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FLEXtra SLIM PROFINET-Switch 5-Port
FLEXtra SLIM PROFINET-Switch 8-Port

Manual

Version 1 | 15.12.2025 | for firmware V0.70 and above

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Link to newest version of manual

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Notes

To download the latest version of this manual, please visit our website at www.helmholz.de.

We welcome all ideas and suggestions.

Helmholz GmbH & Co. KG

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1 General

This operating manual applies only to devices, assemblies, software, and services of Helmholz GmbH & Co. KG.

1.1 Structure of the manual

This manual is divided into 10 sections.

Section 1 contains general information and safety instructions.

Section 2 refers to Security Recommendations.

Section 3 explains the system overview and features of the product.

Section 4 explains the installation and removal.

Section 5 shows the initial commissioning with connection and GSDML configuration.

The configuration and diagnostics of the switch via the web interface are explained in section 6.

Section 7 contains a FAQ about PROFINET.

The technical data are documented in section 8.

1.2 Target audience for this manual

This description is only intended for trained personnel qualified in control and automation engineering who are familiar with the applicable national standards. For installation, commissioning, and operation of the components, compliance with the instructions and explanations in this operating manual is essential.

Configuration, execution, and operating errors can interfere with the proper operation of the FLEXtra SLIM PROFINET Switch and result in personal injury, as well as material or environmental damage. Only suitably qualified personnel may operate the devices!

Qualified personnel must ensure that the application and use of the products described meet all the safety requirements, including all relevant laws, regulations, provisions, and standards.

1.3 Safety instructions

The safety instructions must be observed to prevent harm to living creatures, material goods, and the environment. The safety notes indicate possible hazards and provide information about how hazardous situations can be prevented.

1.4 Note symbols and signal words

HAZARD

If the hazard warning is ignored, there is an imminent danger to life and health of people from electrical voltage.

WARNING

If the warning is ignored, there is a probable danger to life and health of people.

CAUTION

If the caution note is ignored, people can be injured or harmed.

ATTENTION

Draws attention to sources of error that can damage equipment or the environment.

NOTE

Gives an indication for better understanding or preventing errors.

1.5 Intended use

The FLEXtra SLIM PROFINET-Switch (hereinafter referred to as "the device") can be used for networking Ethernet networks. The FLEXtra SLIM PROFINET switch supports the PROFINET protocol and other managed Ethernet functions.

All components are supplied with a factory hardware and software configuration. The user must carry out the hardware and software configuration for the conditions of use. Modifications to hardware or software configurations which are beyond the documented options are not permitted and nullify the liability of Helmholz GmbH & Co. KG.

The device may not be used as the only means for preventing hazardous situations on machinery and systems.

The FLEXtra SLIM PROFINET switch cannot be used for a direct connection to the Internet. Always use a dedicated router with a sufficiently dimensioned Internet firewall for an Internet connection. Observe the security recommendations for project planning, use and maintenance. Observe the recommendations on security during project planning, use and maintenance (see chapter 2).

Problem-free and safe operation of the device presumes proper transport, storage, setup, assembly, installation, commissioning, operation, and maintenance.

The ambient conditions provided in the technical specifications must be adhered to.

The device has a protection rating of IP20 and must be installed in an electrical operating room or a control box/cabinet to protect it against environmental influences. To prevent unauthorized access, the doors of control boxes/cabinets must be closed and possibly locked during operation.

1.6 Improper use

WARNING

The consequences of improper use may include personal injuries of the user or third parties as well as property damage to the control system, the product, or the environment. Use the FLEXtra SLIM PROFINET-Switch only as intended!

1.7 Liability

The contents of this manual are subject to technical changes resulting from the continuous development of products of Helmholz GmbH & Co. KG. If this manual contains technical or clerical errors, we reserve the right to make changes at any time without notice.

No claims for modification of delivered products can be asserted based on the information, illustrations, and descriptions in this documentation. Beyond the instructions contained in the operating manual, the applicable national and international standards and regulations must also be observed in any case.

1.7.1 Disclaimer of liability

Helmholz GmbH &Co. KG is not liable for damages if these were caused by use or application of products that was improper or not as intended.

Helmholz GmbH & Co. KG assumes no responsibility for any printing errors or other inaccuracies that may appear in the operating manual unless there are serious errors about which Helmholz GmbH & Co. KG was already demonstrably aware.

Beyond the instructions contained in the operating manual, the applicable national and international standards and regulations must also be observed in any case.

Helmholz GmbH & CO. KG is not liable for damage caused by software that is running on the user's equipment which compromises, damages, or infects additional equipment or processes through the remote maintenance connection and which triggers or permits unwanted data transfer.

1.7.2 Warranty

Report any defects to the manufacturer immediately after the discovery of the defect.

The warranty is not valid in case of:

- Failure to observe these operating instructions
- Use of the device that is not as intended
- Improper work on and with the device
- Operating errors
- Unauthorized modifications to the device

The agreements met upon contract conclusion under "General Terms and Conditions of Helmholz GmbH & Co. KG" apply.

1.8 Open Source

Among other things, our products contain open-source software. This software is subject to the relevant license terms. The relevant license terms, including a copy of the full license text, are downloadable from the product website. They are also provided in our download area of the respective products at www.helmholz.de.

Furthermore, we offer to send the complete corresponding source code of the respective open-source software to you and to any third party as a DVD upon your request for a contribution towards expenses of Euro 10.00. This offer is valid for a period of three years. This offer is valid for a period of three years, calculated from the delivery of the product.

2 Security recommendations

Managed switches are network infrastructure components, and thus an important element in the security considerations of a system or network. When using the device, therefore please consider the following recommendations to prohibit unauthorized access to plants and systems.

When planning the network and when configuring and using the PROFINET-Switch, we recommend taking the specifications of IEC 62443-3 into account.

Helmholz is guided by IEC 62443-4 in the development and maintenance of the PROFINET-Switch.

General:

- Ensure at regular intervals that all relevant components fulfill these recommendations and possibly any other internal security guidelines.
- Evaluate your system holistically with a view to security. Use a cell protection concepts (“defense-in-depth”) with corresponding products, such as the WALL IE.
- Regularly inform yourself about security threats for all your components
- Train your employees regularly on the subject of security and the safe use of components

Physical access:

- Limit physical access to components of relevance to security to qualified personnel.

Security of the software:

- Always keep the firmware of all communications components up to date.
- Inform yourself regularly of firmware updates for the product.
- Only activate protocols and functions you really need
- If possible, always use those variants of protocols that provide more security

Passwords:

- Define rules and roles for usage of the devices and the awarding of passwords
- Change standard passwords
- Only use strong passwords. Avoid weak passwords like, for example, “password1”, “123456789”, or similar.
- Ensure that all passwords are inaccessible to unauthorized personnel.
- Don’t use one password for various users and systems.

Data protection:

- To avoid the disclosure of sensitive data, always carry out a factory reset of the device before decommissioning it.
- Resetting to the factory settings resets all configuration changes made on site and the Communicator is reset to the same state as when it left Helmholz production.

2.1 Information on security

Helmholz is a member of CERT@VDE and TeleTrust. Here you can obtain specific information on the subject of security in the industrial environment.

In addition to our technical newsletter, we communicate our security-relevant updates, patches and advisories to you as a user of Helmholz products via **CERT@VDE**. You can find the latest advisories for Helmholz products here: https://certvde.com/de/advisories/vendor/helmholz/

2.2 PSIRT

The Helmholz "**Product Security Incident Response Team" (PSIRT)** supports you proactively to protect your machines as best as possible in the context of industrial communication. Whenever new potential threats occur or are reported to us, we evaluate and process them immediately and provide you with recommended actions, patches and updates as quickly as possible to reduce the risk to a minimum. You can find more information about the Helmholz PSIRT here: https://www.helmholz.de/service-support/service/security-psirt/

2.3 Reporting vulnerabilities

You can help too: Report any product incidents to our **Product Security Incident Response Team** at psirt@helmholz.de or support@helmholz.de or to the CERT@VDE at https://cert.vde.com/de/more/report-a-vulnerability.

2.4 Further information about industrial security

You can find more information on the topic of security here:

- CERT@VDE
- TeleTrust
- Sichere-industrie.de
- Bundesamt für Sicherheit in der Informationstechnik (BSI)
- Allianz für Cyber-Sicherheit

2.5 Security advisory relating to PROFINET applications

Under certain circumstances, if an attacker with direct (physical) access to the PROFINET network attacks the devices using the DCP services of the PROFINET protocol, this can lead to a permanent loss of communication capability between the PROFINET controller and the PROFINET device.

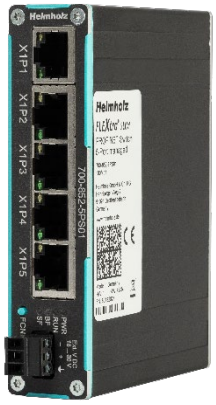
The reason for this lies in the nature of the DCP service provided by the PROFINET protocol. The DCP service can be used to change or reset device parameters via DCP command. Examples of this are DCP-Set “NameOfStation” or DCP-Set “Reset-to-Factory”. The existing PROFINET specification does not provide any security functions for the use of DCP.

Helmholz recommends that its customers introduce or check a strict access policy for the network. Access from other zones to the PROFINET network must be restricted, and DCP services must be blocked. This can be achieved using a firewall or a suitable VLAN configuration.

Further information on security when using PROFINET can be found here: PI Security

3 System overview

One of the most important functions of a PROFINET switch is the prioritization of PROFINET telegram traffic in the machine network. The managed switches can distinguish whether the telegram is a web request, an FTP file transfer, a media stream, or a PROFINET telegram. In the event of a high transmission load, the cyclical PROFINET telegrams can thus be prioritized to prevent telegram losses in the machine components.



With the managed FLEXtra SLIM PROFINET switches, PROFINET components can be networked at speeds of up to 100 Mbps. PROFINET prioritization according to Conformance Class B of the machine components is always guaranteed.

The slim design saves space in the control cabinet. The clearly visible status LEDs on the top of the FLEXtra SLIM PROFINET switches enable easy diagnosis even when fully wired.

In addition to the PROFINET protocol, functions such as SNMP, NTP, VLAN, port mirroring, QoS/CoS mapping, and comprehensive statistics are also available for managing the Ethernet network.

The supported PROFINET protocols, such as LLDP, DCP, or diagnostic alarms, can be easily parameterized and managed.

Technical advantages when using a PROFINET Switch

- Prioritizing of PROFINET frames
- Assignment of a configuration via the device name
- Neighborhood detection
- Device exchange without programming device
- Ring redundancy (MRP)
- Each port can be activated or deactivated
- Diagnostic messages for network problems
- Identification and maintenance data

For the project engineering as a PROFINET device a GSDML file is required.

3.1 Setup

Depending on the model, the PROFINET switch has 5 or 8 Ethernet ports (RJ45). The status is indicated on the device by four LEDs (PWR, RUN, BF, SF) and additional LEDs on the Ethernet ports. The switch has a function button ("FCN") as a control element.

5-port PROFINET-Switch:

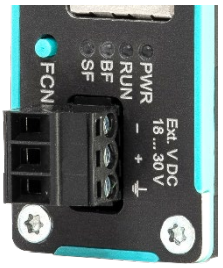
8-port PROFINET-Switch:

3.2 "FCN"-button

The "**FCN**" button can be used to reset the PROFINET switch to factory settings. If the "**FCN**" button is held down during the switch's start-up phase or after a reset, the “RUN” LED will flash orange for 10 seconds. During this period the FCN button must be released, otherwise the factory reset will not be initiated. After releasing the button, the switch will restart with factory settings.

3.3 LEDs

The two system LEDs "**PWR**" and "**RUN**" and the two PROFINET LEDs "**BF**" and "**SF**" indicate the system status of the switch.



3.3.1 System LEDs

PWR	Off	No voltage supply or device defective
	On	Device is correctly supplied with voltage
RUN	Off	Device is booting or defective
	On	Device is ready for operation
	Flashing	Firmware upgrade (green) or factory reset (orange)
BF	On	Bus error or no configuration
	Flashing (together with the BF and SF LED)	PROFINET function device identification (“Flash LED”)
SF	On	System error, network state faulty
	Flashing (together with the BF and SF LED)	PROFINET function device identification (“Flash LED”)

The **PWR LED** is on as soon as the PROFINET switch is connected to a power supply.

The **RUN LED** is on as soon as the PN switch is ready for operation. The LED flashes green during a firmware update or orange during a factory reset.

The **BF LED** is on as long as there is no PROFINET connection. If there is a PROFINET connection and the PROFINET switch has been configured, the LED is off. The PROFINET switch can only receive a PROFINET configuration if it has been assigned the device name set in the project, see chapter 5.7.

The **SF LED** is on if there is a PROFINET alarm (diagnosis) at the PROFINET switch. If there is no PROFINET alarm, the LED is off.

The **BF** and **SF** LEDs flash synchronously if the user has activated the PROFINET function "Flash LED" for device identification.

3.3.2 Ethernet LEDs (RJ45)

Off		No network cable connected, network cable defective or connected device is offline
Green	Off	No Ethernet connection
	steady on	Ethernet communication existing
Orange	steady on	Ethernet connection established
	flashes	Ethernet communication active

4 Installation and removal

4.1 Access restriction

The modules are open operating equipment and must only be installed in electrical equipment rooms, cabinets, or housing.

Access to the electrical equipment rooms, cabinets, or housings must only be possible using a tool or key, and access should only be granted to trained or authorized personnel.

