring test performed

7.7.1 Wiring test on hybrid ports

Check sensor wiring

Prerequisites

- Wiring test has been started

Procedure

- Switch on the test pulse output.
- Activate the sensor.
- Check that the status display at the input changes when the sensor is connected.
- Switch off the test pulse output.

Check actuator wiring

Prerequisites

- Wiring test has been started

Procedure

- Switch on the output.
- Check that the corresponding actuator switches.
- Switch off the output.

7.7.2 Wiring test on IO-Link Safety ports

Check sensor wiring

Prerequisites

- Wiring test has been started

Procedure

- Activate the sensor.
- Check that the status indicator at the input (SIO Digital Input (DI)) changes when the sensor is connected.

Check actuator wiring

Prerequisites

- Wiring test has been started

Procedure

- Switch on the output (SIO Digital Output (DO)).
- Check that the corresponding actuator switches.
- Switch off the output.

Check IO-Link Device wiring

- Switch on the supply voltage (L+).
- Check that the supply voltage is present at the IOL Device.
- Switch off the supply voltage.

7.7.3 End wiring test

- Click on Stop to end the wiring test (the device is restarted).

The wiring test is also ended:

- By pressing the reset button
- By switching off the supply voltage
- After two hours have elapsed

If the wiring test is ended because the device switches to a safe state as the result of a critical error, then once the critical error has been resolved, you will need to perform a warm reset (see Reset button [31]) and start the wiring test again.

7.8 Managing users

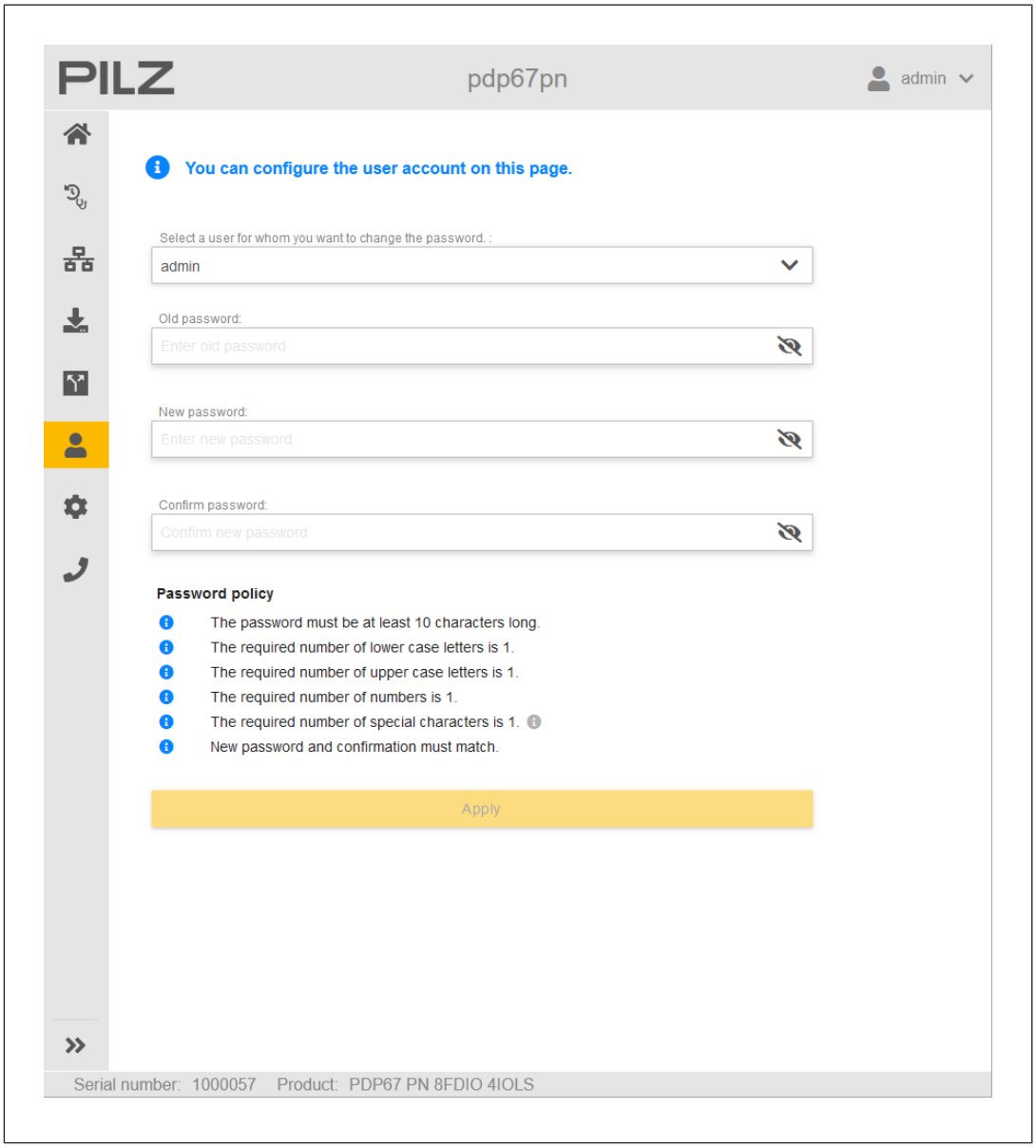


Fig.: Change password

On this page you can change the password for the predefined users. Two default users are defined on the device; these cannot be changed (see Pre-defined user name [📖 79]):

- admin (administrator)
- guest (user with read rights)

Procedure

- Select the user whose password you wish to change.
- If you wish to change the password of the "admin" user, enter the old password. The default password for the "admin" user is ***PDP67.***
- If you wish to change the password of the "guest" user, it is not necessary to enter the old password.
- Enter a new password. The password must meet the listed password policies.

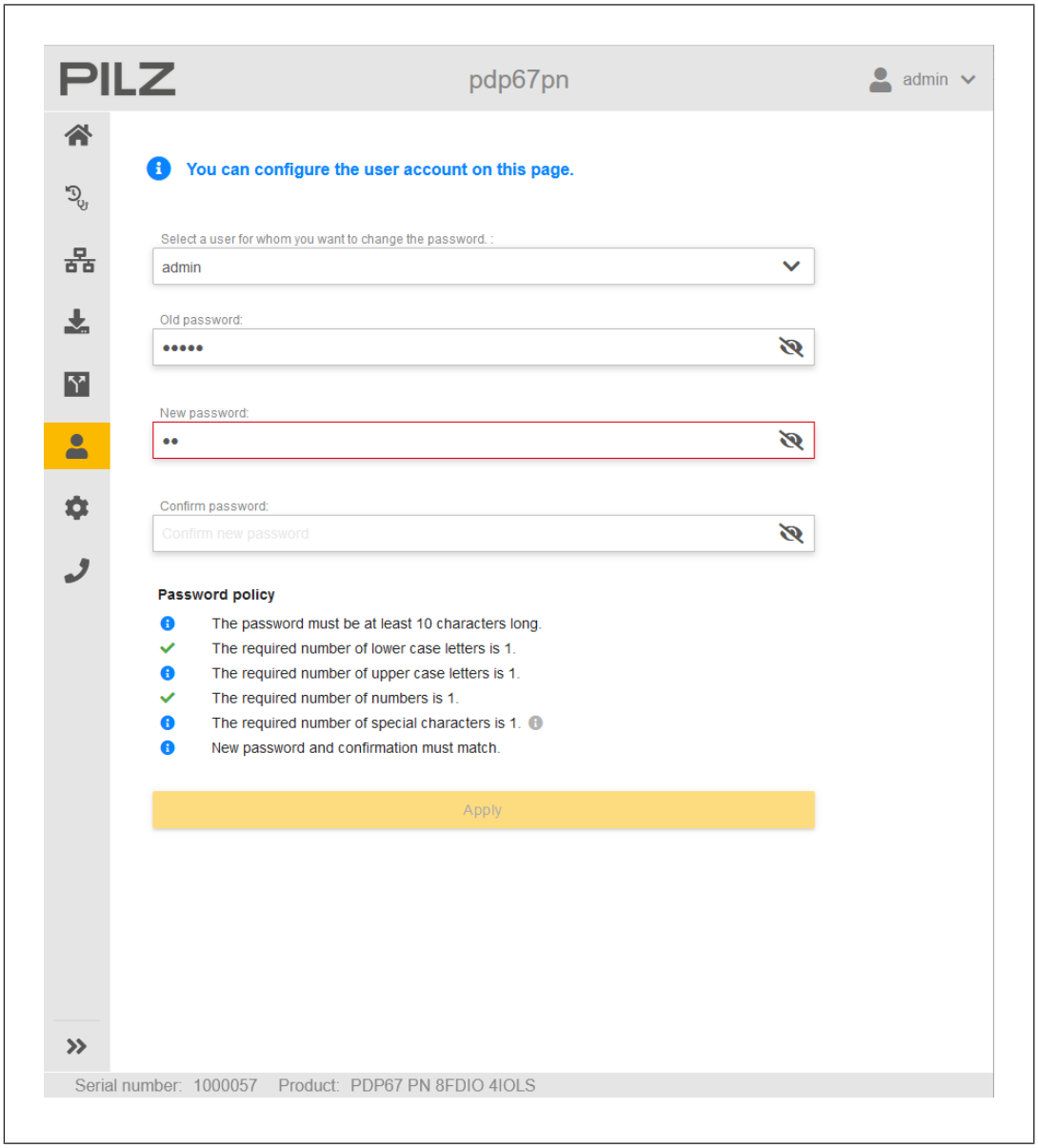


Fig.: Password policy not met

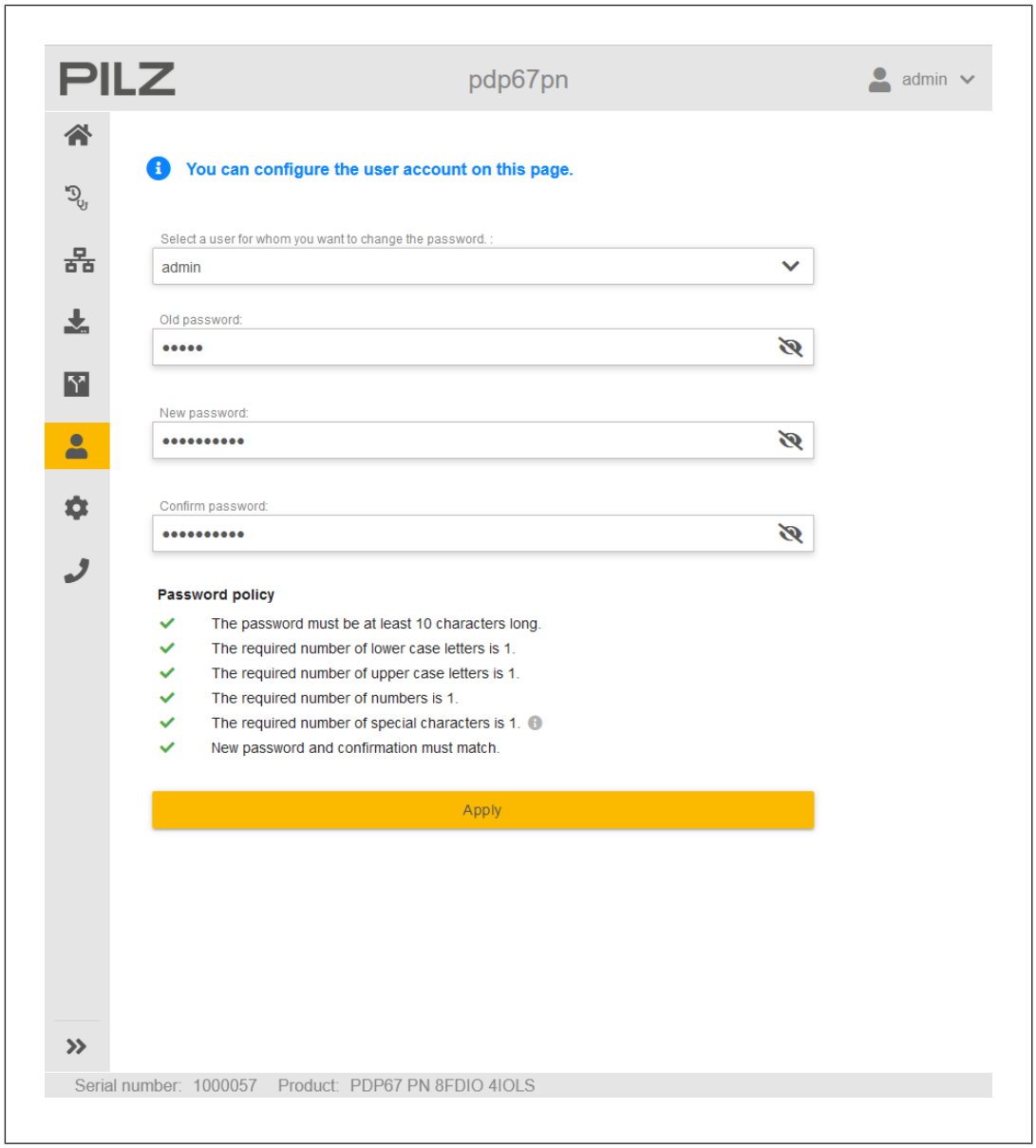


Fig.: Password policy met

- Repeat the password and click on ***Apply***.

