Helmholz
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PROFINET Switch 4/8/16-port

Manual

Version 5 | 14.05.2024 | as of firmware V 1.12

Link to the latest version of the manual.

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Notes

The latest version of the manual can be found on the Internet at www.helmholz.de.

We welcome your suggestions for improvement and comments.

Helmholz GmbH & Co. KG

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Revision record:

Version	Date	Change
1	14.2.20	First version / Firmware V1.04
2	29.5.20	Changed screenshots to match new web interface design
3	4.8.20	Various text corrections and new screenshots
4	24.3.23	Layout corrections; temperature 16-port switch adjusted
5	14.5.24	New firmware V1.12; VLAN, Port-Scan

Contents

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.

WARNING

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

The specialist personnel are to ensure that the application or the use of the products described fulfills all safety requirements, including all applicable 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 hazard warning is ignored, there is a probable danger to life and health of people from electrical voltage.

CAUTION

If the hazard warning 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 PROFINET switch (referred to as “the device” in the following) can be used for the networking of Ethernet networks with the PROFINET protocol .

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 that extend 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 PROFINET switches 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 recommendations on security during project planning, use and maintenance (see chapter 2). Successful and safe operation of the device requires proper transport, storage, setup, assembly, installation, commissioning, operation, and maintenance.

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

The device has a protection rating of IP 20 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

The consequences of improper use may include personal injury to the user or third parties, as well as property damage to the control system, the product, or the environment. Use the device 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 liability for any printing errors or other inaccuracies that may appear in the operating manual unless there are serious errors of 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 that 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 upon 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

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

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 concept with corresponding products, such as the Helmholz “WALL IE”.
- Inform yourself regularly about security threats for all your 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 offer more security.

Passwords:

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

You can find extensive information in the “ICS Security Compendium” of the Federal Office for Information Security (BSI):

https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/ICS/ICS-Security_kompendium_pdf.html

Helmholz is a member of the CERT@VDE. In addition to our technical newsletter, we communicate our security-relevant updates, patches and advisories to you as a user of Helmholz products. Find out more and use the services and database of the CERT@VDE to make your systems secure and keep them secure.

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 help too: Report any product incidents to our Product Security Incident Response Team at psirt@helmholz.de or support@helmholz.de.

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

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

2.1 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.

3 Overview

The managed PROFINET switch supports PROFINET according to Conformance Class B and offers transmission security through ring redundancy as an MRP client.

The flat design saves space in the control cabinet. The status LEDs on the top of the PROFINET switches are always clearly visible and enable simple diagnostics, even with full cabling.

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

One of the most important functions of a PROFINET switch is the prioritizing of the PROFINET frame traffic in the machine network. The managed switch can differentiate whether the frame is a web query, an FTP file transmission, a media stream, or a PROFINET frame. In the case of a high transmission load, the important frames can thus be prioritized to prevent frame losses.

The supported PROFINET protocols, such as LLPD, DCP, or even diagnosis alarms, can be easily configured and administered.