4.2 Mounting and minimum distances

The FLEXtra SLIM PROFINET switches can be mounted on a DIN rail and installed in any position. It is recommended to keep minimum distances when mounting. By keeping the minimum distances

- the modules can be mounted or dismantled without having to dismantle other parts of the system.
- there is enough space to connect all existing connections and contacting possibilities with commercially available accessories.
- There is space for any necessary cable routing.

ATTENTION

Installation must be carried out in accordance with VDE 0100/IEC 364 and applicable national standards. The device has protection level IP20. If a higher degree of protection is required, it must be installed in an enclosure or a control cabinet.

4.3 Electrical installation

Observe the regional safety regulations.

4.4 Protection against electrostatic discharges

To prevent damage through electrostatic discharges, the following safety measures are to be followed during assembly and service work:

- Never place components and modules directly on plastic items (such as polystyrene, PE film) or in their vicinity.
- Before starting work, touch the grounded housing to discharge static electricity.
- Only work with discharged tools.
- Do not touch components and assemblies on contacts.

4.5 EMC protection

To ensure electromagnetic compatibility (EMC) in your control cabinets in electrically harsh environments, the known rules of EMC-compliant configuration are to be observed in the design and construction.

ATTENTION

Observe all standards, regulations and rules regarding shielding when setting up the system and laying the necessary cables. Strictly adhere to the corresponding writings of the PROFIBUS user organization for setting up PROFINET.

Errors in the shielding can lead to malfunctions or even failure of the system.

4.6 Operation

Operate the device only in flawless condition. The permissible operating conditions and performance limits must be adhered to.

Retrofits, changes, or modifications to the device are strictly forbidden.

The device is a piece of operating equipment intended for use in industrial plants. During operation, all covers on the unit and the installation must be closed in order to ensure protection against contact

ATTENTION

When the PROFINET switch is switched off, bus connections are interrupted! Before starting any work on the device, make sure that no impermissible interference occurs in connected systems when the bus connections are interrupted.

4.7 Recycling / WEEE

The company Helmholz GmbH & Co. KG is registered as a manufacturer with the HELMHOLZ brand and the device type "Small devices of information and telecommunications technology for exclusive use in households other than private households" as well as the following registration data:

Helmholz GmbH & Co. KG,
Location / Headquarters: 91091 Großenseebach,
Address: Hannberger Weg 2,
Name of authorized representative: Carsten Bokholt,

Registration number: **DE 44315750**

The electrical devices described in this document are to be recycled. According to Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), they must not be disposed of by municipal waste disposal companies.

5 Preparing the FLEXtra SLIM PROFINET-Switch

5.1 Connecting the power supply

The FLEXtra SLIM PROFINET switch must be supplied with 24 VDC at the wide-range input "Ext. V DC 18 ... 30 V" using the supplied connector plug.

NOTE

The housing of the FLEXtra SLIM PROFINET switch is not grounded. Please connect the functional grounding connection (FG named “FE” on front) of the switch properly to the reference potential.

The power supply is connected via a screw connector. Please use a copper cable with a cross-section of 0.08 - 1.5 mm² (AWG 28 - AWG 16). The maximum stripping length is 6 mm. The tightening torque is 0.25 Nm.

5.2 Connecting the network

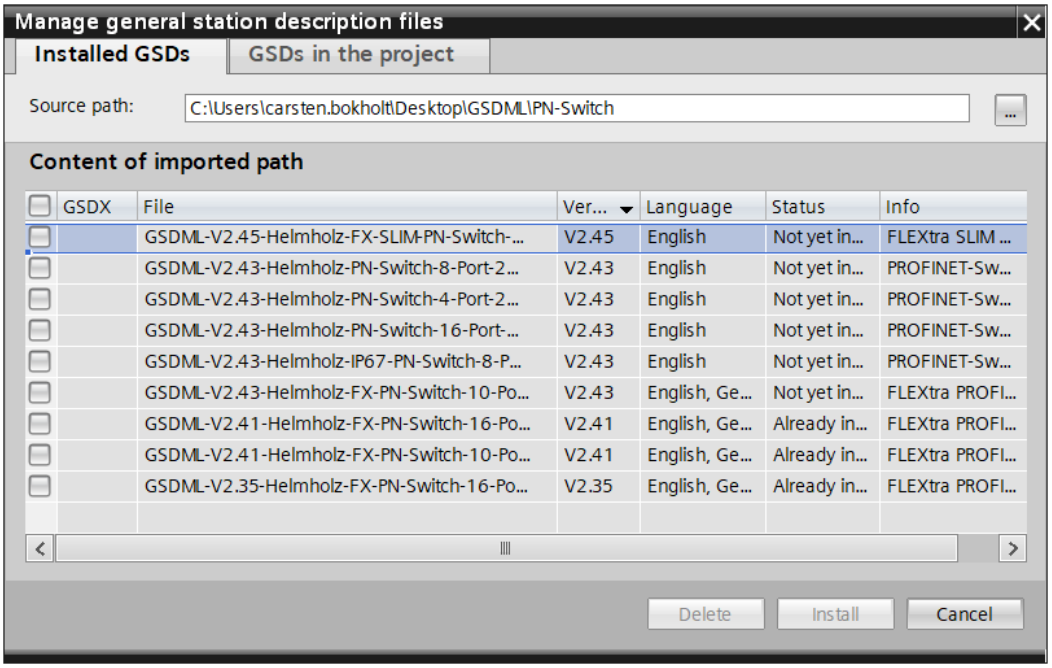
The RJ45 sockets "X1 P1" – "X1 P5" (5-port PROFINET switch) and "X1 P1" – "X1 P8" (8-port PROFINET switch) are used to connect the network participants (PROFINET or Ethernet).

5.3 Install GSDML file

You can download the GSDML file for the FLEXtra SLIM PROFINET switches from the website www.helmholz.de in the download area of the desired product. Alternatively, the GSDML can also be downloaded from the web page of the device.

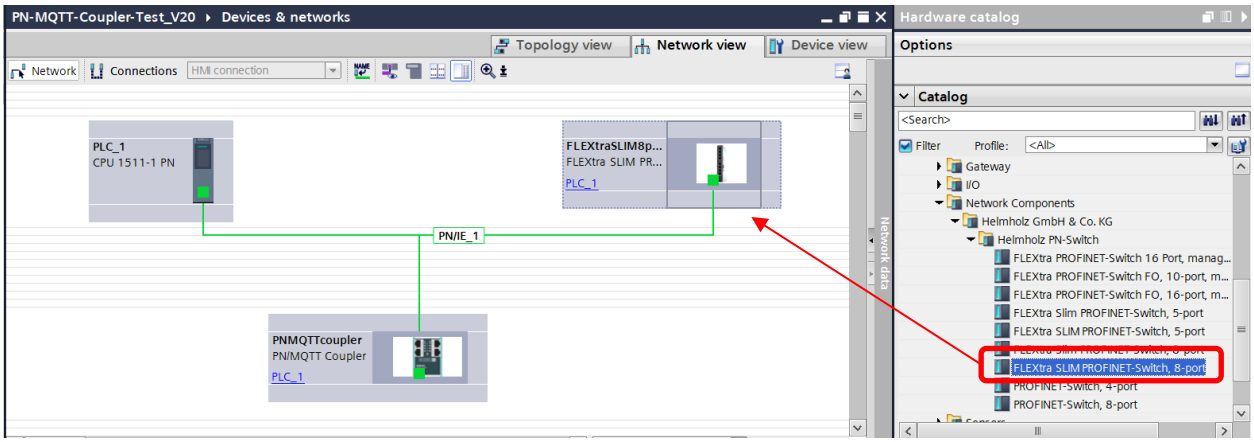
The GSDML file contains both the FLEXtra SLIM PROFINET 5-port switch and the 8-port switch.

Install the GSDML file via the TIA Portal menu ”Options” / “Manage general station description files (GSD)”.



5.4 Setup in the hardware-configuration

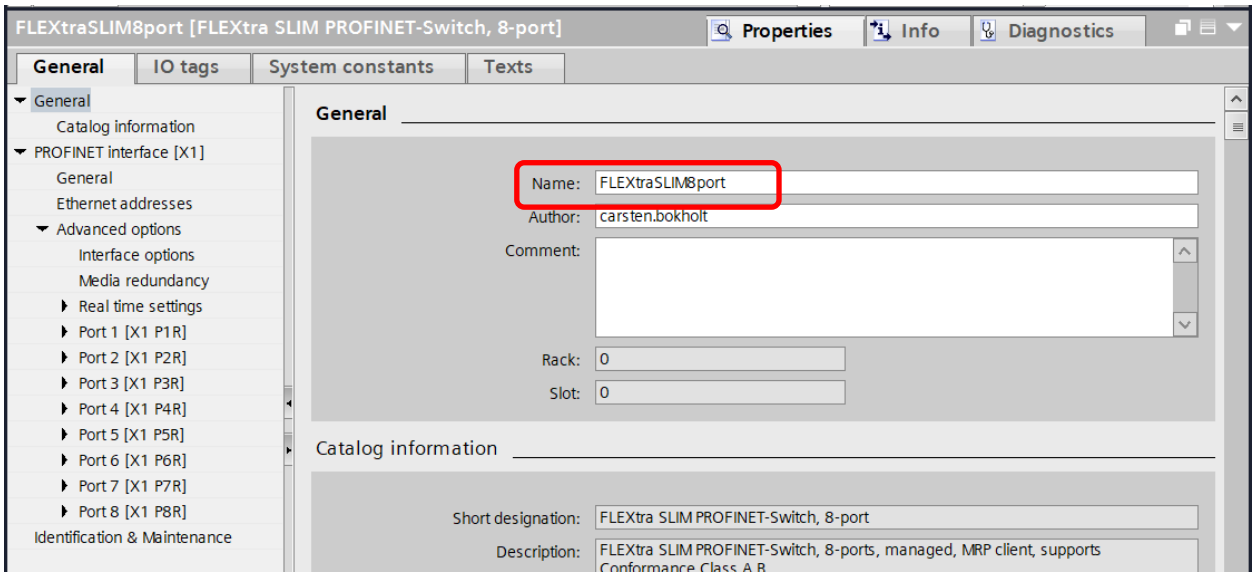
After installation, the FLEXtra SLIM PROFINET-Switch is listed in the hardware catalog under "Other field devices → PROFINET IO → Network Components → Helmholz GmbH & Co. KG → Helmholz PN-Switch" in the hardware catalog. Add the desired device to the project and connect it to your PROFINET network.



By calling up the object properties, you must give the FLEXtra SLIM PROFINET switch a unique PROFINET name in the project and check the IP address for plausibility.

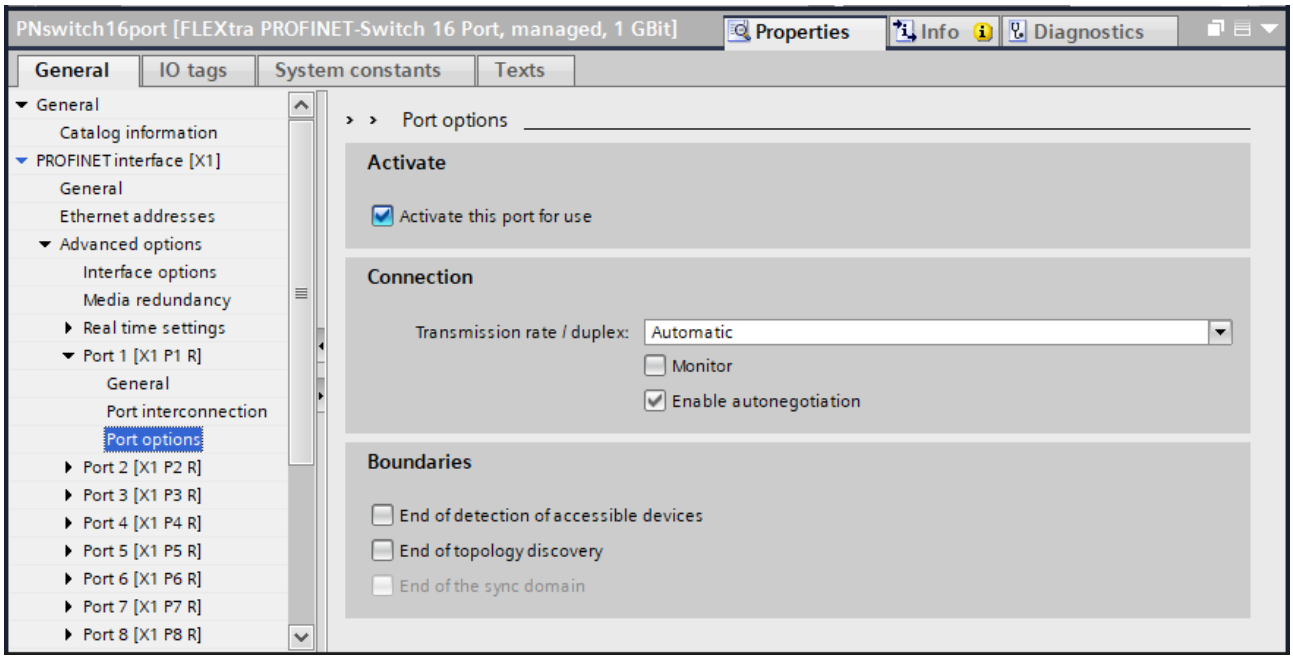
NOTE

The real device must later be assigned the same name as in the project.