7.9 Settings

On this page you can configure the following settings:

- SNTP settings [📖 99]
- Web application settings [📖 101]
  - Managing certificates [📖 101]
  - Adapting the data protection and security information [📖 102]
  - Deactivating the web application [📖 102]

7.9.1 SNTP settings

You can activate time synchronisation with SNTP Server on this page.

- Synchronised time: the diagnostic messages are displayed as follows: (see also Show diagnostics [86]):

  Local time zone of host computer (year, month, day, hour, minute, second, millisecond)

  Default setting: not activated

Procedure

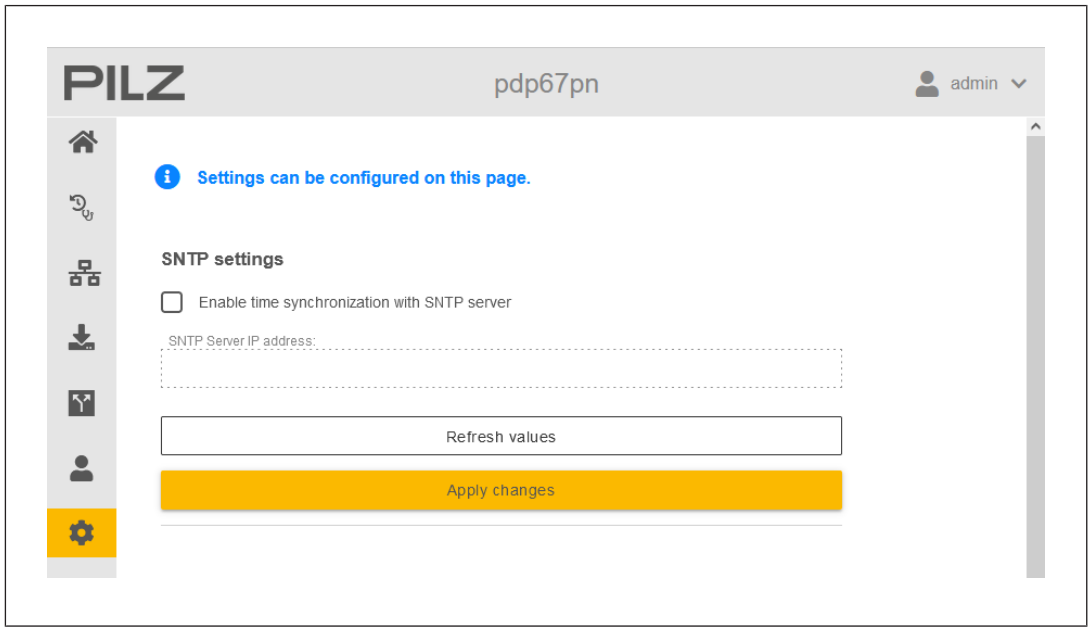


Fig.: SNTP settings

- Select ***Activate time synchronisation with SNTP Server***.
- Enter the SNTP Server IP address.

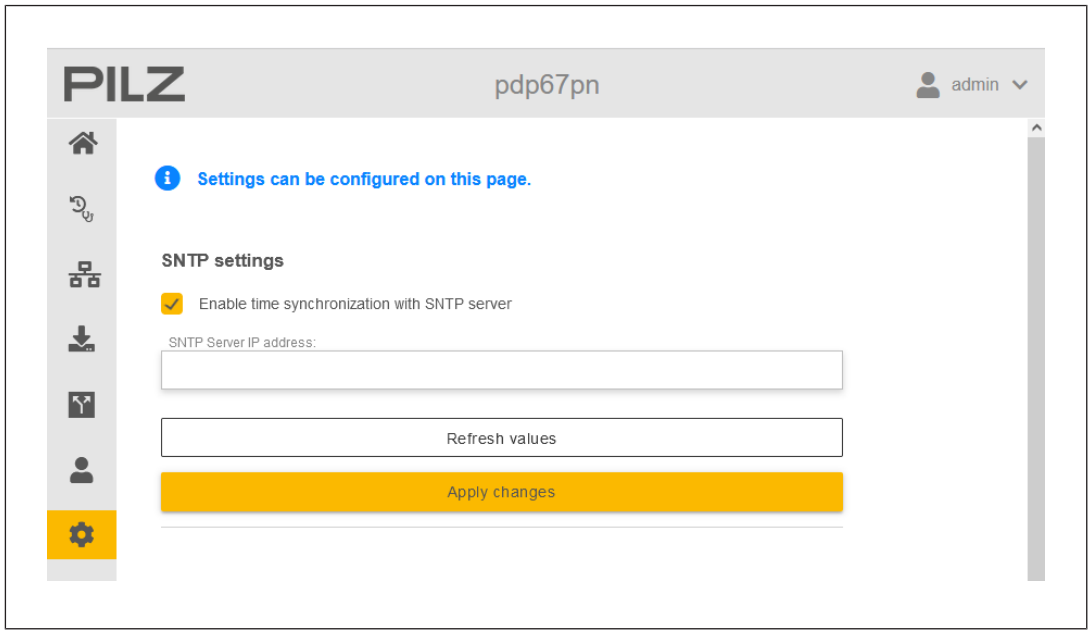


Fig.: SNTP settings

- Click on ***Apply changes*** to write the configuration to the device (the device is then restarted).

The time continues to run once it has been received by the SNTP Server. The time continues to run even if the connection to the SNTP server is interrupted.

The SNTP settings are retrieved from the device using the ***Refresh values*** button.

7.9.2 Web application settings

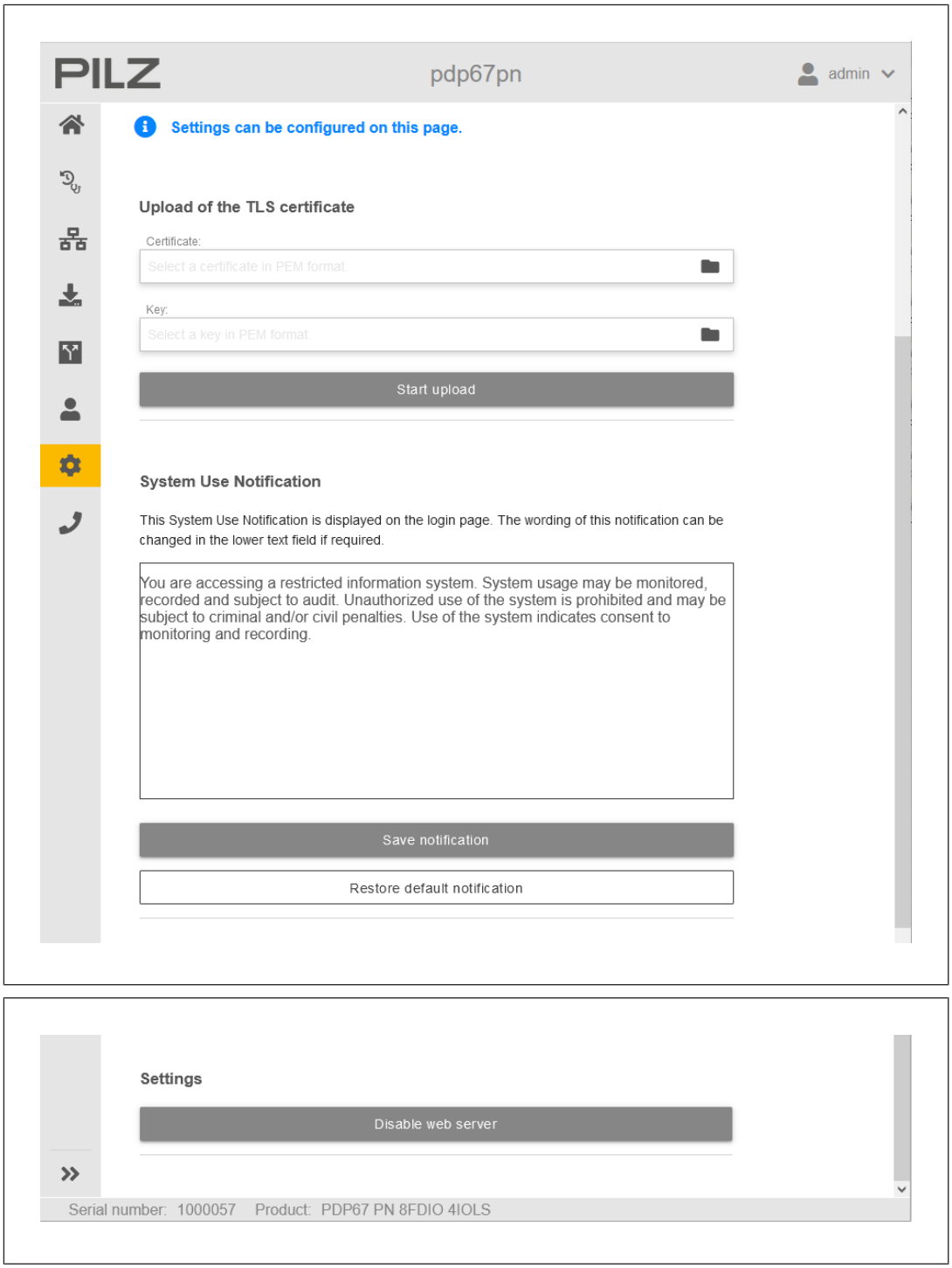


Fig.: Web application settings

7.9.2.1 Managing certificates

The web application uses X.509 certificates to secure communication between the web browser and web application.

By default the system uses a self signed CA certificate to sign the server certificate. The certificates are generated automatically by the web application.

To enable communication, the certificate is downloaded from the web application to the PC and is imported into the web browser. If you use a self-signed CA certificate, then when you try to establish a connection to the web application a warning appears, saying that the connection is not secure. To establish a connection you will need to Add a security exception rule to your web browser [82].

New certificates are generated when the web application is reset to its factory settings.

Certificate upload

If you want to use your own certificates, you can store the CA certificate and server certificate with its private key in the web application. As they are uploaded the certificates are checked to ensure that the syntax is correct.

Possible formats:

- PEM

Effects:

- When a CA certificate is uploaded, any existing private key will be deleted.