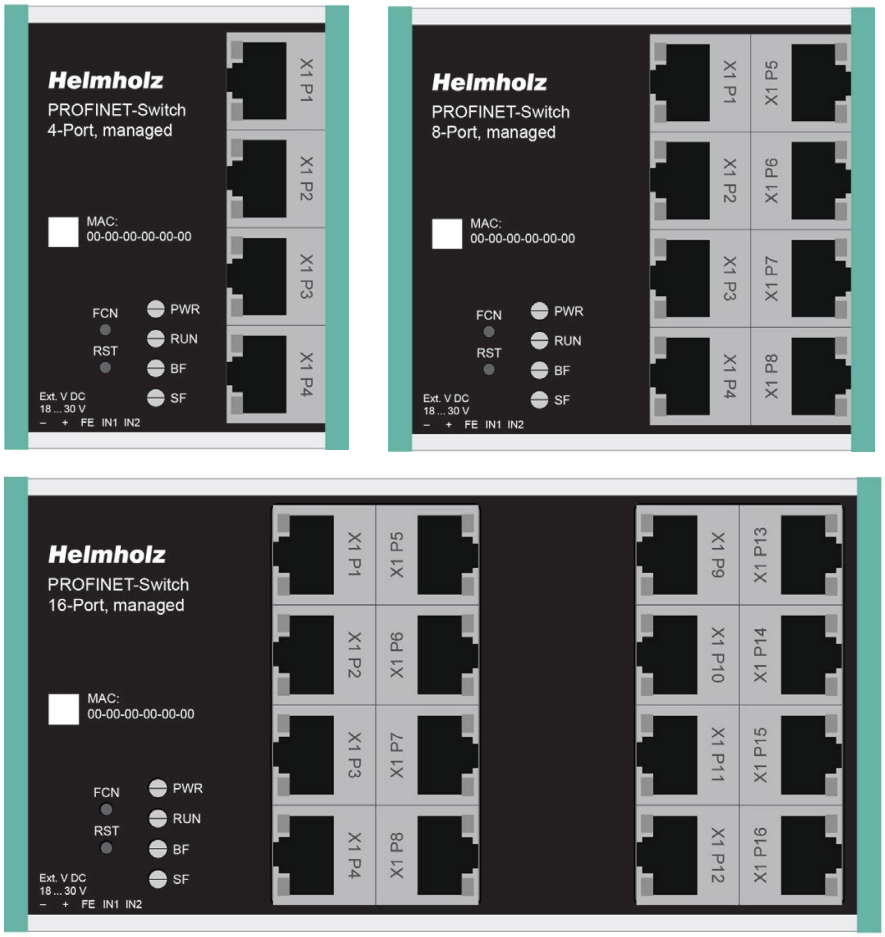
Technical advantages when using a PROFINET switch

- Prioritizing of PROFINET frames
- Allocation of a network configuration based on the device name (SIMATIC Manager: “Assign IP address through IO controller”)
- Definition of transfer procedure and speed of a port (SIMATIC Manager: “Transfer medium / duplex”)
- Neighborhood detection
- Device exchange without programming device
- MRP ring redundancy
- Each port can be activated or deactivated
- Diagnostic messages for network problems
- Identification and maintenance data

A GSDML file is required for configuration as a PROFINET device.

3.1 Setup

Depending upon the model, the PROFINET switch is equipped with 4/8 or 16 Ethernet ports (RJ45). The switch has two recessed function buttons (“RST” and “FCN”) as operating elements. The status display on the device takes place via four LEDs (PWR, RUN, BF, SF), as well as through the LEDs at the Ethernet ports.



3.2 Buttons

The PROFINET switch has two buttons, “FCN” and “RST”, which are found at the top behind the front plate. For purposes of protection against incorrect operation, the buttons can only be accessed with a small object (paper clip).

3.2.1 “RST” button (Reset)

The “RST” button triggers an immediate restart of the PROFINET switch, in the course of which all saved settings are retained.

3.2.2 “FCN” button (Function)

The PROFINET switch can be reset to factory settings with the “FCN” button: If the “FCN” button is pressed during the run-up phase of the switch, the orange “SF” LED begins to flash. The blinking indicates that the switch will be immediately reset to factory settings and restarted as soon as the switch is released. The run-up phase is indicated by the blinking of the “RUN” LED.

3.3 Status-LEDs

PWR	Off	No power supply or device defective
	On	Device is correctly supplied with voltage
RUN	On	Device is ready to operate
	Flashing	Device is starting up
	Flashing synchronous with BF and SF LED	PROFINET function device identification
BF	On	Bus error, no configuration
	Flashing synchronous with RUN and SF LED	PROFINET function device identification
SF	On	System error, network status in error
	Flashing synchronous with RUN and BF LED	PROFINET function device identification
RJ45 LEDs	Green (Link)	Connected
	Orange (Act)	Data transfer at the port

The **PWR (Power) LED** is on as soon as the PN switch is connected to a power supply.

The **RUN LED** is on as soon as the PN switch is ready to operate. The LED flashes before the PN switch is ready to operate. Directly after the device is switched on or reset, the LED is switched on for a short time for the function test.

The **BF (Bus Failure) LED** is on as long as there is no PROFINET connection. The LED is off when a PROFINET connection exists. Directly after the device is switched on or reset, the LED is switched on for a short time for the function test.

The **SF (System Failure) LED** is on when there is a PROFINET alarm at the PN switch. The LED is off when there is no PROFINET alarm. Directly after the device is switched on or reset, the LED is switched on for a short time for the function test.