5.5 Setting the port properties

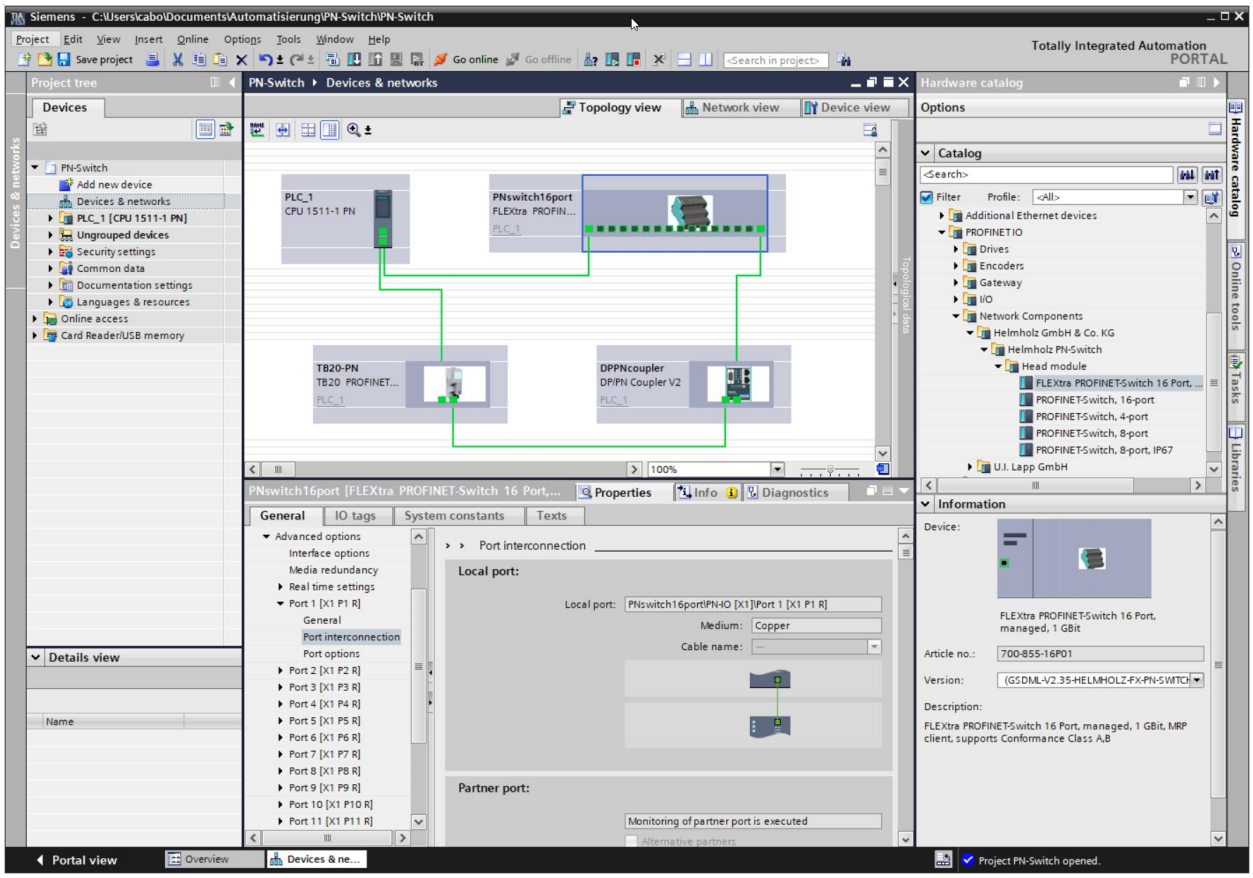
Each port of the PROFINET switch can be individually configured.



“Activate this port”	The port can be switched off here. This option is recommended when the port should not be used. Unauthorized trespass into the network is prevented.
Transmission rate / duplex “Automatic”	The port synchronizes itself automatically with the communication partner (auto-negotiation).
Transmission rate / duplex “TP 100 Mbps full duplex”	Fixed specification of the transmission rate. This option is recommended when connecting PROFINET IO devices.
Monitor	Send a diagnosis by Link Down
Enable autonegotiation	Automatic recognition of the transmission speed and the cable type (cross or patch cable)
End of detection of accessible devices	The DCP telegrams for recording accessible devices are not forwarded from this port. Subscribers behind this port are no longer displayed under "Accessible subscribers" in the topology. Users behind this port can no longer be reached by the CPU.
End of topology discovery	LLDP frames for topology discovery are not forwarded on this port.

5.6 Topology detection

The PROFINET-Switch supports the mechanisms for neighbor detection (LLDP). With this function it is possible to detect the topology of a PROFINET network or to predefine it by the configuration to control the correct setup.



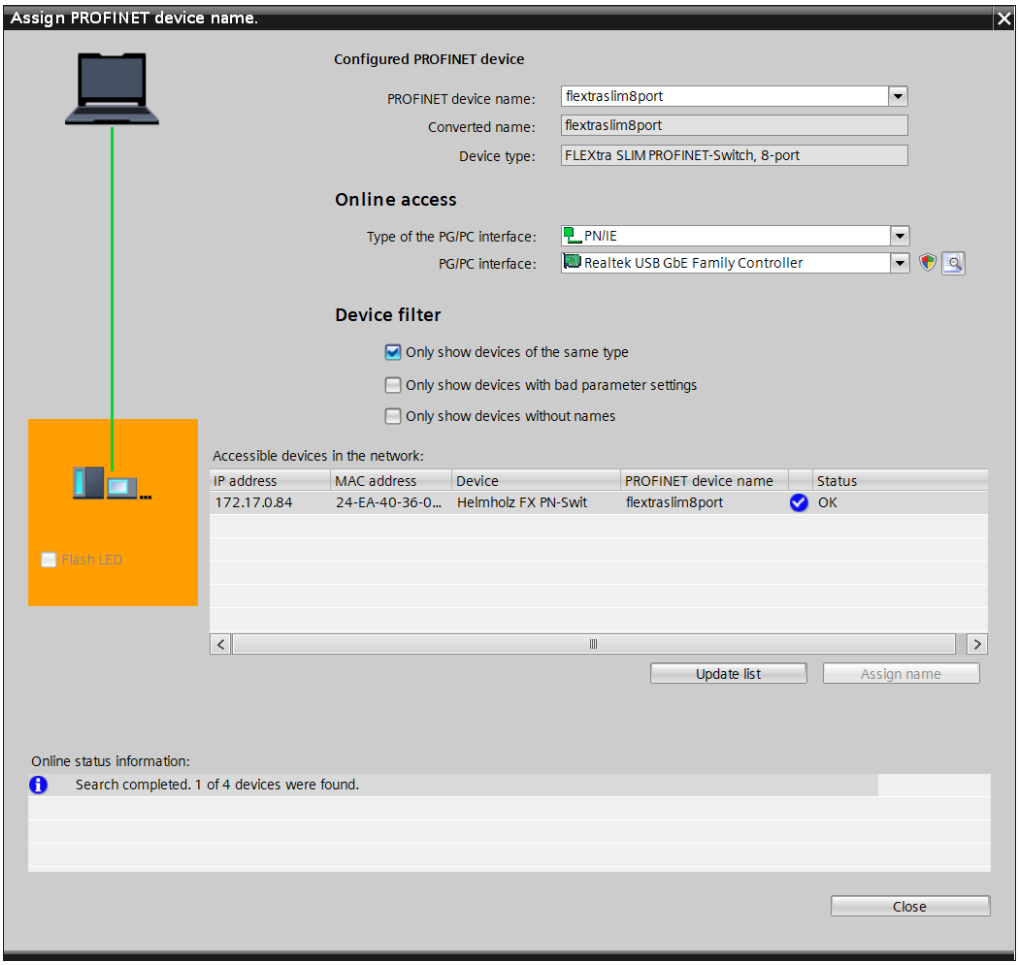
If the topology was specified in the configuration, the PROFINET name can also be assigned to neighboring devices in the event of a device swap. This makes it possible to detect and check the network topology and to "swap devices during operation" of connected PROFINET devices.

5.7 Assign the PROFINET switch a name

When the configuration of the FLEXtra SLIM PROFINET-Switch has been completed in the hardware configurator of the engineering tool, it can be loaded into the PLC.

In order that the PROFINET switch can be found by the PROFINET controller, the PROFINET device name must be assigned to the PROFINET switch. To this purpose, use the function “Assign device name”, which you can access in the Online menu with the right mouse button when the PROFINET switch is activated.

With the “Update list” button, the network can be browsed for PROFINET participants. The PROFINET device name can be assigned to the device with “Assign device name”.



The clear identification of the PROFINET switch is ensured here by the MAC address of the device. The MAC address of the device can be found on the device label of the FLEXtra SLIM PROFINET switch.

If the PROFINET switch has been assigned the correct PROFINET name, it is recognized by the PLC and configured. If configuration has taken place correctly, the PROFINET “BF” LED is off.

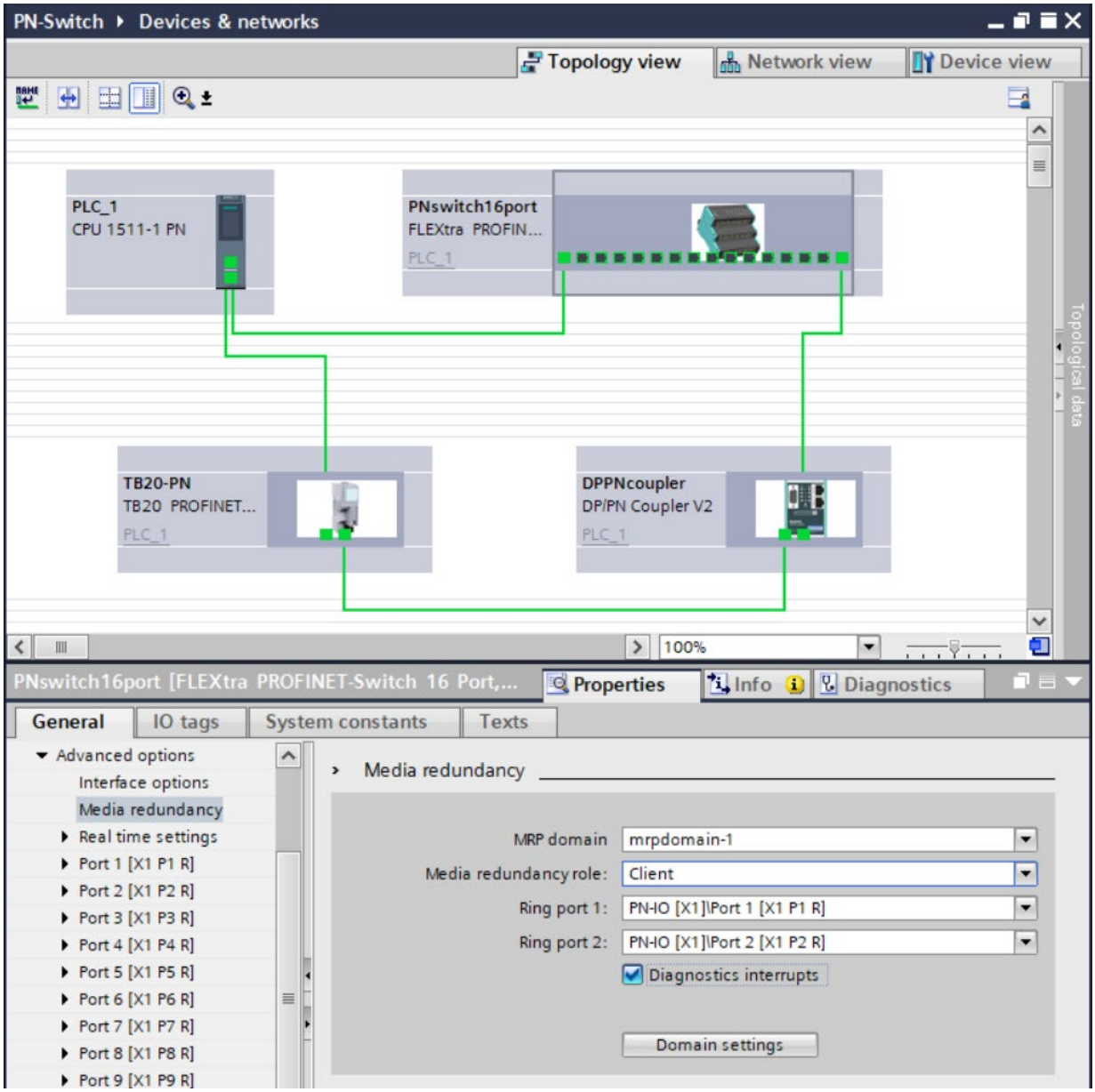
The Helmholz IPSet tool, which can be downloaded at no charge from the Helmholz website, can also be used to set the PROFINET name. Scan the following QR code to download the IPSet tool:

5.8 Media redundancy protocol (MRP)

The FLEXtra SLIM PROFINET switch optionally supports media redundancy (MRP) as a MRP client. MRP enables ring cabling, which allows the PROFINET network to operate even if a cable or a device fails.

In an MRP ring there must be an MRP manager (e.g. the PLC), all other participants in the ring are then MRP clients.

To assign the PROFINET switch to an MRP ring, the media redundancy role "Client" must be set under "Properties"/"General" for the "Media redundancy" option.



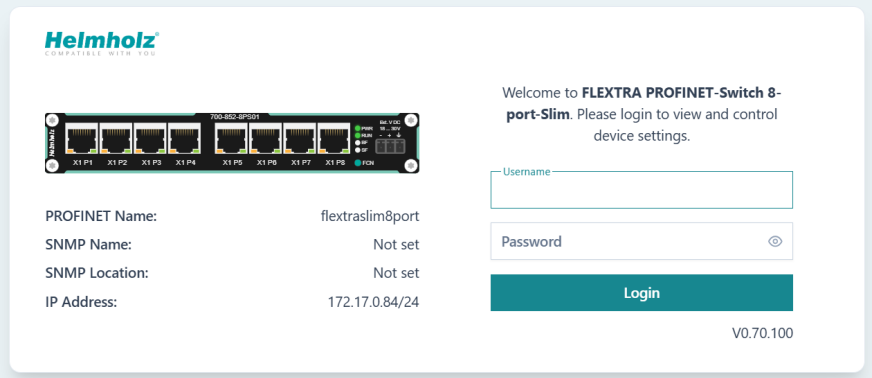
NOTE

If a ring cabling is established without the MRP roles being configured on all devices involved, the PROFINET network may malfunction!