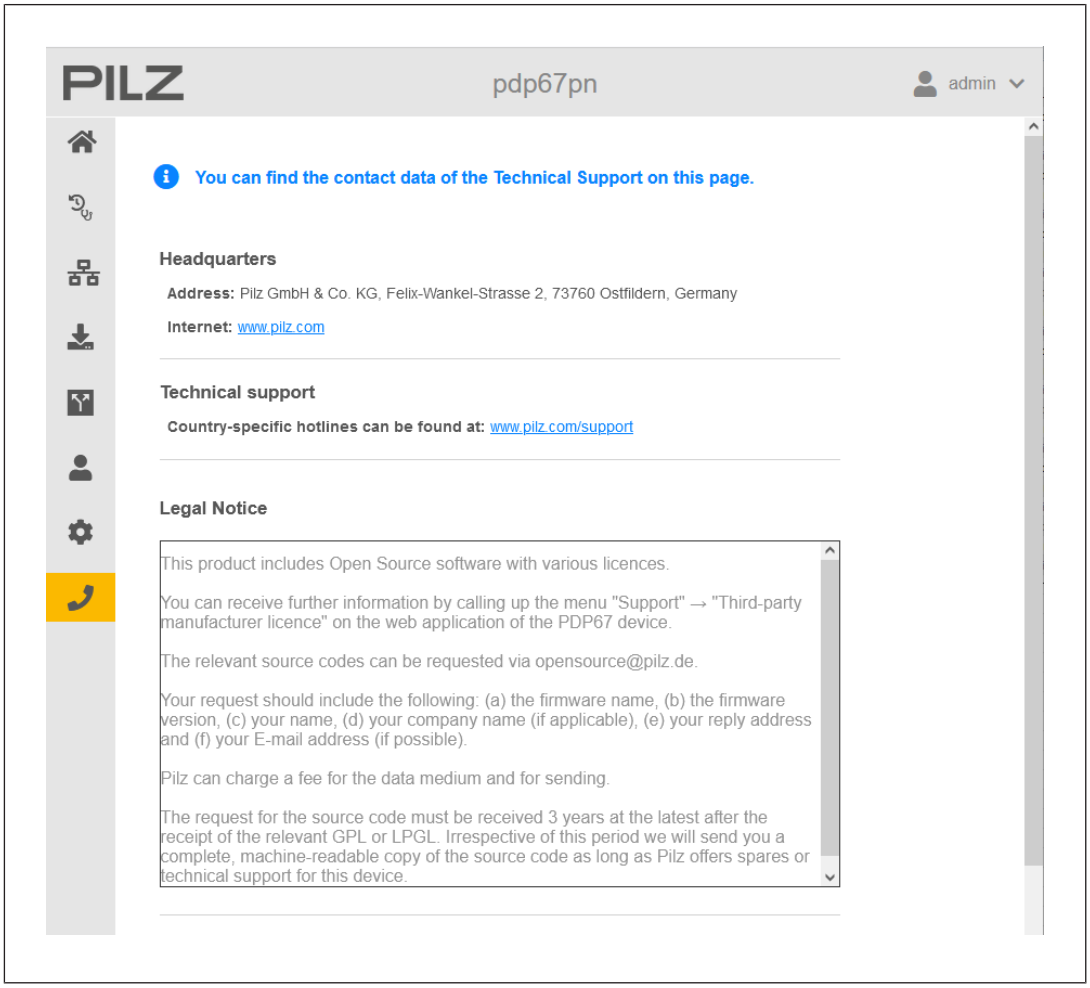
7.9.2.2 Adapting the data protection and security information

Data protection and security information is displayed on the login page. As the administrator and the person responsible for security, you can adapt this information to the needs of your organisation.

7.9.2.3 Deactivating the web application

Once deactivated, the web application is no longer accessible via a web browser. To reactivate the web application you will need to perform an Original reset [31].

7.10 Support


PILZ
pdp67pn
admin
You can find the contact data of the Technical Support on this page.
Headquarters
Address: Pilz GmbH & Co. KG, Felix-Wankel-Strasse 2, 73760 Ostfildern, Germany
Internet: www.pilz.com
Technical support
Country-specific hotlines can be found at: www.pilz.com/support
Legal Notice
This product includes Open Source software with various licences.
You can receive further information by calling up the menu "Support" → "Third-party manufacturer licence" on the web application of the PDP67 device.
The relevant source codes can be requested via opensource@pilz.de.
Your request should include the following: (a) the firmware name, (b) the firmware version, (c) your name, (d) your company name (if applicable), (e) your reply address and (f) your E-mail address (if possible).
Pilz can charge a fee for the data medium and for sending.
The request for the source code must be received 3 years at the latest after the receipt of the relevant GPL or LPGL. Irrespective of this period we will send you a complete, machine-readable copy of the source code as long as Pilz offers spares or technical support for this device.

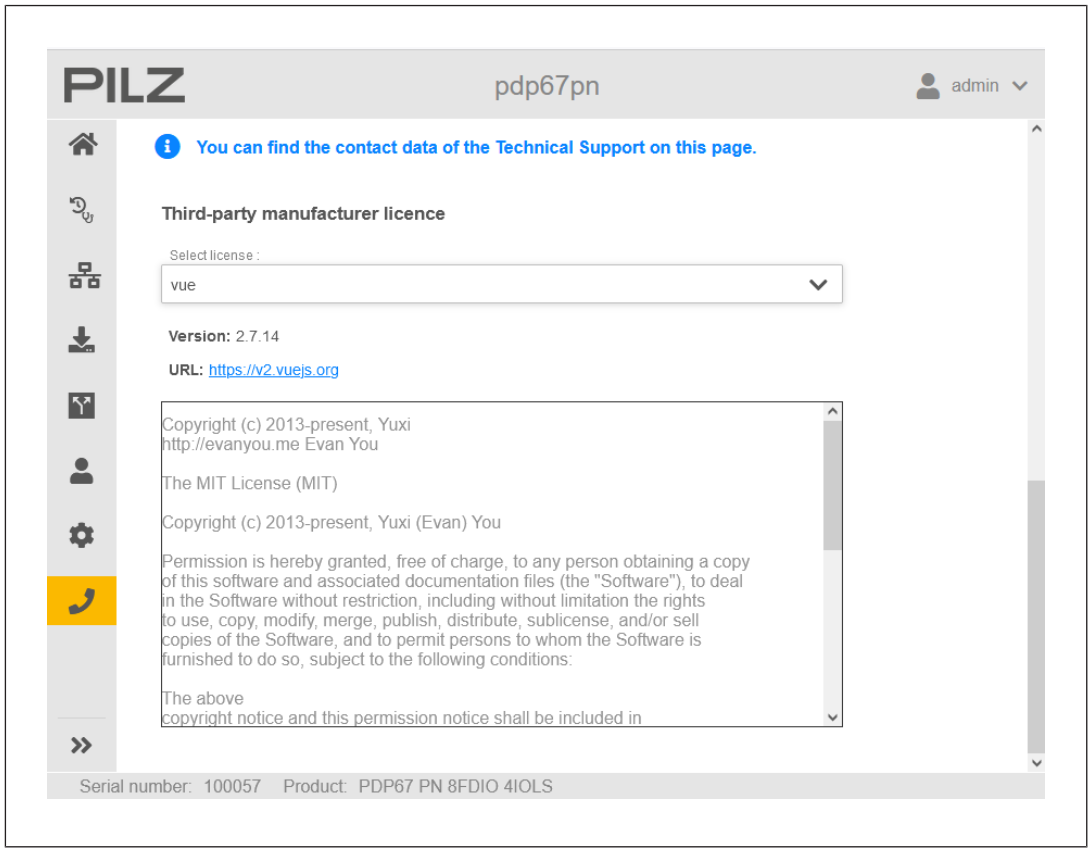


Fig.: Support

The Support page contains contact information for Pilz's technical support team plus the licences for the open source components that are used.

8 Installation

8.1 General installation guidelines

To meet the requirements of protection type IP67/IP69K, ensure that:

- All M12 connections are connected with a torque setting of 0.6 Nm.
- All end caps are fastened with a torque setting of 0.6 Nm. We recommend you use a torque screwdriver with PH3 bit.
- The end cap for the PDP67 removable data medium (optional) is firmly sealed.

INFORMATION

For ports X01 ... X08 and X21, X22 you should only use the end caps 380324 (colour: black), available as an option.

For port X32 you should only use the end cap 380328 (colour: grey), available as an option.

Protect the device from:

- Water or fluids with more stringent conditions than protection type IP67/69K
- Chemicals
- Harmful substances
- Intentional damage

8.1.1 Dimensions

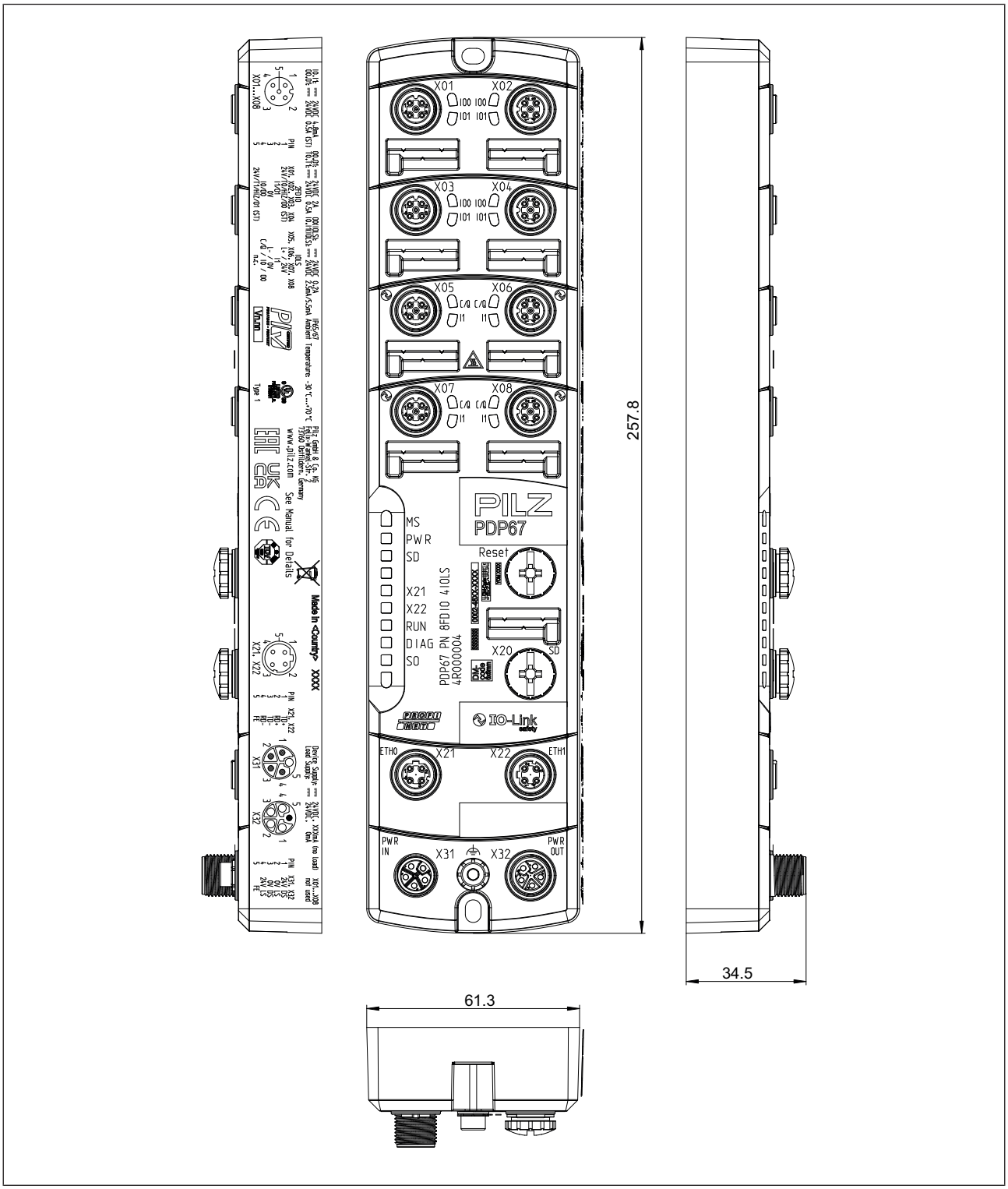


Fig.: Dimensions

8.1.2 Installing the unit

The product must be fastened to a flat mounting surface, so that there is no strain on the housing when the module is screwed down. The mounting distances will depend on which plug-in connectors are used and on the bending radius of the cables.

Screws and locking washers supplied with the device:

- 1 x M4 screw for the functional earth (installed)
- 2 x M4 locking washers for the functional earth (installed)

To install the device and connect the earthing strap to the mounting surface you will need 3 x M4 screws of an appropriate length and 2 x M4 locking washers.