The LEDs RUN, BF, and SF all flash synchronously when the user activates the PROFINET function “Flash LED” for device identification.

3.3.1 LEDs at the Ethernet ports

The green LED shows the existence of an Ethernet connection. There is a connection when it is on. There is no connection when it is off.

The orange LED shows the data traffic. It is on when no data packages run via the port. It is flashing when data packages run via the port.

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 housings.

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

Helmholz GmbH & Co. KG,
Seat of the company: 91091 Großenseebach,
Address: Hannberger Weg 2,
Name of the authorized representative: Carsten Bokholt,

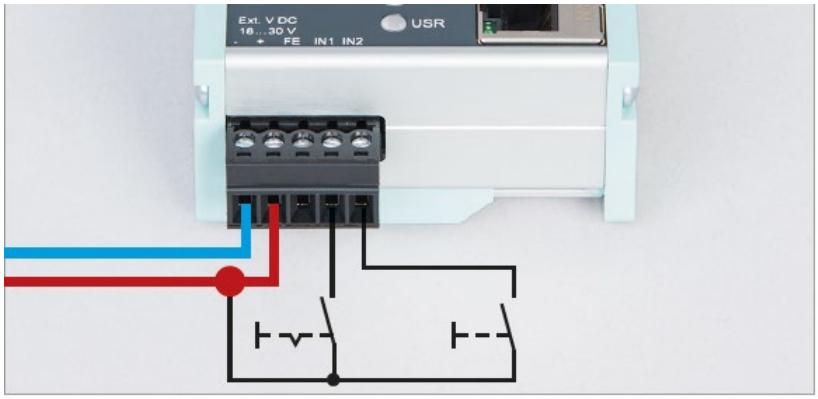
Registration number: DE 44315750.

The electrical devices described in this document are to be recycled. Pursuant to Directive 2012/19/EU on Waste of Electrical and Electronic Equipment (WEEE), they may not be disposed of by way of municipal disposal companies.

5 Preparing the PROFINET switch

5.1 Connection

The PROFINET switch must be supplied with 24 V DC at the wide range input 18 – 30 V DC via the provided connector plug. The RJ45 sockets “P1 – P4” (4-port switch), “P1 – P8” (8-port switch) and “P1 – P16” (16-port switch) serve the connection of the network participants (PROFINET or Ethernet).



The inputs IN1 and IN2 do not yet have a function in the current firmware version but will be available in a later firmware version for additional functionality.

NOTE

The housing of the PROFINET switch is not grounded. Please connect the functional grounding connection (FG named FE on front) of the PROFINET switch correctly with the reference potential.

5.2 Install GSDML file

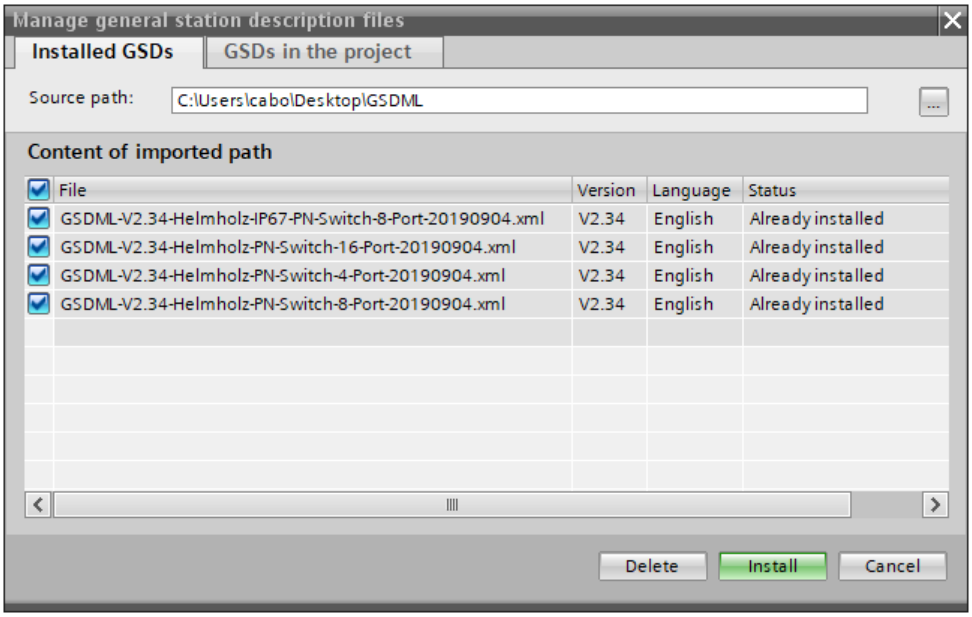
Please download the GSDML file under www.helmholz.de or scan the following QR code:

PROFINET switch 4-port

PROFINET switch 8-port

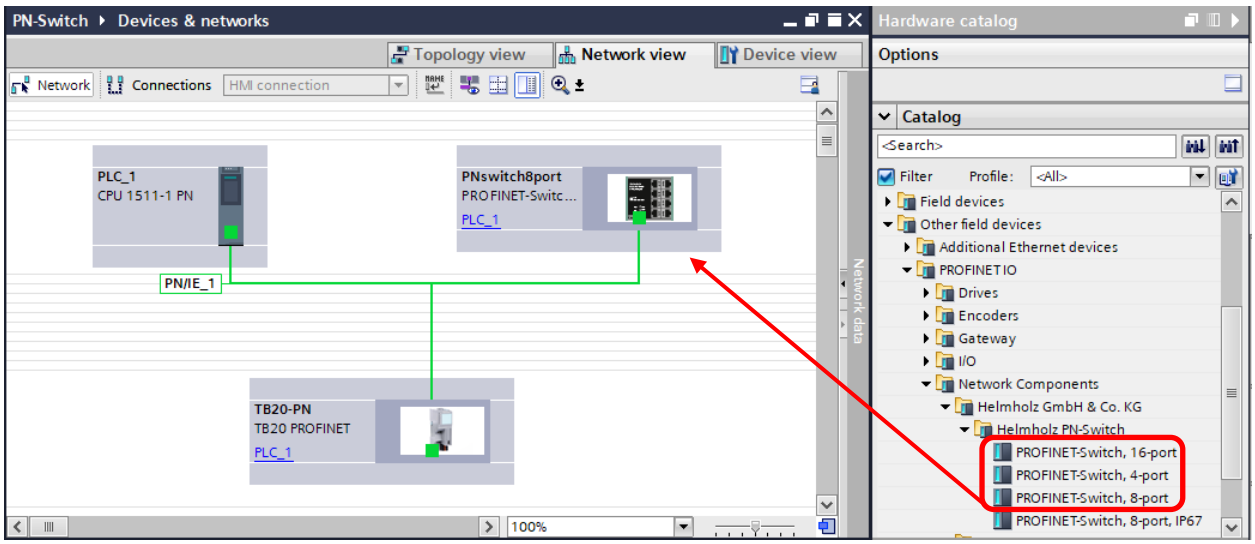
PROFINET switch 16-port

You can find in the “Manage general station description files” dialog in TIA Portal in the menu “Options”.