6 Configuration and diagnostics via the web interface

6.1 Login

The web interface can be accessed as soon as the device has an IP network configuration. The IP address of the device must be specified as the URL.



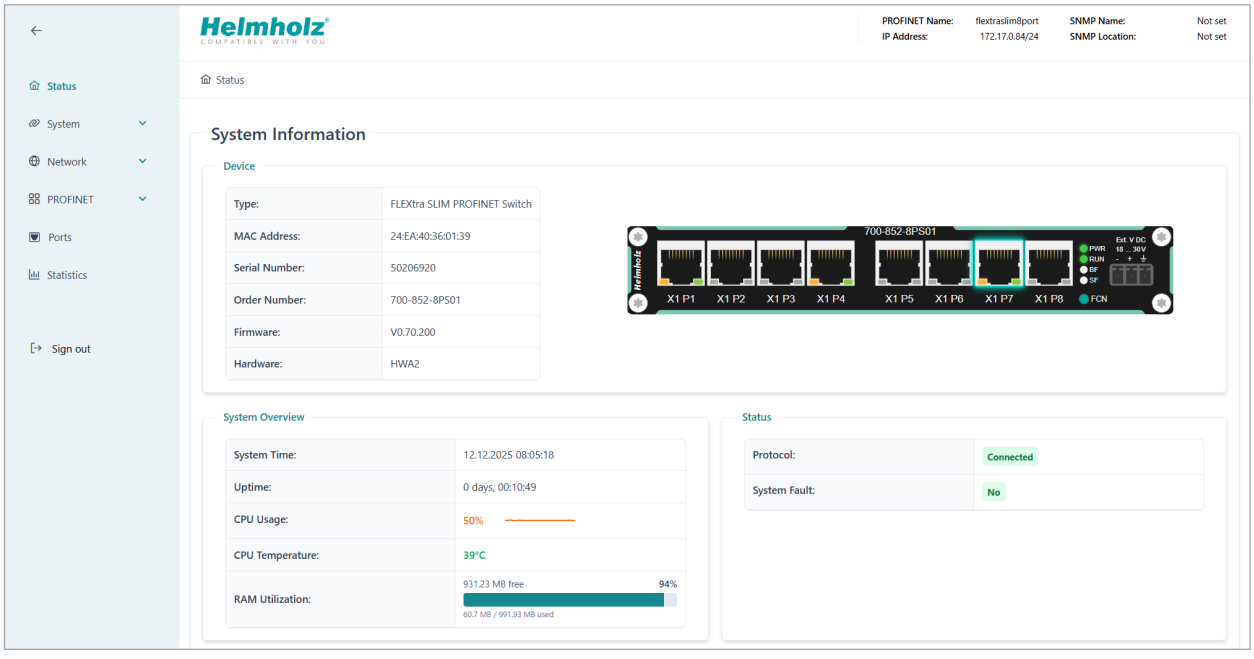
Depending on the browser used, a message such as "This is not a secure connection" may appear when connecting for the first time. The connection to the PROFINET switch website is SSL-encrypted, but the web interface certificate is a self-generated manufacturer certificate. This means that the browser cannot verify its trustworthiness. The PROFINET switch can be assigned to its own HTTPS certificate later.

Allow access to the website in your browser.

In the following login dialog, use the username "admin" and the serial number of the PROFINET switch as the password, which can be found on the side of the device. After logging in for the first time, the default password must be changed.

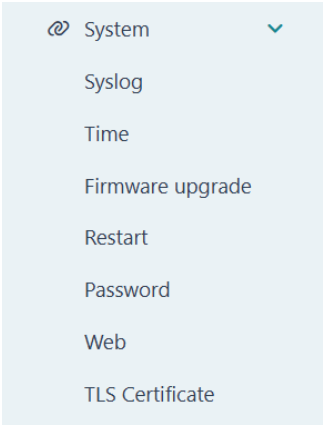
6.2 “Status" menu

The menu "Status" contains basic information about the status of the PROFINET switch. The status web page displays the basic system status and information about the switch. On the left is the menu with additional diagnostic and configuration options.



6.3 „System” menu

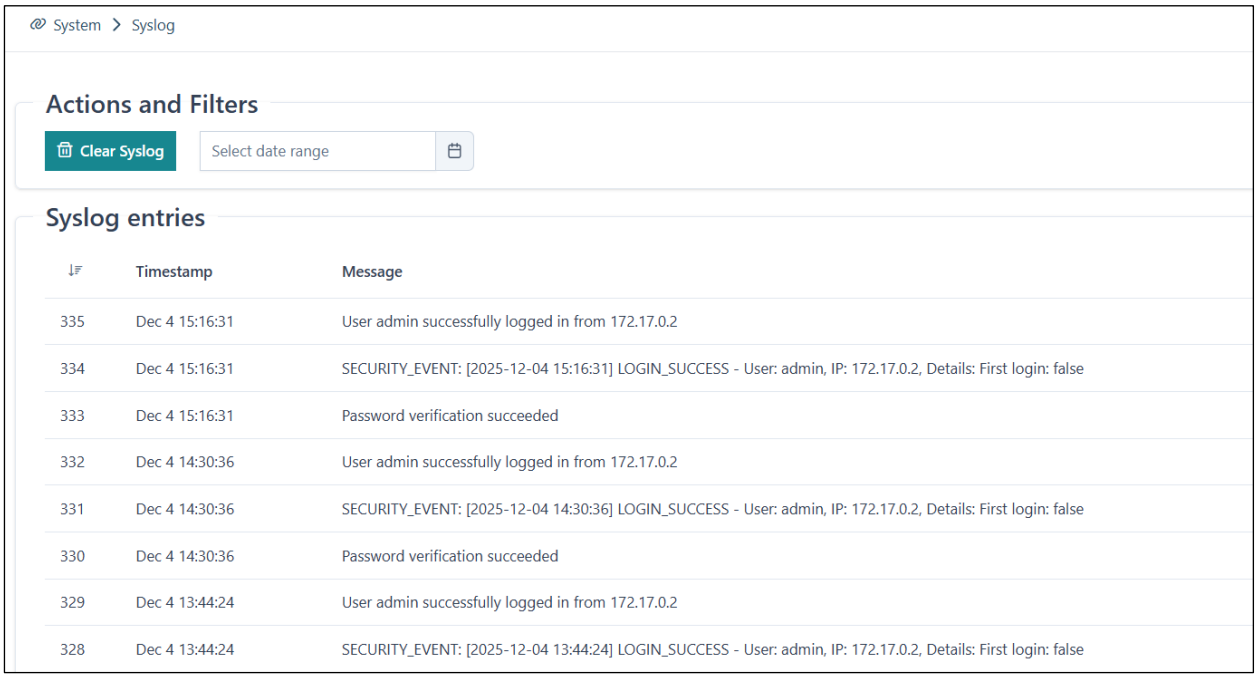
Basic information and settings for the device can be viewed in the System menu.



6.3.1 System events („Syslog“)

System events are stored in the device and can still be accessed after the device has been restarted. System events consist of:

- Sequential entry number since restart
- Time
- Text describing the system event.

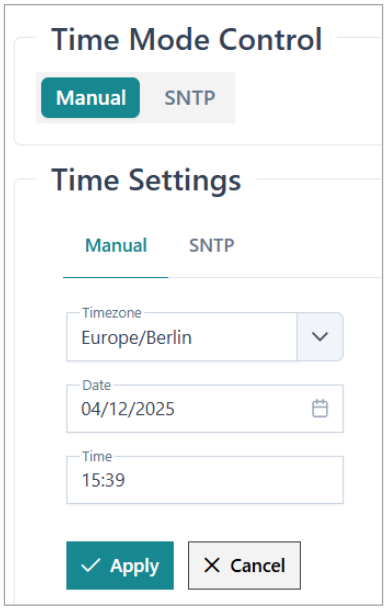


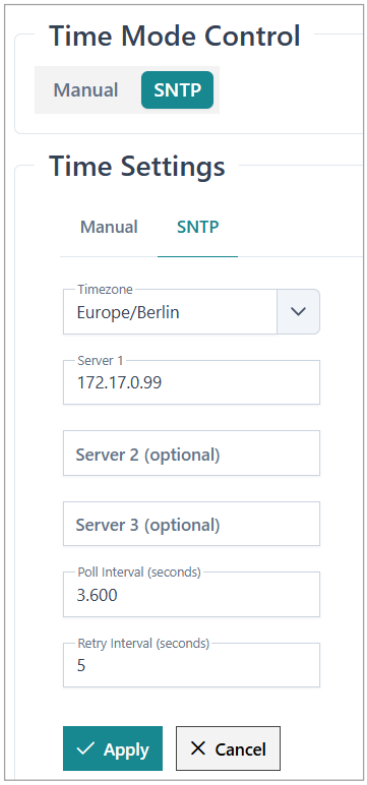
6.3.2 Time settings („Time“)

The time of the FLEXtra SLIM PROFINET switch can be set in this menu. The time is used when storing system events ("syslog"). The time can be set manually or synchronized with a time server (SNTP).

The website is displayed differently depending on the selected synchronization mode.

If manual synchronization is selected, a form appears where the current system time can be displayed and changed. If "SNTP" is selected as the synchronization mode, the form for configuring the SNTP server appears.

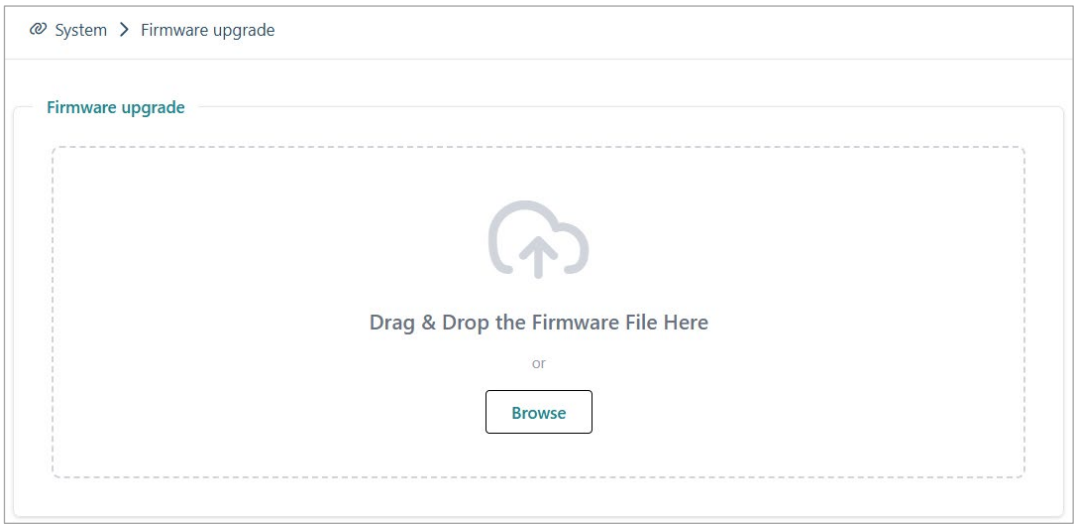




6.3.3 Firmware Upgrade

The firmware stored in the device can be updated. New firmware versions are delivered in files with the extension ".huf4" and are available via the Helmholz homepage www.helmholz.de.

Under "Firmware upgrade in menu "System", a firmware file can be selected and loaded into the device. After Upgrading, a restart is performed.

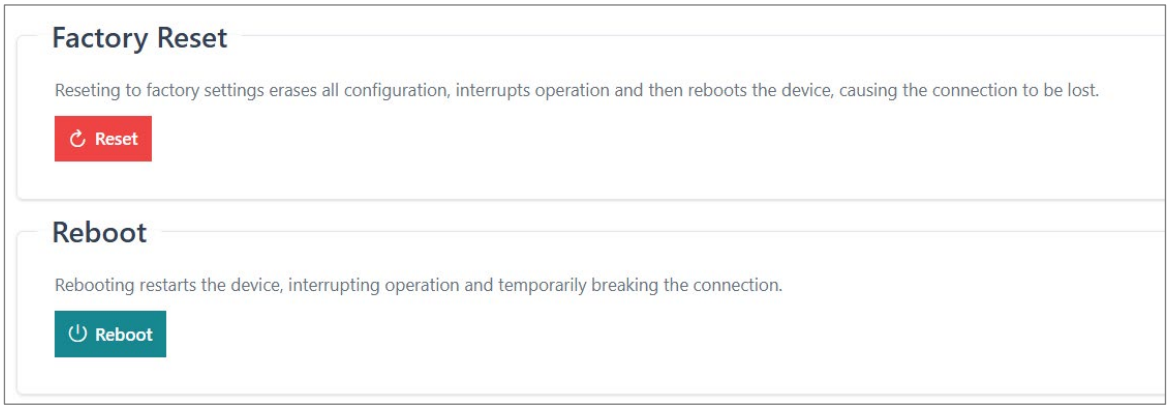


ATTENTION

Interrupting the power supply during the update process can render the device unusable. The device must then be sent in for repair.

6.3.4 Restart and Factory Reset

The device can be restarted (“Reboot”) and reset to factory settings (“Factory Reset”) via the web interface. Both functions are available in the web interface under "Restart" in menu "System".