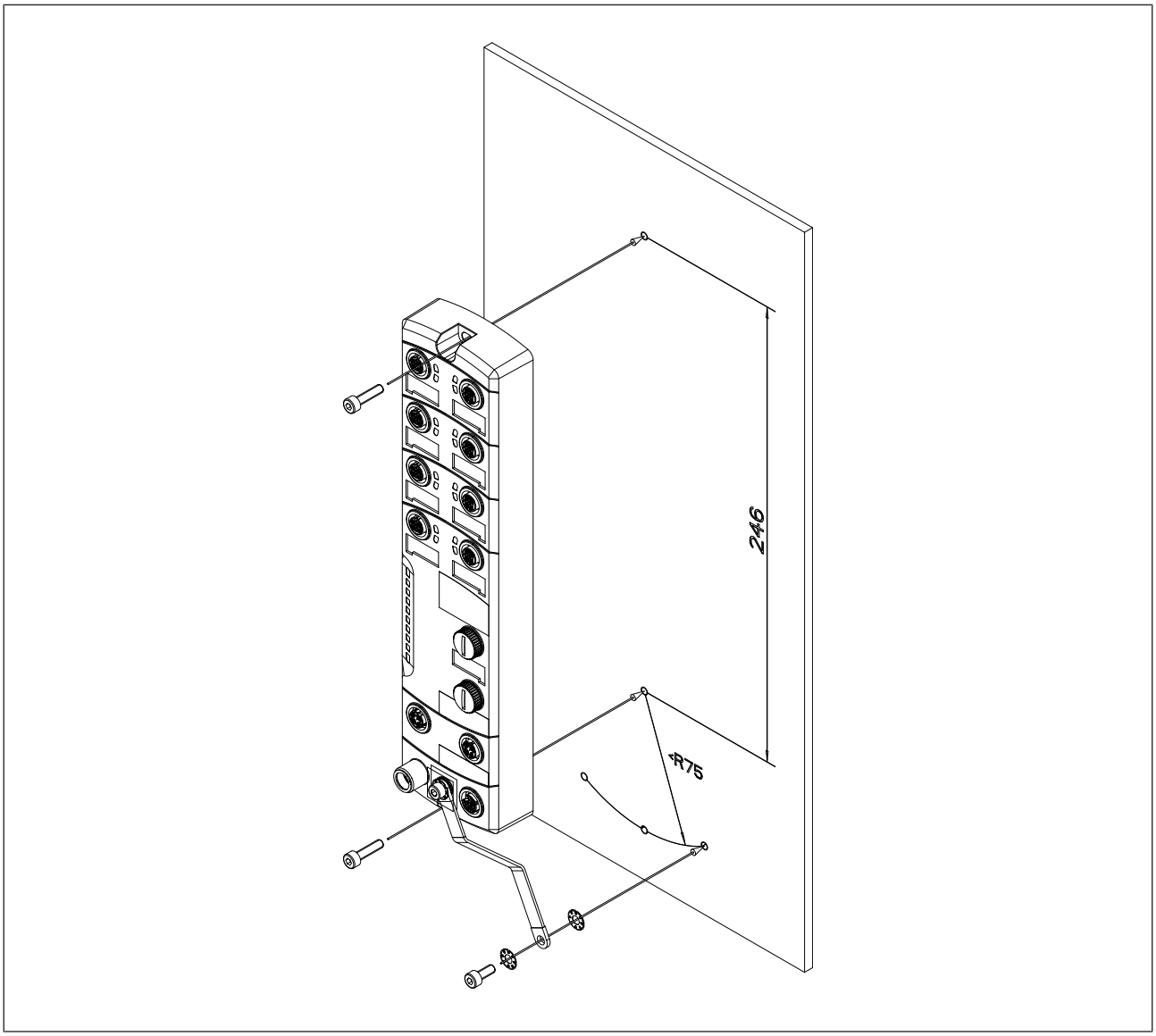


Fig.: Mounting in mm

To install the device, proceed as follows:

- Mark the drill holes and pre-drill them.
- Use fixing screws with washers. In environments with vibration we recommend that you use locking washers.

- When using internal hexagonal fixing screws with a strength class of 8.8, tighten the mounting screws with a torque setting of 2.5 Nm to 2.9 Nm.
- Use two fixing screws to attach the product to the mounting surface.

Connecting the functional earth to the earthing strap provided

The functional earth is connected to the lower fixing screw with the functional earth symbol ⏚. You can use the earthing strap provided or a separate earthing cable. If you use a separate earthing cable, the minimum conductor cross section of the earthing cable is 2.5 mm². Use fixing screws with washers. In environments with vibration we recommend that you use locking washers.

To connect the functional earth to the earthing strap provided, display, proceed as follows:

- Provide the mounting surface with an M4 internal thread (only when attaching the earthing strap to the mounting surface).
- Tighten the fixing screw on the functional earth connection ⏚ with a torque setting of 1.2 Nm. For the fixing screw you can use the M4 ratchet screw provided and the locking washer for the functional earth connection.
- Tighten the mounting screw on the mounting plate. When using an internal hexagonal fixing screw with a strength class of 8.8, tighten the screw with a torque setting of 2.5 Nm to 2.9 Nm.

9 Wiring

9.1 General wiring guidelines

Note:

- You must comply with the information provided under "Technical Details".
- Use shielded cables when using PROFINET IRT mode and under increased EMC influences (above the required values of EN 6100-6-2).
- Ensure that the sensors used for safety functions meet the required SIL value for the application.
- When selecting the sensors, make sure that the sensors' dielectric strength guarantees the required insulation against live parts. The maximum voltage permitted on the device is SELV/PELV.
- When using the FDIO ports as the FS output FDO, make sure that there is never more than 4 A flowing over Pin 3 (0 V).
- Ensure that the maximum 16 A current load capacity of ports X31 and X32 is not exceeded.
- Ensure that the application is designed in such a way that the voltage/current-free state (normally energised mode) represents the safe state.
- Use a torque setting of 0.6 Nm when connecting all M12 cables.
- To connect the wiring we recommend you use pre-assembled cable from Pilz (see Accessories [📖 137]).
- Before exchanging a device, make sure that the defective device, the new device and the connectors are labelled in such a way that the connectors can clearly be assigned to the ports.

EMC-compliant installations

Observe the relevant standards for EMC-compliant installations and observe the following cable routing measures:

It is possible to differentiate between cables according to their function. The following groups exist:

- Group 1: Data and supply lines for DC voltages below 60 V and AC voltages below 25 V
- Group 2: Data and supply lines for DC voltages from 60 V to 400 V and AC voltages from 25 V to 400 V
- Group 3: Supply lines above 400 V

Cabling inside buildings:

- The cable groups listed above should be laid separately.
- Cables of the same group can be laid within the same cable duct.
- Cables from group 1 and group 2 should be laid in the control cabinet or building in separate bundles or cable ducts that are at least 10 cm apart.
- Cables from group 1 and group 3 should be laid in the control cabinet or building in separate bundles or cable ducts that are at least 50 cm apart.
- Data and signal lines should be laid as close as possible to an earthed surface.

Cabling to open air systems:

- As far as possible use metal conduits. These should be electrically connected and earthed.
- Ensure there is sufficient protection against lightning by using metal conduits earthed at both ends, or concrete cable ducts with reinforcements connected across the joints.

CAUTION!

The supply voltages must be protective extra low voltages with safe electrical separation (SELV or PELV). Protective separation must be ensured for the external power supplies that generate the supply voltages. Failure to do so could result in electric shock. The external power supplies must comply with the current applicable standards EN 62368-1, EN 61140, EN 62477-1 or EN 61558-1.

CAUTION!

In order to guarantee protection type IP67, unused plug-in connectors should be sealed using the end caps.

CAUTION!

Make sure that the plug-in connectors are connected to the sensors correctly. Once you have run a function test to check that the plug-in connectors are connected to the sensors and actuators correctly, the IO ports should be labelled. If the IO ports are connected to the sensors and actuators incorrectly, life-threatening situations may arise on the plant.

WARNING!

The internal reverse polarity protection circuit is not a safety function

A defective reverse polarity protection circuit on the device will not be detected. When making the initial connection and when recommissioning, check the correct functionality of the device's reverse polarity protection circuit.

1-channel FS inputs FDI

- The failure of a sensor will not be detected. Possible remedies:
  - Use sensors that meet the required SIL value for the application.
  - Carry out regular function tests.
  - Use 2-channel FS inputs and/or sensors.

- Short circuits between the cable to the sensor and the 24 V cable or between cables to various sensors will not be detected. Avoid short circuits through:
  – Appropriate wiring
- The input is not protected against voltages over 60 V. The power supply to the sensors must meet the regulations for extra low voltages with protective electrical separation (SELV, PELV).

1-pole FS outputs FDO

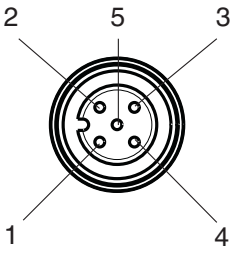
- If short circuits occur between the cable from the output to the load and a supply line, it will no longer be possible to switch off the load. Avoid short circuits through:
  – Appropriate wiring
  – Using a second output as a second shutdown route
- The failure of an actuator will not be detected. Possible remedies:
  – Use actuators that meet the required SIL value for the application.
  – Carry out regular function tests.
  – Use a second actuator and monitor the state of the actuator using feedback loop monitoring in the user program. If the value does not correspond to the set point, then the actuator must be switched off.

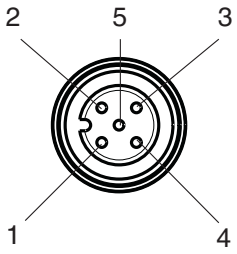
Guidelines for UL approval

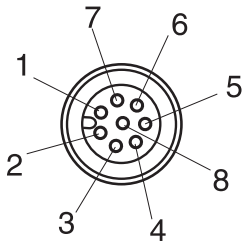
UL Markings

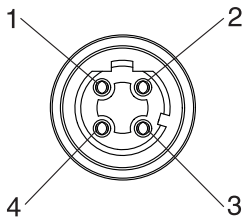
- The minimum cable temperature of the cable assemblies (CYJV2/8, CYJV/7 / PVVA2/8, PVVA/7) connected to the terminals: 85°C
  Use of AWG 14, min. 60 VDC, min. 16 A (X31, X32) or AWG 22 min. 22 A (X01 … X08) required for maximum load, use copper conductors only.

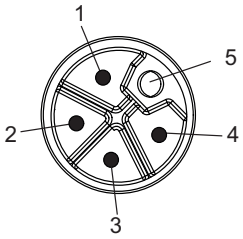
9.2 Connector pin assignment

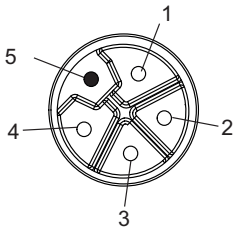
IO ports (hybrid) X01, X02, X03, X04	Assignment	
FDI type: FS inputs **FDO** type: FS outputs, 1-pole **SDO** type: ST outputs 5-pin M12 female connector A-coded	1: Test pulse T0 / 24 VDC / ST output O0 2: FS input I1 / FS output O1 3: 0 V 4: FS input I0 / FS output O0 5: Test pulse T1 / 24 VDC / ST output O1 Connection to functional earth on the connector housing	

IO-Link Safety ports X05, X06, X07, X08	Assignment	
IOLS type: Connection of sensors/actuators 5-pin M12 female connector A-coded	1: L+ (Device Supply) 2: ST input I1 3: L- (Device Supply) 4: C/Q (IO-Link data line) or ST input I0 / ST output O0 5: n. c. The input current via Pin 2 and Pin 4 is configurable: 2 mA 5 mA (default)	

Port X20	
Connection of the PDP67 removable data medium, see under PDP67 removable data medium (available as an option) [📖 33]	

Ports X21 and X22	Assignment	
ETH type: 2 Ethernet interfaces 4-pin M12 female connector D-coded	1: TD+ 2: RD+ 3: TD- 4: RD- Connection to functional earth on the connector housing	

Port X31	Assignment	
PWR type: Supply voltage connection 5-pin M12 male connector L-coded	1: + 24 VDC supply voltage for device supply 2: 0 V supply voltage for load supply 3: 0 V supply voltage for device supply 4: + 24 VDC supply voltage for load supply 5: Connection to functional earth	

Port X32	Assignment	
PWR type: Connection for forwarding the supply voltage 5-pin M12 female connector L-coded	1: + 24 VDC supply voltage for device supply 2: 0 V supply voltage for load supply 3: 0 V supply voltage for device supply 4: + 24 VDC supply voltage for load supply 5: Connection to functional earth.	

9.3 Connecting the supply voltage

Use a 5-pin, L-coded M12 plug-in connector to connect the device to the external supply voltage for device supply and load supply. The device has an M12 socket (X32), which is physically adjacent to the M12 connector; this is used to forward the device supply and load supply to other devices (see also Supply voltages [📖 35]).

WARNING!