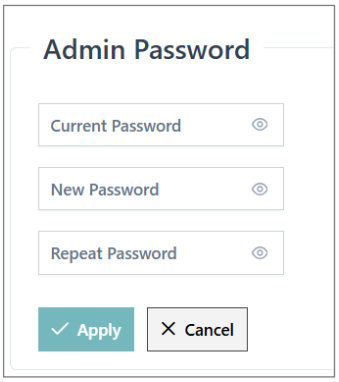
To reset the device to factory settings with the "FCN" button, the following steps are necessary:

1. Press and hold the FCN Button
2. Switch on or restart the device.
3. Wait until the "RUN" LED flashes yellow.
4. Release the "FCN" button within 10 seconds.

6.3.5 Password

Administrator access to the web interface is password protected. The password must be changed after commissioning. The factory default password cannot be reused.

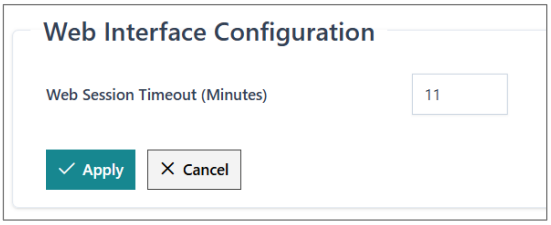
Passwords can be between 8 and 128 ASCII characters long.



6.3.6 Websession Timeout („Web“)

If a user is logged in to a PROFINET switch website, this session is logged out after a specified time for security reasons.

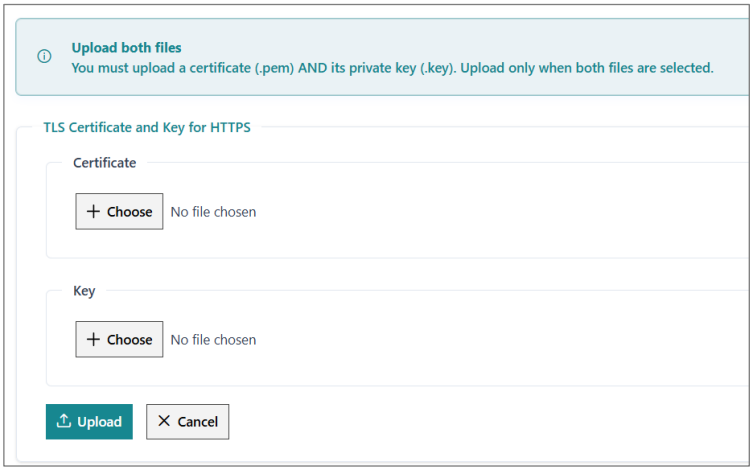
This time can be set in the dialog box.



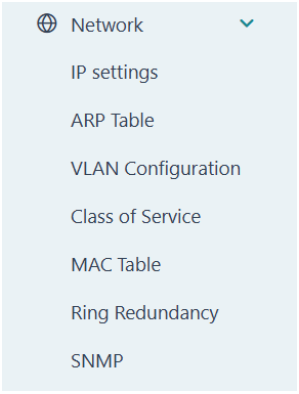
6.3.7 Certificates for website („TLS Certificate“)

To secure SSL-encrypted access to the website, it is possible to store a certificate for the device. HTTPS access is then not only encrypted but also secured by authentication of the website.

The certificate and private key for the website can be stored in the "TLS Certificate" menu.



6.4 “Network” menu



The PROFINET switch can be operated in two modes:

1. Configured via PROFINET
2. Managed switch without PROFINET

In PROFINET configuration operating mode, a PROFINET name must be assigned to the switch, which then receives its IP address, subnet mask, and default gateway from the configuration stored in the PROFINET controller when the PLC starts up.

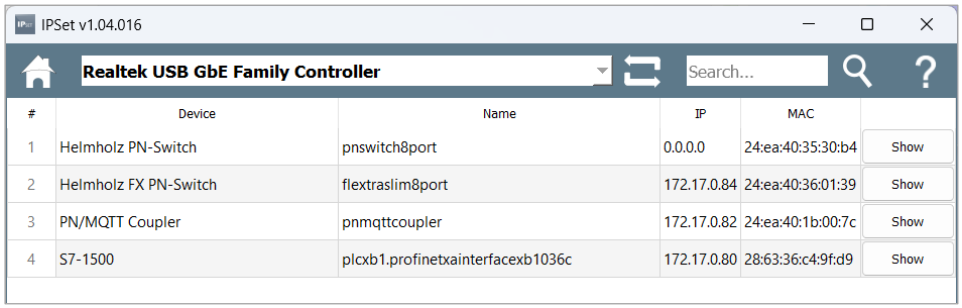
The PROFINET device name can be set using the PROFINET configuration tool or the Helmholz IPSet tool (see section 5.7).

NOTE

If the PROFINET switch has been configured via PROFINET, no changes to the network parameters are possible.

6.4.1 IP Settings

In the "Managed Switch" operating mode, the IP address can be set via the "IPSet" tool to be able to access the web page for further configuration.

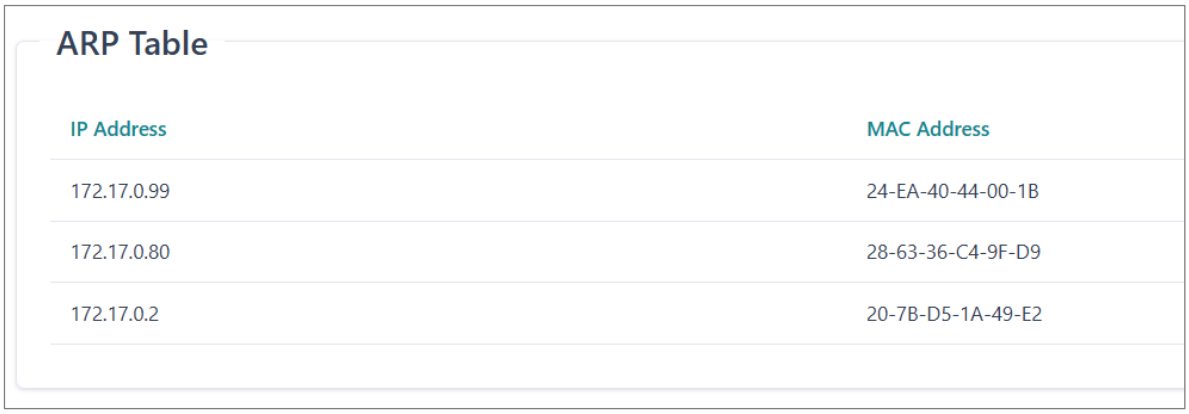


The network configuration can be displayed under "IP Settings” in menu “Network" and changed in the "Managed Switch" operating mode.

The DNS servers can also be changed in PROFINET mode.

6.4.2 ARP-Table

The IP addresses known to the PROFINET switch and their associated MAC addresses can be queried. The query only takes into account IP addresses of devices with which the PROFINET switch communicates via IP.



6.4.3 Preferential forwarding of time-critical data („CoS“)

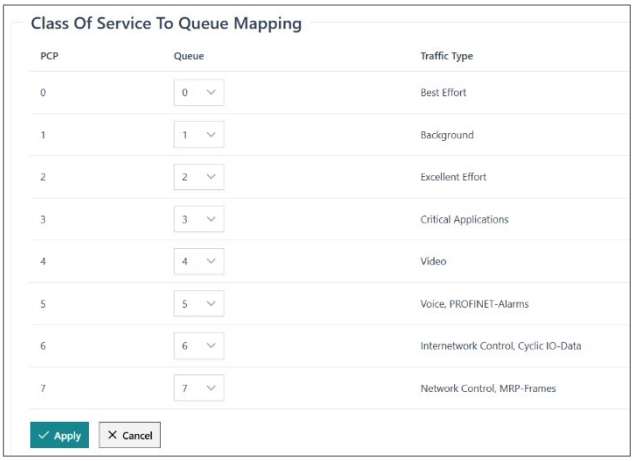
Time critical PROFINET data are sent as Ethernet frames with IEEE 802.1q header. In this header there is IEEE 801.2p data, which contains a priority specification (PCP).

The following PCP values are in use with PROFINET:

Frame	PCP-Value (0 ... 7)
PROFINET alarms	5
Cyclic IO data	6
MRP-Frames	7

The PROFINET switch can use this priority specification for preferred forwarding. This is particularly important when larger data volumes that are less time-critical sometimes pass through the switch.

The configuration allows the priority specifications to be assigned to four queues. The queues are numbered 0 through 3 with 0 being the lowest priority and 3 being the highest priority. Ethernet frames without IEEE 802.1q headers are assigned to queue 0.



NOTE

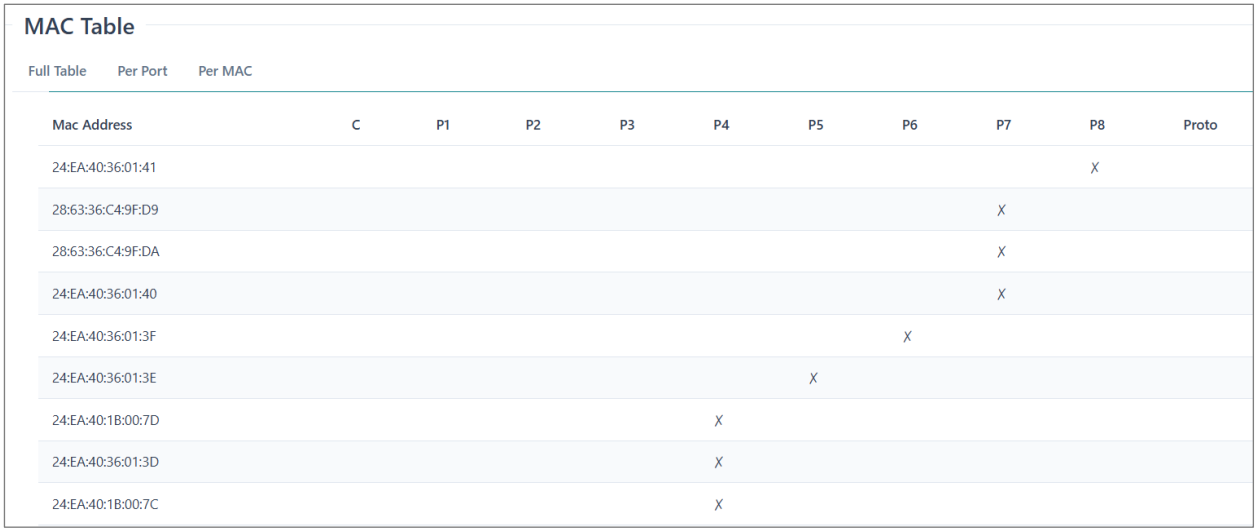
The factory default setting ensures preferential forwarding of time-critical PROFINET data ("Cyclic IO Data") and PROFINET alarms.

6.4.4 Port Forwarding rules („MAC Table“)

Ethernet frames are forwarded based on forwarding rules. Such a rule consists of a MAC address and the ports to which frames with this destination address are forwarded. The currently valid forwarding rules can be queried.

In addition to the five or eight external ports, the forwarding to the internal interface of the PROFINET switch ("C") is also shown.

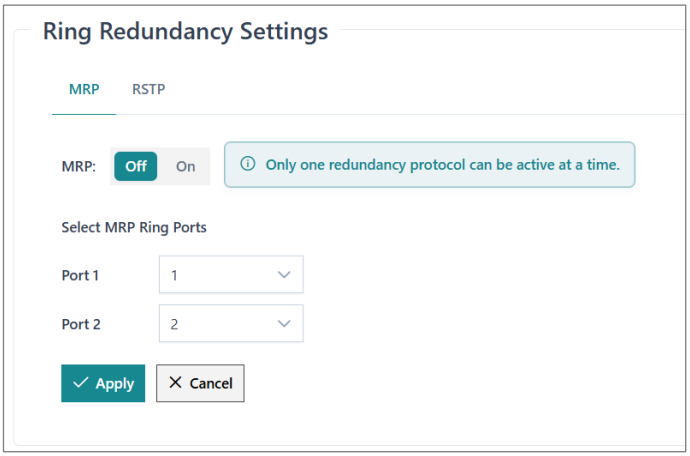
The dialog for querying the forwarding rules is located under "MAC Table" in the "Network" menu.



6.4.5 Ring Redundancy

The PROFINET switch can be used in a ring topology as MRP client.

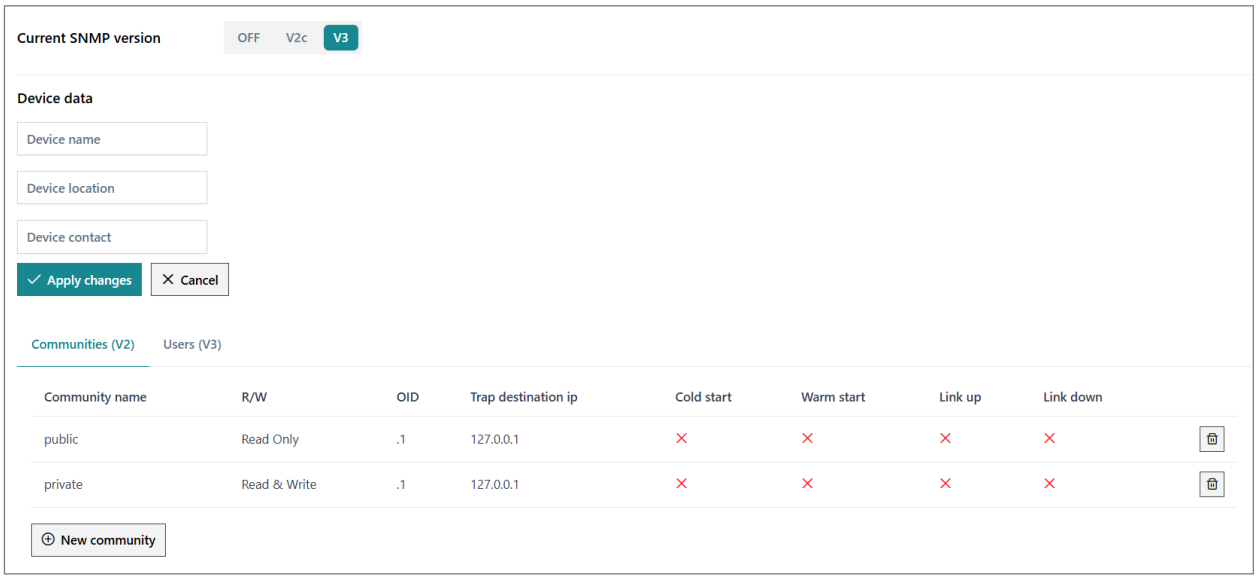
The current MRP settings can be viewed under "Ring Redundancy" in the "Network" menu. When a PROFINET connection is established, it is not possible to change the settings from the Web interface.



6.4.6 SNMP

SNMP (Simple Network Management Protocol) is an IP-based protocol for monitoring and controlling network components. The FLEXtra SLIM PROFINET switches support SNMP V2 by default. SNMP V3 can be activated if required.

For security reasons, SNMP can also be completely disabled (SNMP version "Off").



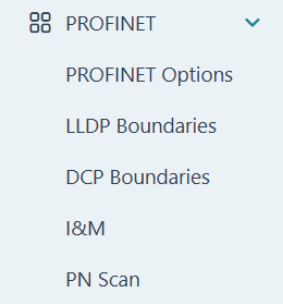
The following SNMP attributes can be displayed and changed:

- Device Name
  (SNMP-OID: 1.3.6.1.2.1.1.5)
- Device Location
  (SNMP-OID: 1.3.6.1.2.1.1.6)
- Device Contact
  (SNMP-OID: 1.3.6.1.2.1.1.4)

For **SNMP V3** applications, users can be created in the switch.

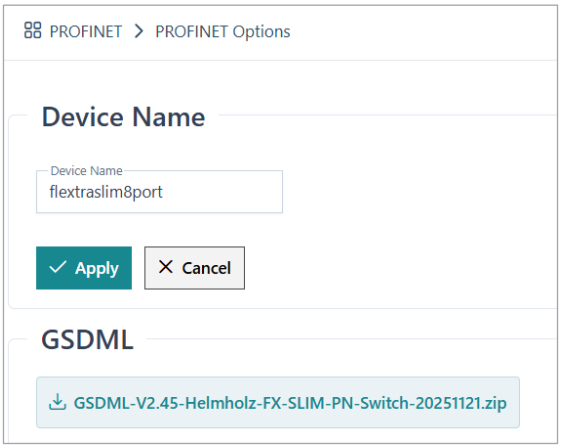
6.5 “PROFINET” menu

In the “PROFINET” menu, you can set the PROFINET device name, the LLDP and DCP boundaries of the switch, display the I&M data, and perform a PROFINET device scan.



6.5.1 PROFINET Options

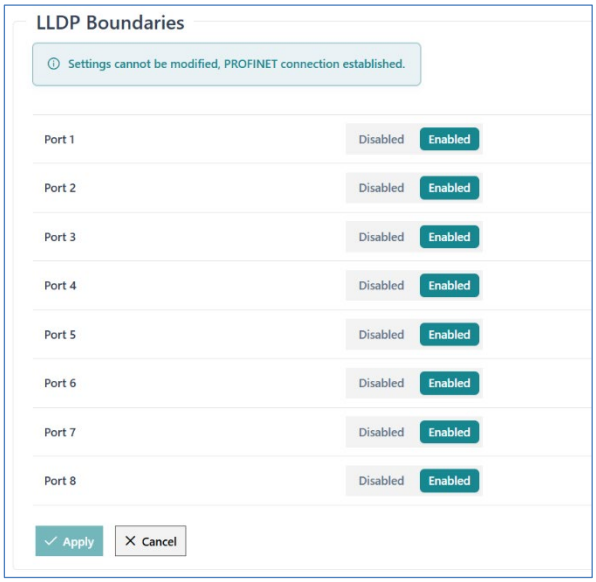
In the "PROFINET Options" menu, you can change the PROFINET name of the device and download the GSDML file supplied with the firmware.



6.5.2 LLDP Boundaries

PROFINET devices periodically send so-called LLDP frames to the devices to which they are connected via Ethernet. In this way, PROFINET devices receive information about exactly who they are connected to. This information is retained and forms the basis for determining the network topology.

If the connected device is not a PROFINET device, sending the LLDP frames and holding the corresponding information can lead to problems when detecting the network topology. Therefore, this function can be disabled for each port.



For the LLDP frames, each port has its own MAC address. Example of the first ports of the PROFINET-Switch:

Device: 24-EA-40-20-xx-xx

Port 1: 24-EA-40-21-xx-xx

Port 2: 24-EA-40-22-xx-xx

Port 3: 24-EA-40-23-xx-xx

...

NOTE

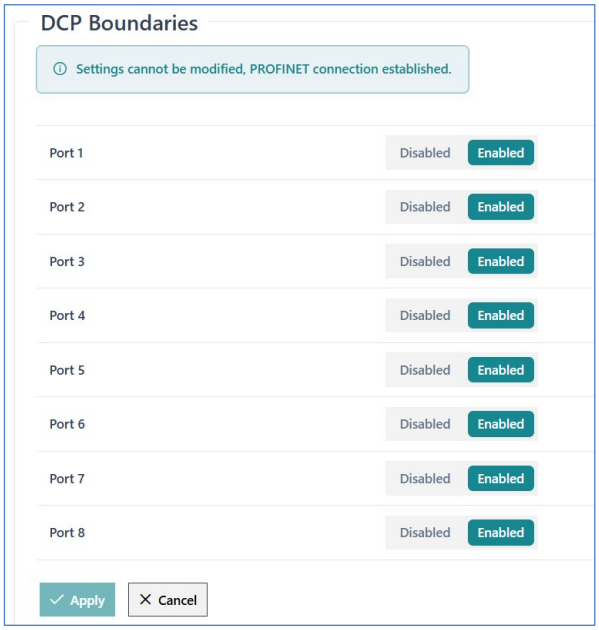
Changes to the LLDP settings are only possible on the web page if no PROFINET configuration is active in the switch. With a PROFINET configuration, this function can be set via the port configuration in the PROFINET tool.

6.5.3 DCP boundaries

The DCP protocol can be used to detect PROFINET devices in a network and provide them with basic parameters such as IP address and device name. For this purpose, DCP frames are forwarded to all ports.

If forwarding to a particular port is undesirable, it can be disabled. The reception of DCP frames on this port is unaffected.

The dialog for querying and changing the DCP settings is located under "DCP Boundaries" in the "PROFINET" menu.



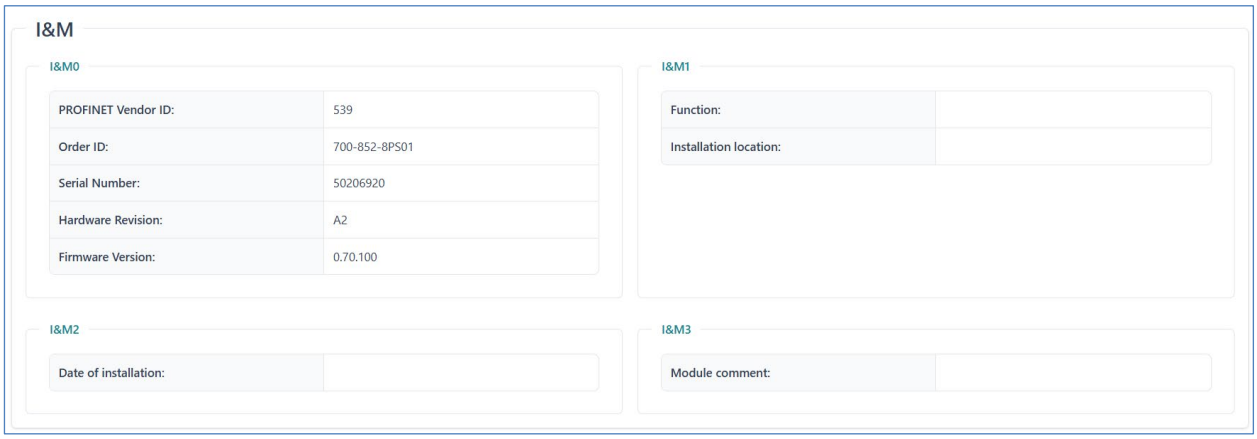
NOTE

Changes to the DCP settings are only possible on the web page if no PROFINET configuration is active in the switch. With a PROFINET configuration, this function can be set via the port configuration in the PROFINET tool.

6.5.4 Identification & Maintenance

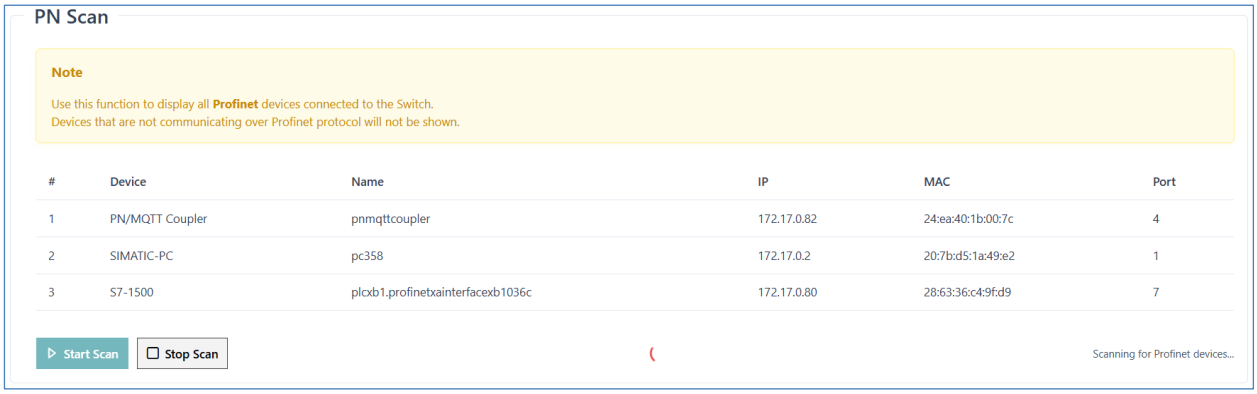
The information on identification and maintenance (I&M0) includes the PROFINET vendor ID, order number, serial number and information on the hardware and firmware version. The user settings for I&M1 to I&M3 are also displayed here.

The information is displayed under "I&M" in the "PROFINET" menu.



6.5.5 PROFINET Scan

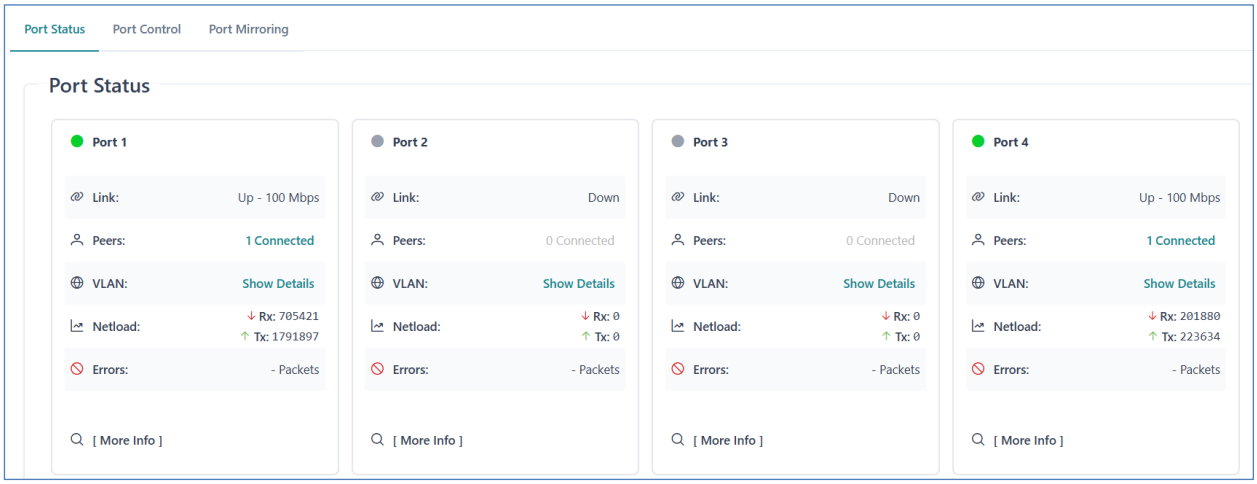
The "PN Scan" function in the "PROFINET" menu can be used to perform a scan of the network for PROFINET nodes. All devices found are displayed with type, name, current IP address, MAC address. In addition, the port of the FLEXtra SLIM PROFINET switch at which the device was found is displayed.