Damage to the connector

The current load capacity of the M12 connectors X31 and X32 is 16 A per feed (device supply / load supply). You must ensure that this value is not exceeded. Exceeding the permitted current load capacity can damage the plug-in connector. Please note that the supply voltage connections are not monitored for overload. Please note the derating diagram under Derating diagram [📖 37].

In the case of an application with UL approval, refer to the derating table under Derating values for UL approval [📖 37].

- If switching loads leads to disturbances on the input signals, then we recommend you use separate power supplies to supply the device supply and load supply.

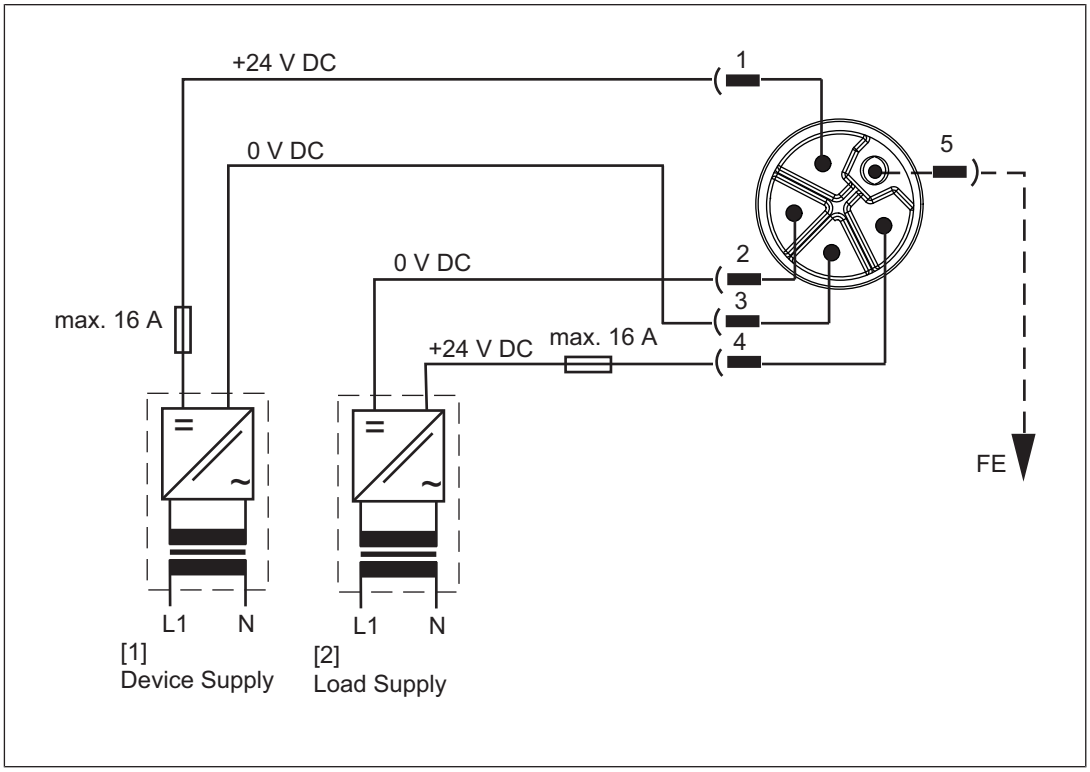


Fig.: Separate power supplies for device supply and load supply

Legend

[1] Infeed for device supply

[2] Infeed for load supply

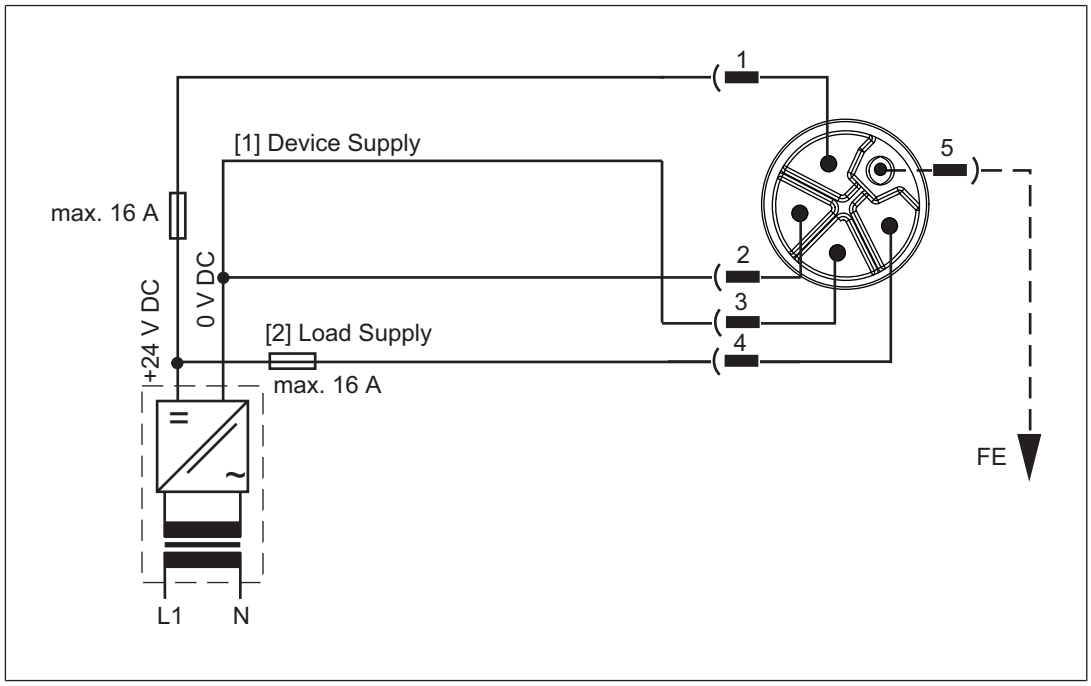


Fig.: Common power supply for device supply and load supply

Legend

[1] Infeed for device supply

[2] Infeed for load supply

Guidelines for UL approval

UL Markings

- The external circuits intended to be connected to this device shall be separated from MAINS supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuit of UL/CSA/IEC 61010-1, 61010-2-201.

Routing the supply voltages

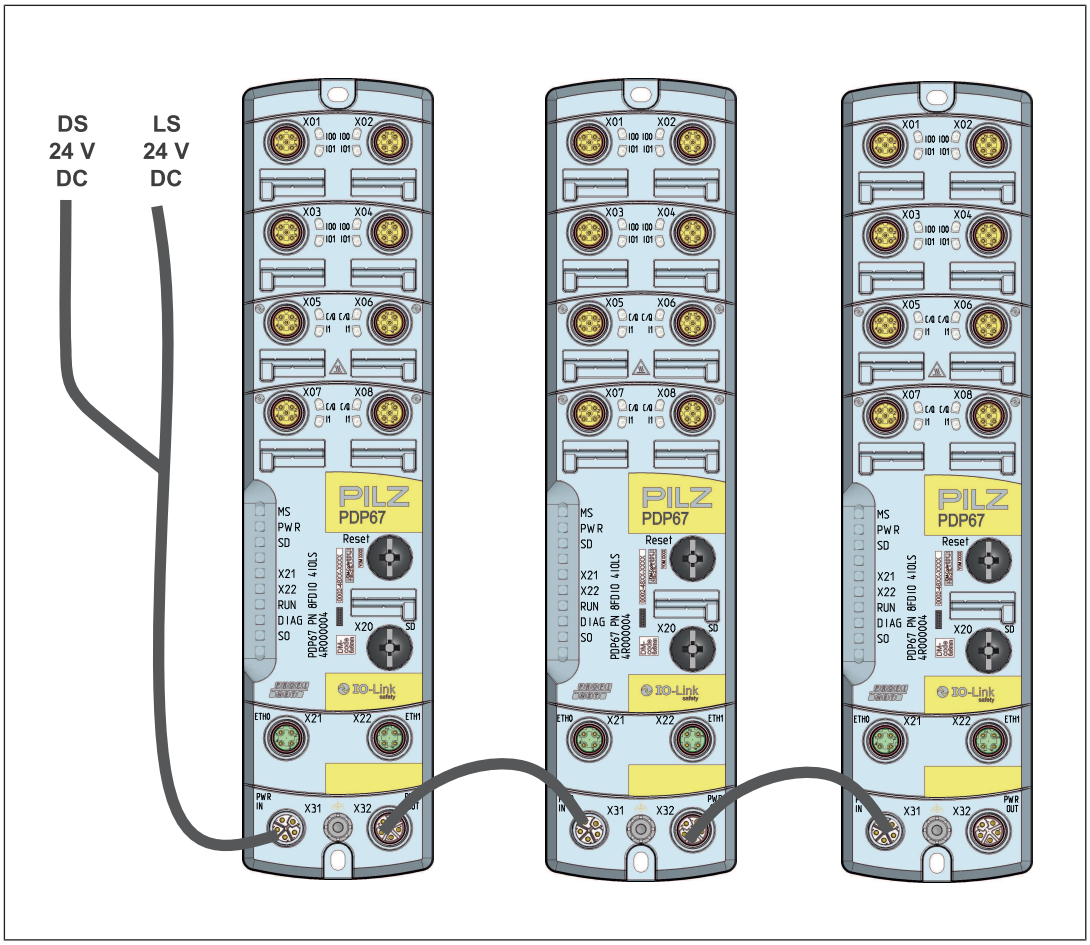


Fig.: Routing the supply voltage

9.4 Connecting the functional earth

The functional earth is used to divert electromagnetic interference.

Earth the device as follows:

Connect the functional earth connection on the device ⏚ to the plant's functional earth using the earthing strap provided. If several devices are used, the earthing strap must be connected to each device. To install the earthing strap see Connecting the functional earth to the earthing strap provided [📖 108].

- Connect pin 5 of the supply voltage connection PWR to the functional earth of the SELV/PELV power supply.

The connections must be low impedance and must be good conductors. Connections should be kept as short as possible. A conductor cross section of at least 2.5 mm² should be used for the connection to the central earth bar.

9.5 Connecting the fieldbus

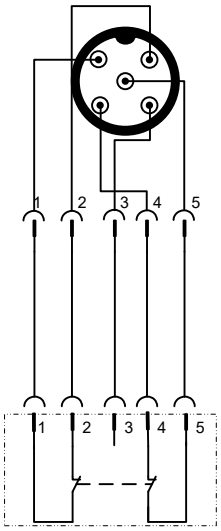
Refer to the specifications regarding installation and wiring of PROFINET devices in the PROFINET Installation Guidelines (profibus.com).

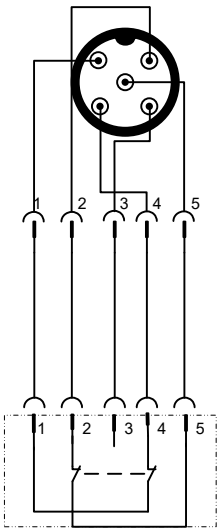
9.6 Wiring examples

Check the safety characteristics and notes for your specific application, see the section entitled Safety characteristic data [📖 135].

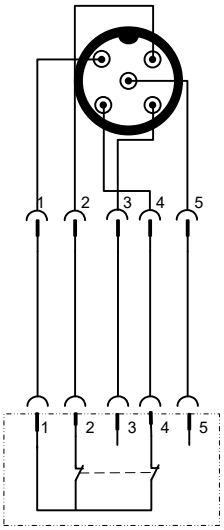
9.6.1 2-channel safety switch

Safety switch with volt-free contacts, equivalent, separate test pulse

Features	Connection example, PILZ safety switch
▸ Configuration of test pulses: – I0: T1 – I1: T0 ▸ Connection to FDIO ports: – Channel A of the safety switch to I0 and T1 Channel B of the safety switch to I1 and T0	

Features	Connection example, AIDA wiring
▸ Configuration of test pulses: – I0: T0 – I1: T1 ▸ Connection to FDIO ports: – Channel A of the safety switch to I0 and T0 Channel B of the safety switch to I1 and T1	

Safety switch with volt-free contacts, equivalent, shared test pulse

Features	Connection example, AIDA wiring
▸ Configuration of test pulses: – I0: T0 – I1: T0 ▸ Connection to FDIO ports: – Channel A of the safety switch to I0 and T0 – Channel B of the safety switch to I1 and T0	

WARNING!