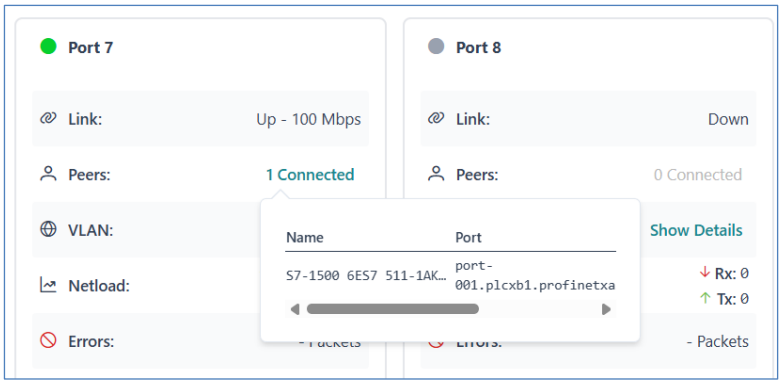
6.6 Ports

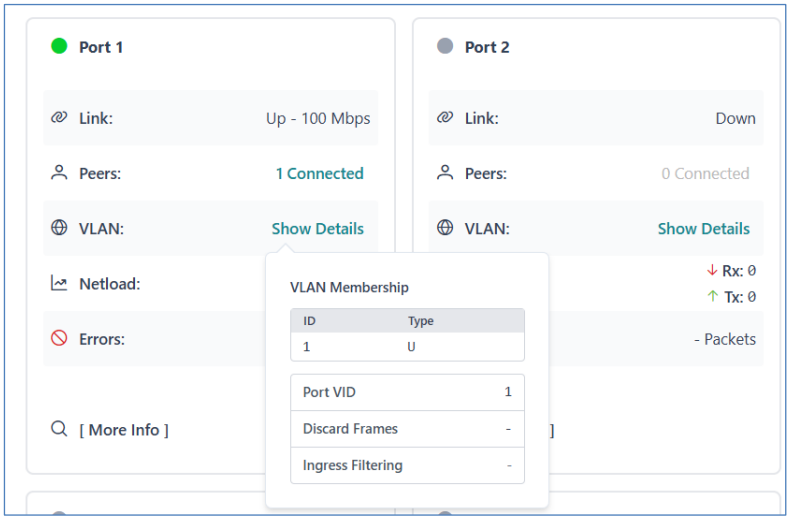
The status of the ports can be displayed, and port functions can be configured on the "Ports" web page.

6.6.1 Port Status



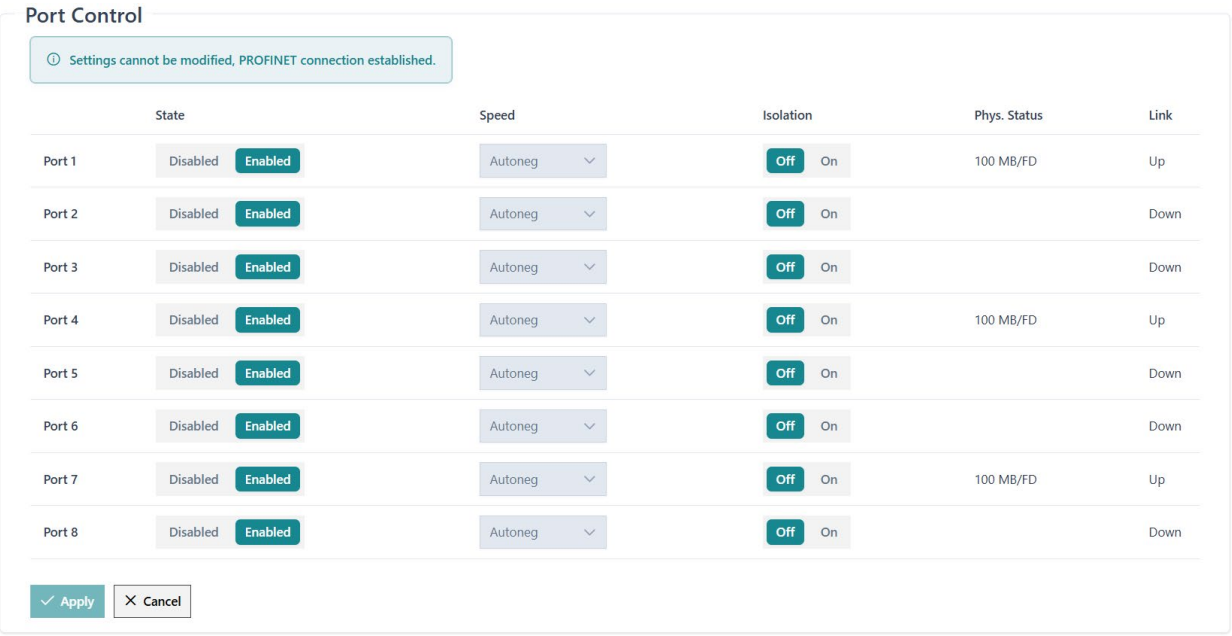
By clicking on "Peer Connected" or "VLAN: Show Details," you can get more info about the port.





6.6.2 Port Control

A port can be switched on or off, i.e. deactivated. A port can operate with auto-negotiation ("auto") or with fixed 100 Mbit/full duplex ("100MB/FD").



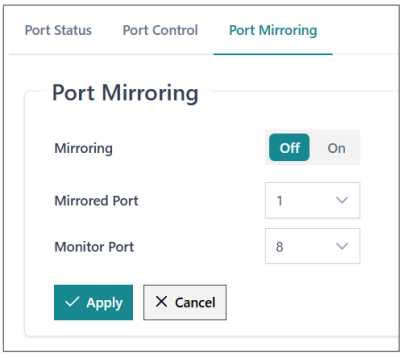
With the "Autoneg" setting, the establishment of the Ethernet connection is preceded by a process in which Auto-MDI/MDI-X is activated and the partners agree on a speed/duplex together.

NOTE

Changes to the port settings are only possible if no PROFINET configuration is active in the switch.

The option “Port isolation” is used to disable communication between isolated ports. When active, communication between devices connected to isolated ports is disabled. They can, however, still communicate with non-isolated ports and vice-versa

6.6.3 Port Mirroring



The Ethernet ports of the PROFINET switch can be set up to mirror the incoming and outgoing data traffic of another port.
A maximum of one port can be set up as a mirror of another. The port remains usable for its own data traffic without any restrictions.

The dialog for viewing and changing port mirroring is located under "Port / Port Mirroring".

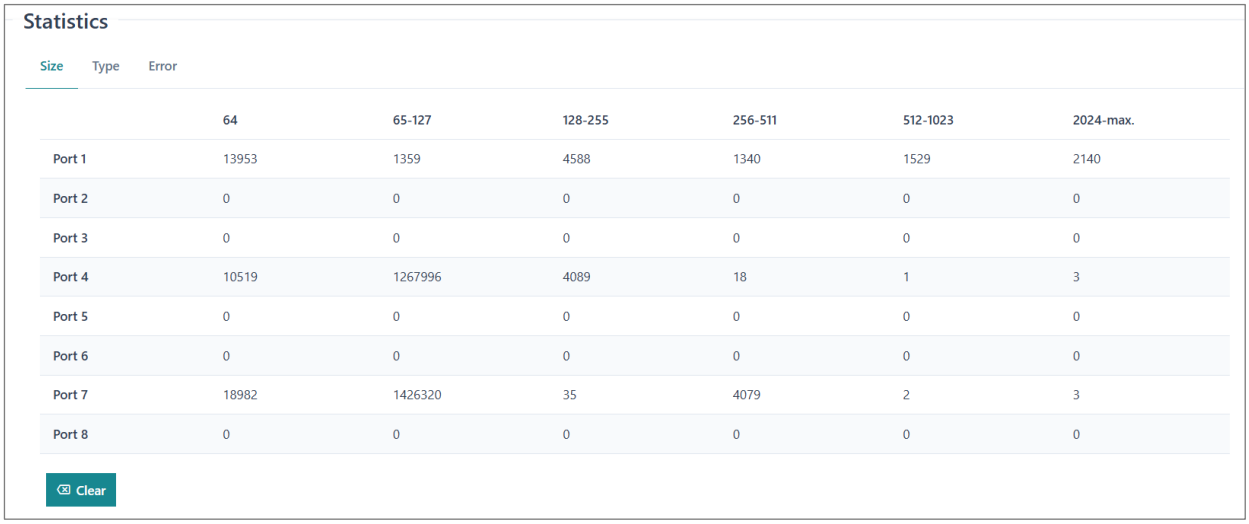
Under "Mirrored Port", any of the ports can be selected whose telegram traffic is output on "Monitor Port".

Please note that the transmission capacity of the monitor port may not be sufficient when mirroring several ports with a lot of traffic. This can result in telegram losses at the monitor port.

6.7 Network statistics („Statistics“)

The PROFINET switch collects statistical data per port on the type of incoming (RX) and forwarded (TX) frames. The statistics can be displayed according to frame size, frame type, and errors.

The statistics can be displayed and reset.



	64	65-127	128-255	256-511	512-1023	2024-max.
Port 1	13953	1359	4588	1340	1529	2140
Port 2	0	0	0	0	0	0
Port 3	0	0	0	0	0	0
Port 4	10519	1267996	4089	18	1	3
Port 5	0	0	0	0	0	0
Port 6	0	0	0	0	0	0
Port 7	18982	1426320	35	4079	2	3
Port 8	0	0	0	0	0	0

6.7.1 VLAN configuration

A Virtual Local Area Network ("VLAN") is a logical subnet within a larger physical network. It can extend across multiple switches.

A VLAN separates physical networks into subnets by ensuring that VLAN-enabled switches do not forward data packets into another VLAN. Devices logically connected via a VLAN remain among themselves. The use of VLANs in large physical networks is useful for controlling data traffic and securing access rights to devices.

The assignment of the subnets to a VLAN can be realized via special markings in the ethernet frames ("tagged") or statically via port assignment in the switches ("untagged").

Tagged: If the port is a tagged member of a particular VLAN, all packets in that VLAN are tagged when they leave the port. The VLAN tag is a 4-byte overhead on the standard Ethernet frame consisting of a 2-byte Tag Protocol Identifier (TPID), which is 0x8100, and a 2-byte Tag Control Information (TCI). The TCI contains a 12-bit VLAN identifier. Thus, up to 4096 different VLANs can be managed.

Untagged: If a port is an untagged member of a particular VLAN, the VLAN tag will be stripped and the packet will leave the port without a tag.

NOTE

The following special features must be observed in the interaction of PROFINET and VLANs:

Management-VLAN

In the FLEXtra SLIM PROFINET switch, VLAN 1 is the management VLAN. The Switch web interface and the PROFINET interface are only available in VLAN 1. To prevent the connection to the device from being lost, port 1 as management port in the VLAN configuration is always tagged member of VLAN 1.

AR Connection

The PROFINET interface in the FLEXtra is only available in VLAN 1. The PROFINET controller can establish the AR connection only on the ports that are members of VLAN1.

MRP

If the PROFINET-Switch is configured as MRP client, both MRP ring ports must be members of VLAN1 for normal operation!

NOTE

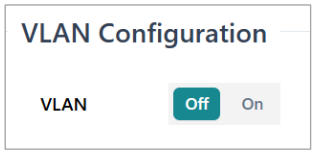
1. It is highly recommended to create VLANs and edit the VLAN membership and port-based settings before enabling the VLAN feature.

2. It is highly recommended to always use Port 1 for configuration. Port 1 is always a member of the management VLAN 1 and the web interface can always be accessed.

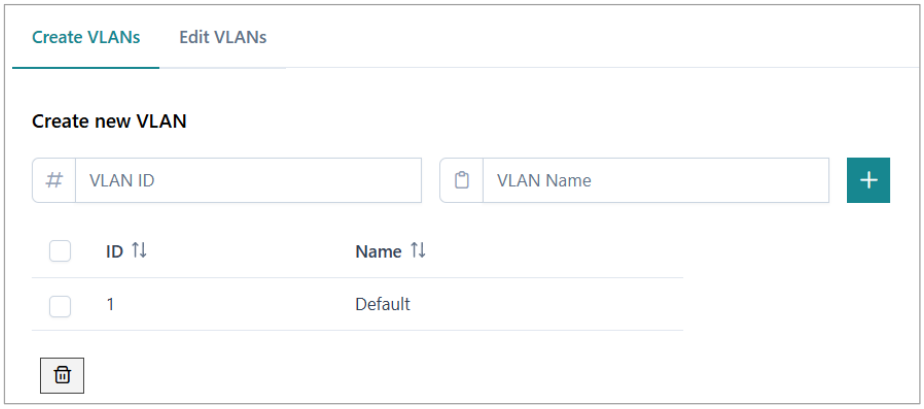
3. It is highly recommended to use only VLAN 1 for the PROFINET network. Only on VLAN 1 can the PROFINET functionality of the Switch be accessed.

The FLEXtra SLIM PROFINET Switch supports VLANs, both tagged and untagged. The VLAN configuration can be configured in the "Switch" menu under "VLAN Configuration". The VLAN configuration is divided into two dialogs, which can be switched between with a button.

The device can operate as a VLAN active and VLAN inactive device. This is controlled with the switch "VLAN 802.1Q: ON/OFF".



1. **„Create VLANs“**: Virtual LANs can be created in this dialog.