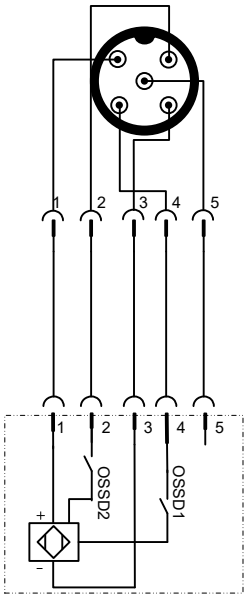
Use of shared test pulse

Short circuits between the cable from the test pulse to the sensor and the cable from the sensor to the input or between cables to various sensors will not be detected. Depending on the application, serious injury or death may result.

Avoid short circuits through

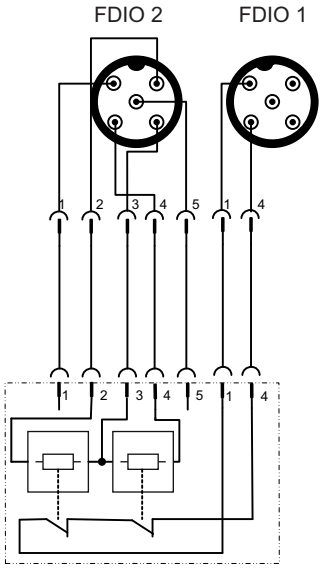
- Appropriate wiring
- Wiring in accordance with the requirements of IEC 61076-2-101 and IEC 60204-1, clause 14.1.1 and 14.1.2

Safety switch with electronic OSSD outputs, equivalent, no test pulse

Features	Connection example, AIDA sensor
▸ Configuration of test pulses: – T0: 24 V – T1: 24 V – I0 -> Test pulse: no test pulse – I1 -> Test pulse: no test pulse ▸ Connection to FDIO ports: – OSSD1 to I0 – OSSD2 to I1 – Safety switch supplied with 24 VDC through voltage output T0	

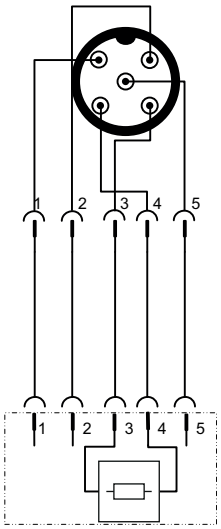
9.6.2 Control of actuators with 1-pole switching outputs

9.6.2.1 Control via two outputs

Features	Connection example
▸ Configuration of test pulses: – I0: T0 ▸ Connection to port FDIO 1: – Feedback loops of actuators 1 and 2 at input I0 ▸ Connection to FDIO 2 port: – Actuator 1 at output O0 and 0 V – Actuator 2 at output O1 and 0 V – For Cat. 4, PL e, SIL 3, the following protective measures must be taken: Both actuators must control the same safety function.	

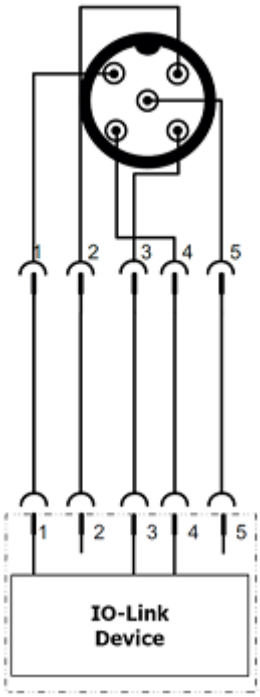
9.6.3 One actuator, 1-pole switching

Actuator, 1-pole switching

Features	Connection example
▸ Connection to FDIO ports: – Actuator at output O0 and 0 V	

9.6.4 IO-Link

IO-Link Device

Features	Connection example
▸ Connection to IOLS ports: – Pin 1: 24 V (L+) – Pin 3: 0 V (L-) – Pin 4: Switching and communication line (C/Q)	

10 Operation

10.1 Display elements

Fig.: LEDs

Legend

LED on

LED flashes
LED 500 ms on, 500 ms off
LED flashes
LED 900 ms on, 100 ms off

LED flashes quickly
50 ms on, 950 ms off

LED off

10.1.1 MS

This "MS" LED indicates the device status.

Colour	Status	Meaning
- - -		No supply voltage/not ready for operation
Green		Device is ready for operation
Green		Device in operation
Red		Device error, device is in a safe state, there is a diagnostic entry in the diagnostic log (see Read diagnostic log [129]). Once the error has been recovered, a restart (warm reset, see Reset button [31]) is required.
Yellow		Wiring test mode active
Yellow		Bootloader mode The user can perform a firmware update in bootloader mode.
Red		Updating firmware

10.1.2 PWR

The "PWR" LED indicates the status of the load and device supply.

Colour	Status	Meaning
- - -		No supply voltage
Yellow		Load supply or device supply faulty
Green		Load supply and device supply ok

10.1.3 SD

The "SD" LED indicates the status of the removable data medium.

Colour	Status	Meaning
- - -		No PDP67 removable data medium
Yellow		Confirmation for accepting the device project and configuration expected
Green		PDP67 removable data medium present

10.1.4 ETH0 (X21), ETH1 (X22)

These status LEDs are the display elements for the interfaces (X21 and X22). Each of the two interfaces is assigned an LED.

X21, X22

Colour	State	Meaning
---		No network connection
Green		Network connection present
Green		Data traffic is error-free

10.1.5 RUN

The "RUN" LED indicates the status of the PROFINET interface.

Colour	Status	Meaning
---		No PROFINET connection
Green		PROFINET connection available
Green		Device does not yet have a device name Flash test (RUN and DIAG LEDs flash green)

10.1.6 DIAG

The "DIAG" LED indicates recoverable errors/malfunctions.

Colour	Status	Meaning
- - -		No recoverable error/malfunction present
Red		Recoverable error/malfunction, there is a diagnostic entry in the diagnostic log (see Read diagnostic log [📖 129])
Green		Flash test (RUN and DIAG LEDs flash)

10.1.7 SO (safe operation)

The "SO" LED indicates the status of the PROFIsafe interface.

Colour	Status	Meaning
---		▸ F-parameter error ▸ F-host inactive
Green		▸ PROFIsafe is in operation All configured PROFIsafe instances are in operation If just one instance is not working, the LED is off/will flash.
Green		▸ PROFIsafe requires reintegration.

10.1.8 LEDs at the IO ports of the inputs and outputs (X01 ... X04)

These LEDs indicate the status of the inputs and outputs.

Colour	State	Meaning
- - -		The pin was not activated or Device in operation and: ▸ with inputs: a "0" signal is present ▸ with outputs: a "0" signal is emitted
Green		Device in operation and ▸ with inputs: a "1" signal is present ▸ with outputs: a "1" signal is emitted
Green		An error is present, there is a diagnostic entry in the diagnostic log (see Read diagnostic log [📖 129]).

10.1.9 LEDs at the IO-Link ports (X05 ... X08)

LED I1 at the ports X05 … X08 indicates the status of the digital inputs I1 (Pin 2).

Colour	Status	Meaning
- - -		The pin was not activated or Device in operation and ▸ with inputs: a "0" signal is present
Green		Device in operation and ▸ with inputs: a "1" signal is present

C/Q LED

The C/Q LED depends on the following configurable IOLS operating modes:

- Deactivated
- IO-Link Manual
- IO-Link Autostart
- SIO Digital Input (DI)
- SIO Digital Output (DO)
- IO-Link Safetycom

C/Q LED at X05 … X08 "deactivated" in the configured operating mode

Colour	Status	Meaning
- - -		The port is deactivated.

C/Q LED at X05 … X08 "SIO Digital Input (DI)" in the configured operating mode

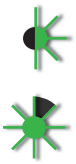
Colour	Status	Meaning
- - -		The pin was not activated or Device in operation and: ▸ with inputs: a "0" signal is present
Green		Device in operation and ▸ with inputs: a "1" signal is present

C/Q LED at X05 … X08 "SIO Digital Output (DO)" in the configured operating mode

Colour	Status	Meaning
- - -		The pin was not activated or Device in operation and: ▸ with outputs: a "0" signal is emitted
Green		Device in operation and ▸ with outputs: a "1" signal is emitted

C/Q LED at X05 … X08 "IO-Link Manual or "IO-Link Autostart"

in the configured operating mode

Colour	Status	Meaning
- - -		No communication
Green	 1 Hz; TON = 900 ms; TOFF = 100 ms	Communication

Colour	Status	Meaning
Green	 1 Hz; TON = 500 ms; TOFF = 500 ms	Error

C/Q LED at X05 … X08 "IO-Link Safetycom"

in the configured operating mode

Colour	Status	Meaning
- - -		No communication
Green	  1 Hz; TON = 900 ms; TOFF = 100 ms	Communication
Green, flashes	 1 Hz; TON = 500 ms; TOFF = 500 ms	Error
Green, flashes quickly	 1 Hz; TON = 50 ms; TOFF = 950 ms	AckReq

10.2 Diagnostics

The device offers various options for diagnostics and fault detection.

Diagnostics for the device can be run via the

- LEDs on the device (see Display elements [📖 122])
- And the device's own diagnostic log.

The device provides the following diagnostic data:

- Start-up error
- Configuration error
- FS communication error
- Temperature warning: too warm, low
- Temperature error: too hot, too low
- Output error
- Test pulse error
- Input error
- Undervoltage
- Overvoltage
- Overload
  - IO-Link, current at C/Q between 500 … 650 mA
  - IO-Link, current at L+ between 1.15 … 1.7 A

10.2.1 Read diagnostic log

All errors and malfunctions detected by the device are entered in the diagnostic log. You can read the device's diagnostic log using PASconfig (see PASconfig online help) or the web application (see Display diagnostics [📖 86]).

10.2.2 Remedies

Remedies are available in PASconfig via the diagnostic log (see PASconfig online help).

11 Maintenance and testing

NOTICE

Note when using the operating mode: IO-Link Safetycom

If an IO-Link communication error occurs more than once in 10 hours (PFH monitor time = 10 hours), the user must check the wiring of the device and the signal quality of the IO-Link data transmission.

It is not necessary to perform maintenance work on the product in normal operation.

- Please return any faulty product to Pilz.

12 Technical details

Where standards are undated, the 2023-06 valid editions apply.

General	
Certifications	**CE, EAC, TÜV, UKCA, cULus Listed**
Application range	**Failsafe**
Number of FS input bits	**8**
Number of FS output bits	**8**
Electrical data	
Supply voltage	
for	**Device supply**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-15 %/+25 %**
Output of external power supply (DC)	**480 W**
Output of external power supply (DC) at no load	**4,5 W**
Residual ripple DC	**5 %**
SELV/PELV required	**Yes**
Supply voltage	
for	**Load supply**
Voltage	**24 V**
Kind	**DC**
Output of external power supply (DC)	**0,0 W**
Output of external power supply (DC) at no load	**0,0 W**
SELV/PELV required	**Yes**
IO-Link port (C/Q)	
Port class	**A**
Feature level	**b**
Potential isolation between the IO-Link ports	**No**
Support for IO-Link Safety	**Yes**
IO-Link Safety port level	**b**
IO-Link Safety specification version	**V1.1.4**
IO-Link mode	
IO-Link revision	**V1.1.3**
Communication speed	**COM1/COM2/COM3**
Max. cable length	**20 m**
Min. cycle time (dynamic and dependent on the payload length)	**3 ms**
Max. size of input process data per port	**33 Byte**
Max. size of output process data per port	**33 Byte**
Max. size of input process data per module	**132 Byte**
Max. size of output process data per module	**132 Byte**
DI mode	
Input current	**2.5 mA/5 mA (switchable)**

IO-Link port (C/Q)	
DO mode	
Short circuit-proof	**Yes**
Output current	**500 mA**
Actuator/sensor supply L+	
Short circuit-proof	**Yes**
Current at L+	**1.000 mA**
Inputs	
Quantity	**8**
Signal level at g0 h	**-3 - +5 V DC**
Signal level at "1"	**11 - 30 V DC**
Voltage at inputs	**24 V DC**
Input type in accordance with EN 61131-2	**1, 3**
Input current range	**2,8 - 4,8 mA**
Software filter time	**0 ms ... 10 ms**
Corresponding supply voltage	**Device Supply**
Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**8**
Output type in accordance with EN 61131-2	**2**
Max. power consumption	**3 W**
Corresponding supply voltage	**Device Supply**
Typ. output current at "1" signal and rated voltage of semiconductor output	**2 A**
Residual current at "0" signal	**0,1 mA**
Max. internal voltage drop	**999 mV**
Max. duration of on time during self test	**100 - 12700 µs**
Max. duration of off time during self test	**100 - 12700 µs**
Short circuit-proof	**Yes**
Permitted loads	**inductive, capacitive, resistive**
Output rating in accordance with UL 61010-1	**general use, pilot duty, resistive**
Test pulse outputs	
Number of test pulse outputs	**8**
Output type in accordance with EN 61131-2	**0,5**
Configurable as	**24 V DC, ST output, test pulse output**
Voltage, test pulse outputs	**24 V DC**
Corresponding supply voltage	**Device Supply**
Short circuit-proof	**Yes**
Number of outputs that can be configured as test pulses	**8**
Typ. output current at "1" signal and rated voltage of test pulse output	**0,5 A**
PROFINET interface	
Quantity	**2**
PROFINET IO specification	**V2.42**
Conformance Class	**C**