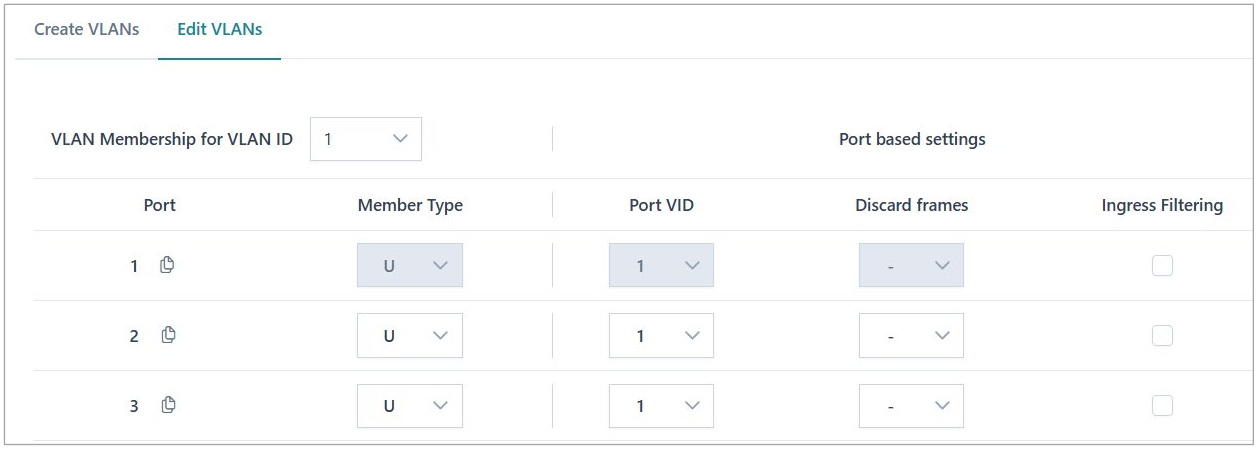


The VLAN ID can be set from 1-4095, the VLAN name is freely selectable.

The icon  is used to create the new VLAN.

The icon  can be used to delete a VLAN.

2. **„Edit VLANs“:** In this dialog, one or more VLANs can be assigned for each port.



“**VLAN Membership**” – In the first two columns you can see or change the membership of all ports for the selected "VLAN ID".

“VLAN ID” Current VLAN ID for which the membership configuration is displayed.

“Member Type” Port member type:

“-“ Port is not a member of the specified VLAN

“T” Port is a tagged member of the specified VLAN

“U” Port is not tagged member of the specified VLAN

 Copy settings for this VLAN ID to all other ports

"**Port Based Settings**" In the rear 3 columns the VLAN ID and security settings can be defined for each port.

"Port VID" default port VLAN ID. When a frame arrives on a port without a VLAN ID, the default VID is applied, and the frame is switched as if it had the specified VID.

"Discard Frames" Specifies what kind of frames should be discarded:

"- " All frames are accepted

"T" Tagged frames are discarded

"U" Untagged frames are discarded

"Ingress filtering" specifies whether the VID of incoming frames should be evaluated:

Active: Frames are only accepted if the VLAN ID in the Ethernet telegram matches the port VLAN ID. That is, if the port is a tagged member of VID 100 and an untagged member of VLAN 1000. It accepts frames with VID 100 and 1000, and all other VLAN tagged frames are discarded.

Inactive: All frames are accepted.

7 PROFINET FAQ

7.1 Why do you need a PROFINET switch for a PROFINET network?

A PROFINET switch handles PROFINET frames with the highest priority and ensures that frame loss doesn't occur and jitter in the transmission remains minor. That secures the PROFINET transmission and allows precise regulation in PROFINET systems.

A PROFINET switch supports mechanisms for neighborhood detection (LLDP protocol) to detect and check the topology of the network. This ensures that the setup and the network wiring of the system are correct.

PROFINET switch supports device replacement without exchangeable medium. If a PROFINET node needs to be replaced, new device is automatically recognized based on its position in network by the CPU, and thus it can be configured without the need for additional actions. This reduces the down time of the malfunction device significantly.

Because many different devices are often installed into automation systems, the "Finding devices via LED flash" function supports the easy search for a participant.

In order to improve the reliability of networks, PROFINET switches support the ring redundancy technology MRP (Media Redundancy Protocol).

However, the operation of a PROFINET network is also possible with unmanaged switches.

7.2 Is the PROFINET switch "real time-compatible"?

The PROFINET switch is "real time-compatible" and supports the PROFINET real time class 2 for cyclical data exchange. PROFINET is generally differentiated into two main real time classes: RT and IRT.

The "real time capability" of an industrial bus system generally involves the chronological precision of the cyclical IO transmission. For complex and distributed automation tasks, especially in the drive control area, it is important that cyclical data transmission always takes place consistently. Longer interruptions due to other Ethernet traffic, for example, video cameras or project transmissions, should not influence the PROFINET IO cycle where possible.

PROFINET RT (real time) uses the standard technologies of managed switches (e.g. QoS) to always prioritize important Ethernet frames of bus communication in relation to chronologically non-critical frames.

PROFINET IRT (isochronous real time) uses special PROFINET switches to keep the jitter and the rhythm of the IO cycle as exact as possible in the network and to ensure a synchronous rhythm and the best transmission possible.

The Helmholz PROFINET switch supports PROFINET RT, but not IRT.

7.3 What do the LEDs BF and SF mean?

The “BF” LED shows logical “bus errors”, for example, that the device has not received a configuration, the configuration is defective, or no PROFINET communication is possible at all (network error).

The “SF” LED shows “collective errors”. This can include, for example, an existing PROFINET diagnosis.

7.4 What is “Device exchange during operation”, and what role does the PROFINET switch play here?

If a PROFINET participant malfunctions while in operation, a replacement device is detected following installation based on its position in the topology (by the PROFINET neighbors) and is automatically provided with its IP address and its PROFINET name. The CPU can then configure the replacement device and restart. The neighboring PROFINET devices, for example, the switch, must this purpose support PROFINET to enable this function.

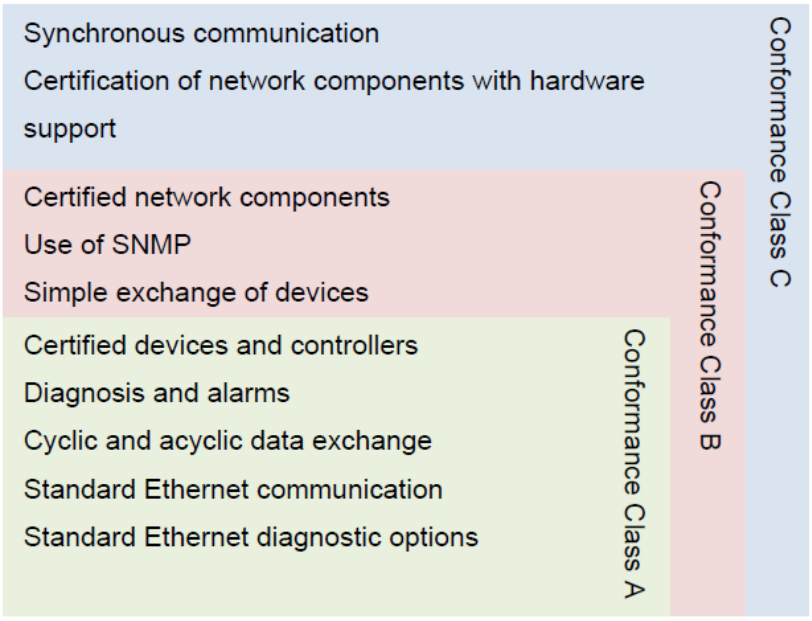
7.5 Why should PROFINET devices have PROFINET certification?

The PNO certification is carried out by accredited testing labs and is standardized by the PNO. PROFINET certification should ensure both the function of the PROFINET components in accordance with standards and the interoperability of various manufacturers in a PROFINET network.

7.6 What is behind the PROFINET conformance classes A, B, C?

PROFINET is divided into conformance classes (CC). The conformance classes define sensible function scopes and are thus decision-making criteria for system operators when using PROFINET components.

With prior definition of an application in a CC, the user can select components with clearly defined minimum properties.



From the PNO document “PROFINET Planning Guideline (Order no.: 8.061)”

You can find more information on the conformance classes in the PNO document “The PROFINET IO Conformance Classes - Guidelines for PROFINET IO (Order no.: 7.041)”.

7.7 Which Ethernet cable types can be used for PROFINET?

The conformance classes B and C presume Ethernet cable in accordance with IEC61784-5-3.

In conformance class A, other cables (see PNO document “CC-A Cabling Guide”) and wireless connections can also be used.

7.8 Can PROFIsafe be transmitted via the PROFINET switch?

Yes, the PROFIsafe protocol classifies all components between the PROFIsafe controller and the PROFIsafe device as “black channel”. Any number of network participants and components can thus be used in the PROFINET route. If transmission disruptions should occur, the PROFIsafe components switch to a secure status

7.9 Why does the PROFINET switch have its own IP address and a PROFINET name?

The PROFINET switch is a managed switch. The IP address is necessary to be able to address the switch as an active infrastructure component. PROFINET switch can be reached via IP address over Web browser (web interface) or by other PROFINET participants (e.g. a CPU or a programming device can configure the switch and read out information from the switch).

For the purposes of simplifying the IP address in the PROFINET, a device name can be used that is then synonymous in a project for the IP address.

7.10 What are I&M data?

For PROFINET and PROFIBUS, I&M stands for “Identification and Maintenance”. The I&M data contains information about the PROFINET participants. Some I&M fields are programmed by the manufacturer (e.g. order number, serial number, ...), and fields can be used by users to store their own information in the module(e.g. location, service contact, ...)

The I&M data of all PROFINET participants can be read out and evaluated in the automation network with standard functions. The PROFINET switch has appropriate I&M data records.

7.11 Can I also use the PROFINET switch in other industrial networks without PROFINET?

PROFINET is based on the Ethernet standard and the PROFINET switch can be used in normal TCP/IP networks, especially in industrial networks, as a managed switch. In the process, the PROFINET-specific functions of the PROFINET switch are not addressed.

General Ethernet functions can be read out and configured through the switch web interface.

7.12 What happens with a PROFINET participant when the power supply fails?

PROFINET participants mostly have 2 ports for the PROFINET cabling. The two ports are connected with one another by an internal 2-port switch component. If the power supply of a PROFINET participant fails, the communication is interrupted at this point in a network line. One can get around this problem with ring cabling using MRP technology.

If the power supply of a PROFINET switch fails, communication with all participants connected to this switch is no longer possible.

This behavior is clearly different from that of PROFIBUS networks!

7.13 Why is “Port Mirroring” necessary?

PROFINET is a complex communication protocol. In some situations, it may be necessary to read and interpret the frame traffic with a protocol analyzer.

In order to be able to monitor PROFINET network expensive coupling hardware which is looped into the line can be used. Alternative is Port mirroring feature configured on free port. The monitor port transmits all frames from mirrored port of the switch as a copy. A device or PC can then capture packets on monitor port with the corresponding analysis software.

7.14 Do the PROFINET switches support TSN?

TSN ("Time Sensitive Networking") is currently not yet supported by the Helmholz PROFINET switches.

7.15 More information on PROFINET

More information on PROFINET can be found in the documentation “PROFINET Planning Guideline (Order no.: 8.061)”, “PROFINET Installation Guideline (Order no.: 8.071)” and the “PROFINET Commissioning Guideline (Order no.: 8.081)”, which are available from PNO (https://www.profibus.com/).

8 Technical data

8.1 FLEXtra SLIM PROFINET-Switch 5-port

Order number	**700-852-5PS01**
Name	FLEXtra SLIMPROFINET-Switch 5-Port, managed, 100 Mbps
Scope of delivery	PROFINET-Switch 5-Port with power supply plug
Dimensions (D x W x H)	80 x 25 x 109 mm
Weight	Ca. 200 g
PROFINET/Ethernet interfaces (X1)	
Connection	5 x RJ45, integrated Switch
Transmission rate	10/100 Mbps
Protocol	PROFINET IO Device as defined in IEC 61158-6-10
Features	PROFINET Conformance Class B *(in preparation)*, Netload Class III, Media Redundancy (MRP), automatic addressing (DCP), topology detection (LLDP), diagnostic alarms, VLAN, SNMP V2/V3, Port-Mirroring, Port statistics
Status indication	
Function status	4 LEDs (PWR, RUN, BF, SF)
Ethernet status	10 LEDs (bi-colored)
Power supply	
Operating voltage	DC 24 V, 18 – 30 V DC
Current draw	max. 140 mA with DC 24 V
Power dissipation	Max. 3.3 W
Ambient conditions	
Ambient temperature	-25° C to +60° C
Transport and storage temperature	-40° C to +85° C
Relative humidity	95% without condensation
Protection rating	IP 20
Mounting position	As desired
Approvals	CE, PROFINET Conformance Class B *(in preparation)*

8.2 FLEXtra SLIM PROFINET-Switch 8-port

Order number	**700-852-8PS01**
Name	FLEXtra SLIMPROFINET-Switch 8-Port, managed, 100 Mbps
Scope of delivery	PROFINET-Switch 8-Port with power supply plug
Dimensions (D x W x H)	80 x 25 x 157 mm
Weight	Ca. 275 g
PROFINET/Ethernet interfaces (X1)	
Connection	8 x RJ45, integrated Switch
Transmission rate	10/100 Mbps
Protocol	PROFINET IO Device as defined in IEC 61158-6-10
Features	PROFINET Conformance Class B *(in preparation)*, Netload Class III, Media Redundancy (MRP), automatic addressing (DCP), topology detection (LLDP), diagnostic alarms, VLAN, SNMP V2/V3, Port-Mirroring, Port statistics
Status indication	
Function status	4 LEDs (PWR, RUN, BF, SF)
Ethernet status	16 LEDs (bi-colored)
Power supply	
Operating voltage	DC 24 V, 18 – 30 V DC
Current draw	max. 160 mA with DC 24 V
Power dissipation	Max. 3.8 W
Ambient conditions	
Ambient temperature	-25° C to +60° C
Transport and storage temperature	-40° C to +85° C
Relative humidity	95% without condensation
Protection rating	IP 20
Mounting position	As desired
Approvals	CE, PROFINET Conformance Class B *(in preparation)*