PROFINET interface	
Network load class	**III**
PROFIsafe protocol version	**V2.6**
Input	**1.440 Byte**
Output	**1.440 Byte**
Transmission rates	**100 MBit/s**
Transmission rate selectable via	**Automatic**
Certification	**PNO**
Vendor ID	**092Fh**
Connection	**M12**
Device type	**IO-Device**
Environmental data	
Climatic suitability	**EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-30, EN 60068-2-78**
Ambient temperature	
in accordance with the standard	**EN 60068-2-14**
Temperature range	**-30 - 70 °C**
Max. temperature in accordance with UL	**-30 - 50 °C**
Storage temperature	
in accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-40 - 70 °C**
Climatic suitability	
in accordance with the standard	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Short-term**
Max. operating height above SL	**5000 m**
EMC	**EN 61131-2 (Zone B)**
Vibration	
in accordance with the standard	**EN 60068-2-6**
Frequency	**8,4 - 150 Hz**
Acceleration	**50 m/s²**
Shock stress	
in accordance with the standard	**EN 60068-2-27**
Number of shocks	**3**
Acceleration	**200 m/s²**
Duration	**11 ms**
Airgap creepage	
in accordance with the standard	**EN 61131-2, UL/IEC 61010-2-201**
Overvoltage category	**II**
Pollution degree	**2**
Protection type	
in accordance with the standard	**EN 60529**
Housing	**IP67 (not evaluated by UL), IP69K (not evaluated by UL)**
in accordance with UL 61010	**Type 1 Indoor use only**

Potential isolation	
Potential isolation between	**Load supply and device supply**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**1000 V**
Potential isolation between	**Ethernet and device supply**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**1000 V**
Potential isolation between	**Ethernet and load supply**
Type of potential isolation	**Functional insulation**
Rated surge voltage	**1000 V**
Mechanical data	
Material	
Housing	**GD-ZnAl4Cu1**
Connection type	**M12**
Mounting type	**screw interlocked**
Dimensions	
Height	**257,8 mm**
Width	**61,3 mm**
Depth	**34,5 mm**
Weight	**988 g**

12.1 Safety characteristic data

NOTICE

You must comply with the safety characteristic data in order to achieve the required safety level for your plant/machine.

Unit	Operating mode	EN ISO 13849-1 PL	EN ISO 13849-1 Category	EN IEC 62061 SIL CL/ max. SIL	EN IEC 62061 61508 PFH [1/h]	EN/IEC 61511 61508 SIL	EN/IEC 61511 61508 PFD	EN ISO 13849-1: 2015 T_M [year]
Logic								
Logic	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**5,61E-11**	**SIL 3**	**4,89E-06**	**20**
Input								
Digital inputs	**1-channel**	**PL d**	**Cat. 2**	**SIL CL 2**	**2,33E-09**	**SIL 2**	**2,04E-04**	**20**
Digital inputs	**1-ch., pulsed**	**PL e**	**Cat. 4**	**SIL CL 3**	**3,05E-10**	**SIL 3**	**2,68E-05**	**20**
Digital inputs	**2-channel**	**PL e**	**Cat. 4**	**SIL CL 3**	**1,25E-10**	**SIL 3**	**1,09E-05**	**20**
Digital inputs	**2-ch., pulsed**	**PL e**	**Cat. 4**	**SIL CL 3**	**8,40E-11**	**SIL 3**	**7,30E-06**	**20**
Output								
SC outputs (1-pole)	**1-channel with advanced fault detection**	**PL e**	**Cat. 4**	**SIL CL 3**	**6,11E-11**	**SIL 3**	**5,33E-06**	**20**
SC outputs (1-pole)	**2-ch. with advanced fault detection**	**PL e**	**Cat. 4**	**SIL CL 3**	**6,11E-11**	**SIL 3**	**5,33E-06**	**20**

NOTICE

When two actuators are controlled via an output with the target Cat. 4, PL e, SIL 3, the application's risk assessment must demonstrate how the effect of assumed wiring errors (short circuits/shorts across contacts) can be managed or avoided. This usually involves increased technical effort.
It is the responsibility of the user/operator to implement the necessary technical measures and to provide evidence of this.

NOTICE

When a 1-channel, pulsed input is used with the target Cat. 4, PL e, the application's risk assessment must demonstrate how drift in the input signal can be excluded and that all other assumed errors can also be detected with the help of test pulse evaluation.

If the device is operated at an ambient temperature above 60° C, the values stated in the table for PFH and PFD must be multiplied by a factor of 3.5 when calculating a safety function.

When PROFINET is used, the PFH value with 10^{-9}/h (1 % of SIL 3) and the PFD value with 10^{-5} (1 % of SIL 3) must be taken into consideration.

When IO-Link is used, the PFH value with 10^{-9}/h (1 % of SIL 3) and the PFD value with 10^{-5} (1 % of SIL 3) must be taken into consideration.

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 products used and may differ from these.

13 Order reference

13.1 Product

Product type	Features	Order no.
PDP67 PN 8FDIO 4 IOLS	Decentralised field device for failsafe and standard applications, protection type IP67/IP69K, M12 female connector, PROFINET IO DEVICE with PROFIsafe, Conformance Class C (CC-C), PROFIenergy, IRT/RT, data set I&M 0 and 1-4, Shared Device, MRP, IO-Link Safety Master with 4 ports (V1.1.3), max. 8 configurable safe digital inputs/outputs, test pulse outputs with 24 VDC 0.25 A, semiconductor output 0.5 A, single-pole, positive-switching, short circuit-proof, overload-proof, feed device supply 24 VDC 16 A, feed load supply 24 VDC 16 A, potential isolation, functional earth connection	4R000004

13.2 Accessories

PDP67 removable data medium

Product type	Features	Order no.
µSD memory card 512MB M12A	PDP67, accessories, microSD memory card, 512 MB, industrial design, nickel-plated brass housing, M12 connector, A-coded, for PDP67 devices	4R000002

Label plates

Product type	Features	Order no.
Acc/MA/label plates/IP67	Plastic label plates (bag of 10)	C1000033

End caps

Product type	Features	Order no.
Caps for IP67 modules	Accessories, end caps for M12 ports on PDP67 and PSS67 devices, protection type IP67, black, PU 4 pieces, only use for A- and D-coded M12 ports (380328 only for L-coded)	380324
Acc/MA/caps L-coded/ M12	Accessories, end caps for M12 ports on PDP67 and PSS67 devices, protection type IP67, grey, PU 2 pieces, only use for L-coded M12 ports (380324 only for A- and D-coded)	380328

Adapter for cable

Product type	Features	Order no.
PSEN ma adapter	Cable, adapter, IP68, M12 female connector, black, straight, 4-pin, A-coded on M12 male connector, black, angled, 5-pin, A-coded, PUR, 0.1 m, 4× 0.34 mm², black, for connecting the sensors PSENmag (safety switch)/PIT en1.0 (enabling switch) to PSS67 and PDP67	380300
PSEN cs adapter	Cable, adapter, IP68, M12 female connector, black, straight, 8-pin, A-coded on M12 male connector, black, angled, 5-pin, A-coded, PUR, 0.1 m, 5× 0.25 mm², black, with shielding (wire mesh), for connecting a PSENcode sensor (coded safety switch) to PSS67 and PDP67	380301
Adapter/ML/M12-5SMX/M12-5SMX/M12-8SFX/XX	Y adapter for connecting PSEN ml b or PSEN ml s to PDP67 PN 6FDI 6FDIO 2FDOTP, 1 x 8-pin M12 female connector, straight, A-coded on 2 x 5-pin M12 male connector, straight, A-coded	C1000059

Ethernet cable

Product type	Features	Order no.
Cable/PN/RJ45-4SM/M12-4SMX/D/003/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, RJ45 connector, PUR shielded green, suitable for drag chains, 3 m	C1000001
Cable/PN/RJ45-4SM/M12-4SMX/D/005/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, RJ45 connector, PUR shielded green, suitable for drag chains, 5 m	C1000002
Cable/PN/RJ45-4SM/M12-4SMX/D/010/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, RJ45 connector, PUR shielded green, suitable for drag chains, 10 m	C1000003
Cable/PN/RJ45-4SM/M12-4SMX/D/020/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, RJ45 connector, PUR shielded green, suitable for drag chains, 20 m	C1000004
Cable/PN/M12-4SMX/M12-4SMX/D/0,5/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, M12 connector, PUR shielded green, suitable for drag chains, 0.5 m	C1000005
Cable/PN/M12-4SMX/M12-4SMX/D/003/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, M12 connector, PUR shielded green, suitable for drag chains, 3 m	C1000006
Cable/PN/M12-4SMX/M12-4SMX/D/005/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, M12 connector, PUR shielded green, suitable for drag chains, 5 m	C1000007
Cable/PN/M12-4SMX/M12-4SMX/D/010/Q324/GN	Ethernet cable, M12 connector, 4-pin, D-coded, M12 connector, PUR shielded green, suitable for drag chains, 10 m	C1000008

Product type	Features	Order no.
Cable/PN/M12-4SMX/ M12-4SMX/D/020/Q324/ GN	Ethernet cable, M12 connector, 4-pin, D-coded, M12 connector, PUR shielded green, suitable for drag chains, 20 m	C1000009

Cable for supply voltage

Product type	Features	Order no.
Cable/PW/M12-5SMX/ M12-5SFX/L/0,5/1Q50/BK	Power supply cable, M12 connector, 5-pin, L-coded, M12 socket, PUR black, suitable for drag chains, 5× 1.5 mm², 0.5 m	C1000010
Cable/PW/M12-5SMX/ M12-5SFX/L/003/1Q50/BK	Power supply cable, M12 connector, 5-pin, L-coded, M12 socket, PUR black, suitable for drag chains, 5× 1.5 mm², 3 m	C1000011
Cable/PW/M12-5SMX/ M12-5SFX/L/005/1Q50/BK	Power supply cable, M12 connector, 5-pin, L-coded, M12 socket, PUR black, suitable for drag chains, 5× 1.5 mm², 5 m	C1000012
Cable/PW/M12-5SMX/ M12-5SFX/L/010/1Q50/BK	Power supply cable, M12 connector, 5-pin, L-coded, M12 socket, PUR black, suitable for drag chains, 5× 1.5 mm², 10 m	C1000013
Cable/PW/M12-5SMX/ M12-5SFX/L/020/1Q50/BK	Power supply cable, M12 connector, 5-pin, L-coded, M12 socket, PUR black, suitable for drag chains, 5× 1.5 mm², 20 m	C1000014
Cable/PW/M12-5SFX/ XXX-5XXX/L/003/1Q50/ BK	Power supply cable, M12 socket, 5-pin, L-coded, open cable end, PUR black, suitable for drag chains, 5× 1.5 mm², 3 m	C1000027
Cable/PW/M12-5SFX/ XXX-5XXX/L/005/1Q50/ BK	Power supply cable, M12 socket, 5-pin, L-coded, open cable end, PUR black, suitable for drag chains, 5× 1.5 mm², 5 m	C1000028
Cable/PW/M12-5SFX/ XXX-5XXX/L/010/1Q50/ BK	Power supply cable, M12 socket, 5-pin, L-coded, open cable end, PUR black, suitable for drag chains, 5× 1.5 mm², 10 m	C1000029
Cable/PW/M12-5SFX/ XXX-5XXX/L/020/1Q50/ BK	Power supply cable, M12 socket, 5-pin, L-coded, open cable end, PUR black, suitable for drag chains, 5× 1.5 mm², 20 m	C1000030
Supply cable 5x1.5	By the metre, PVC (90°C to UL 1581), black RAL9005, 5x1.5, UV-resistant IEC 603323-3-24 (cat. C), 1000V UL/CSA, colour of the single wires: 1 grey wire, 4 black wires with white digits. Suitable for laying in dry, damp or wet rooms (also water-oil mixtures), outdoor, nor suitable for burial underground. Minimum order quantity: 10 m	380327
Cable/PW/M12-5SMX/ M12-5SFX/L/0,5/2Q50/BK	Power supply cable, 5-pin M12 male connector, straight, L-coded on 5-pin M12 female connector, straight, L-coded, conductor cross section: 5 x 2.5 mm², 16 A, cable length: 0.5 m	C1000060

Product type	Features	Order no.
Cable/PW/M12-5SMX/M12-5SFX/L/003/2Q50/BK	Power supply cable, 5-pin M12 male connector, straight, L-coded on 5-pin M12 female connector, straight, L-coded, conductor cross section: 5 x 2.5 mm², 16 A, cable length: 3 m	C1000061
Cable/PW/M12-5SFX/XXX-5XXX/L/010/2Q50/BK	Power supply cable, 5-pin M12 female connector, straight, L-coded, open cable end, conductor cross section: 5 x 2.5 mm², 16 A, cable length: 10 m	C1000062

Cable for sensors and actuators

Product type	Features	Order no.
Cable/FC/M12-5SMX/M12-5SFX/A/0.5/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 0.5 m, IOL-S compatible	C1000015
Cable/FC/M12-5SMX/M12-5SFX/A/003/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 3 m, IOL-S compatible	C1000016
Cable/FC/M12-5SMX/M12-5SFX/A/005/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 5 m, IOL-S compatible	C1000017
Cable/FC/M12-5SMX/M12-5SFX/A/010/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 10 m, IOL-S compatible	C1000018
Cable/FC/M12-5SMX/M12-5SFX/A/020/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 20 m, IOL-S compatible	C1000019
Cable/FC/M12-5SMX/M12-5SFX/A/030/0Q34/BK	Field connection cable, straight M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 30 m	C1000020
Cable/FC/M12-5AMX/M12-5SFX/A/0.5/0Q34/BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 0.5 m, IOL-S compatible	C1000021
Cable/FC/M12-5AMX/M12-5SFX/A/003/0Q34/BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 3 m, IOL-S compatible	C1000022
Cable/FC/M12-5AMX/M12-5SFX/A/005/0Q34/BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 5 m, IOL-S compatible	C1000023

Product type	Features	Order no.
Cable/FC/M12-5AMX/ M12-5SFX/A/010/0Q34/ BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 10 m, IOL-S compatible	C1000024
Cable/FC/M12-5AMX/ M12-5SFX/A/020/0Q34/ BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 20 m, IOL-S compatible	C1000025
Cable/FC/M12-5AMX/ M12-5SFX/A/030/0Q34/ BK	Field connection cable, angled M12 connector, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 30 m	C1000026
Cable/FC/XXX-XXXX/ M12-5SFX/A/0,5/0Q34/BK	Field connection cable, open cable end, 5-pin, A-coded, straight M12 socket, suitable for drag chains, 5× 0.34 mm², 0.5 m, IOL-S compatible	C1000038
Cable/FC/XXX-XXXX/ M12-5SFX/A/003/0Q34/ BK	Field connection cable, open cable end, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 3 m, IOL-S compatible	C1000039
Cable/FC/XXX-XXXX/ M12-5SFX/A/005/0Q34/ BK	Field connection cable, open cable end, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 5 m, IOL-S compatible	C1000040
Cable/FC/XXX-XXXX/ M12-5SFX/A/010/0Q34/ BK	Field connection cable, open cable end, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 10 m, IOL-S compatible	C1000041
Cable/FC/XXX-XXXX/ M12-5SFX/A/020/0Q34/ BK	Field connection cable, open cable end, 5-pin, A-coded, straight M12 socket, PUR, suitable for drag chains, 5× 0.34 mm², 20 m, IOL-S compatible	C1000042

Cable accessories

Product type	Features	Order no.
Stripping tool	Tool for fast and multi-stage stripping of Ethernet and SafetyNET p cables, PU 1 set.	380070
Crimping tool	Manual crimping tool used to crimp machined male and female contacts, diameter 0.08 - 2.5 mm², AWG 28 - 13, four-mandrel pressing, sensitive setting of the crimp measurement using an adjustment wheel, forced locking to prevent faulty crimping.	380071
PSS67 M12 connector, straight, male, 5pole	Plug-in connector, 5-pin, straight M12 connector, A-coded, screw connection, material ring nut: CuZn nickel-plated, outer cable diameter: 4 – 6 mm	380308

Product type	Features	Order no.
PSS67 M12 connector straight, female, 5pin	Plug-in connector, 5-pin, straight M12 socket, A-coded, screw connection, material ring nut: CuZn nickel-plated, outer cable diameter: 4 – 6 mm	380309
M12 con., straight, female, 5 pin, L, S	Plug-in connector, 5-pin (4+FE), shielded, straight M12 socket, L-coded (power), crimp connection, material ring nut: die-cast zinc nickel-plated, cable screw connection Pg11, outer cable diameter 5 – 9 mm	380317
M12 con., straight, male, 4 pin, D	Plug-in connector, 4-pin, straight M12 connector, D-coded, IDC connection, material ring nut: die-cast zinc nickel-plated, cable screw connection Pg9, outer cable diameter 6 – 8 mm	380316
M12 con., straight, male, 5 pin, L, S	Plug-in connector, 5-pin (4+FE), shielded, straight M12 socket, L-coded (power), crimp connection, material ring nut: die-cast zinc nickel-plated, cable screw connection Pg11, outer cable diameter 5 – 9 mm	380318
PSS67 M12 connector, angled, female,5pole	Plug-in connector, 5-pin, angled M12 socket, A-coded, screw connection, material ring nut: CuZn nickel-plated, outer cable diameter: 4 – 6 mm	380311
PSS67 M12 connector, angled, male, 5pole	Plug-in connector, 5-pin, angled M12 connector, A-coded, screw connection, material ring nut: CuZn nickel-plated, outer cable diameter: 4 – 6 mm	380310

14 Supplementary data

14.1 Network data

Protocol	Direc-tion [*]	Transport protocol (IP ver-sion)	Port no.	Can be deac-tivated	Time-critical	Description
HTTP	In	TCP	0 … 65535 Default: 80	Yes	No	**User interface:** Communication with a browser. The browser is always converted to HT-TPS.
HTTPS	In	TCP	0 … 65535 Default: 443	Yes	No	**User interface:** Secured communication with a browser. Communication is via TLSv1.2. The web server is authen-ticated via an X.509 certificate.
mDNS	In	UDP (IPv4)	5353	No	No	Multicast Domain Name System
NTP	Out	UDP (IPv4)	123	Yes	No	Network Time Protocol Time synchronisation
Tool interface	In	TCP (IPv4)	18080	No	No	Communication with the configura-tion tool
PROFINET	In	UDP (IPv4)	161	No	No	SNMP Server port
PROFINET	In	UDP (IPv4)	34962	No	No	UDP Unicast port
PROFINET	In	UDP (IPv4)	34963	No	No	UDP Multicast port
PROFINET	In	UDP (IPv4)	34964	No	No	RCP Endpoint Mapper port
PROFINET	In	UDP (IPv4)	49152 … 65 535	No	No	Service Request ports

*
in: the communication partner starts communication with the device.
out: the device starts communication with the communication partner.

14.2 Operating height

The values stated in the technical details apply to the use of the device in operating heights up to max. 2000 m above SL. When used at higher levels, restrictions of the ambient temperature (standard IEC 61131-2) must be taken into account.

Operating height above SL [m]	Multiplication factors for the devices' ambient temperature
0 … 2000	1.0
3000	0.9
4000	0.8
5000	0.7

14.3 EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC on machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.
Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

14.4 UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.
The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

Representative: Pilz Automation Technology, Pilz House, Little Colliers Field, Corby, Northamptonshire, NN18 8TJ United Kingdom, eMail: mail@pilz.co.uk

15 Appendix

15.1 Establishing the F-address (PROFINET with PROFIsafe)

The F-address of the PROFIsafe Container on slot 11 is used as:

- F-address of the device for PROFIsafe communication in the PROFINET network
- F-address for establishing the connection to the configuration PC

A connection cannot be established to the device without the F-address. If you no longer know the F-address of a configured fieldbus device, you can read it from the device and then use it to establish the connection to the device.

Prerequisite:

- The configuration PC is connected to the device.
- You know the IP address and port number of the device.

Procedure:

1. Read in the configuration of a device with an unknown F-address or create a new project in PASconfig.
2. Select ***Tools*** -> ***Connection Manager***. The Connection Manager is started.
3. Activate your connection in the Connection Manager and click on ***Test.*** The system checks that the connection is fault-free. If the F-address is unknown, see point 5.
4. Select ***Edit***. The ***Edit connection*** menu opens
5. Select ***Read F-address for the Ethernet connection***. You will be prompted to enter the ***FS password*** (default value: pssu) [2][3]. The F-address for the Ethernet connection is now read from the device.
6. The displayed F-address [4] is used temporarily to establish a connection to the device [5].

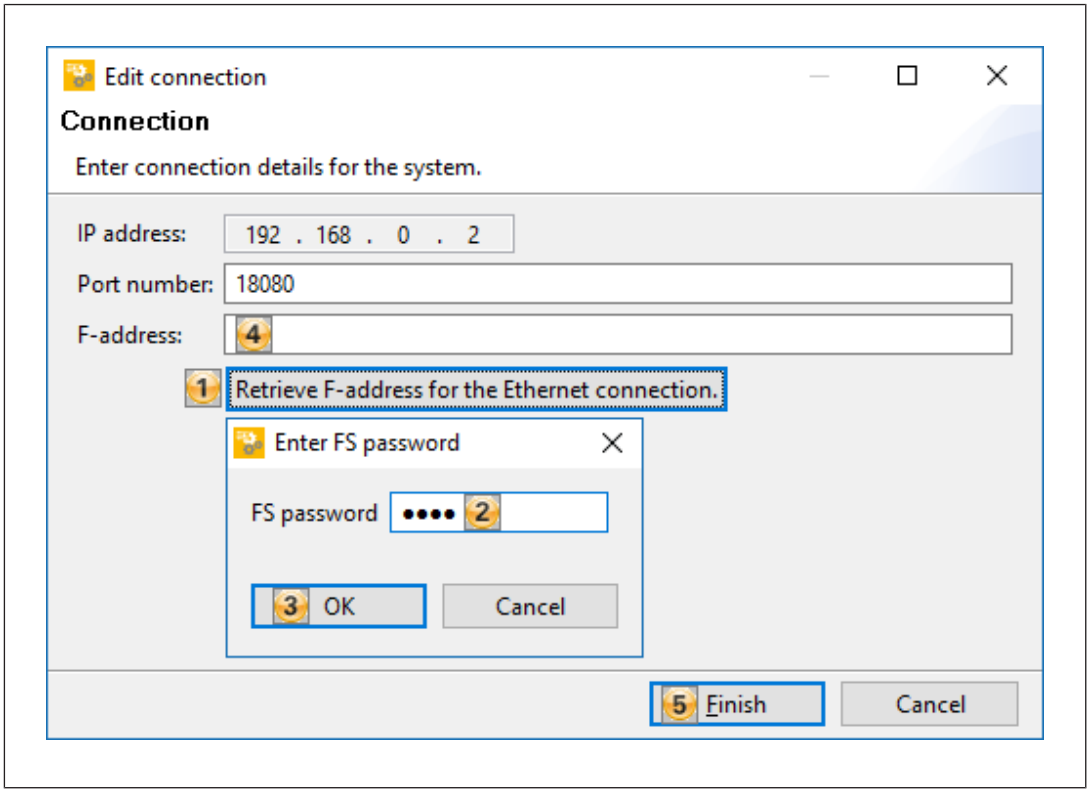


Fig.: PASconfig connection, read F-address for the Ethernet connection

Now you can perform two functions independently of each other and in any sequence:

- Load the current I/O configuration on to the device
- Load the current (just read) F-address in the menu ***System*** -> ***Enter F-address*** on to the device

Support

Technical support is available from Pilz round the clock.

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