5.3 Setup in the hardware-configuration

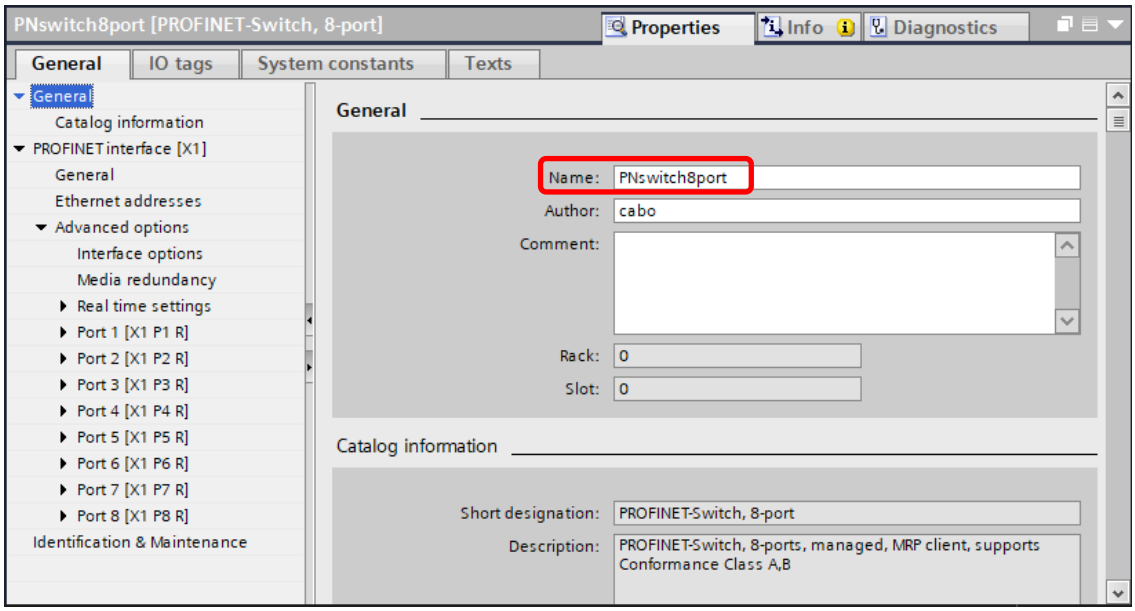
Following installation, the PROFINET switch can be found in the hardware catalog under “Other field devices -> PROFINET IO -> Network Components -> Helmholz GmbH & Co. KG -> Helmholz PN-Switch”. Add the “PROFINET-Switch, 4-port”, “PROFINET-Switch 8-port” or “PROFINET-Switch, 16-port” device to the project and connect it with your PROFINET network.



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

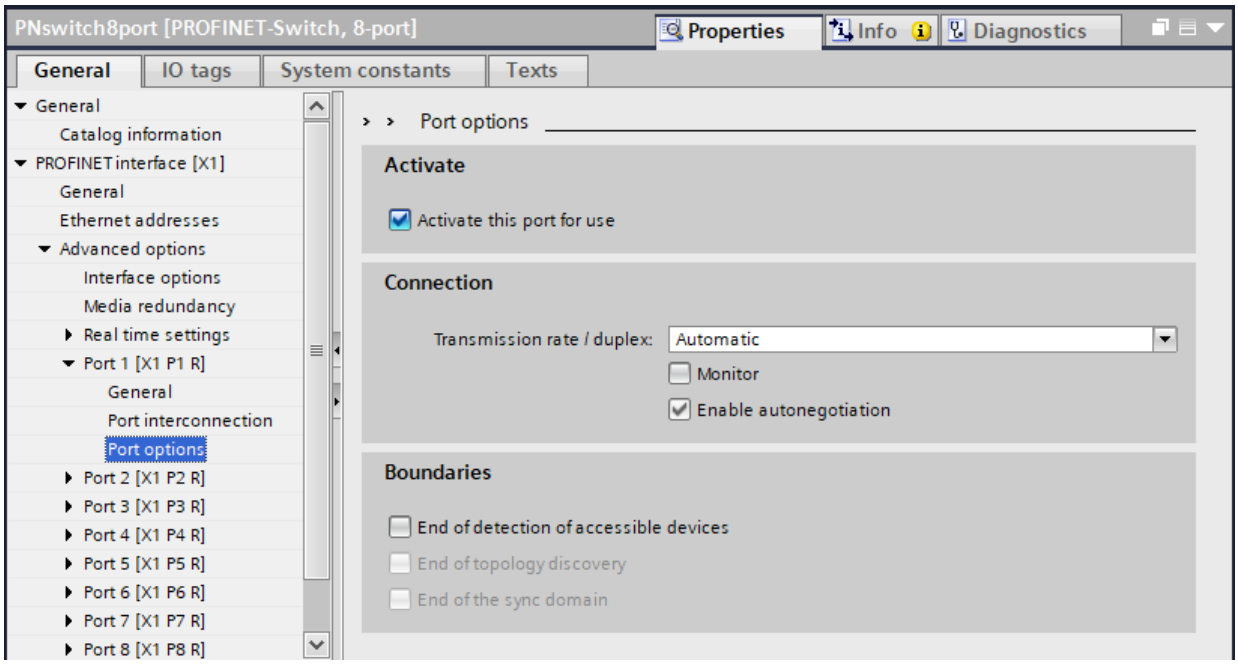
NOTE

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



5.4 Setting the port properties

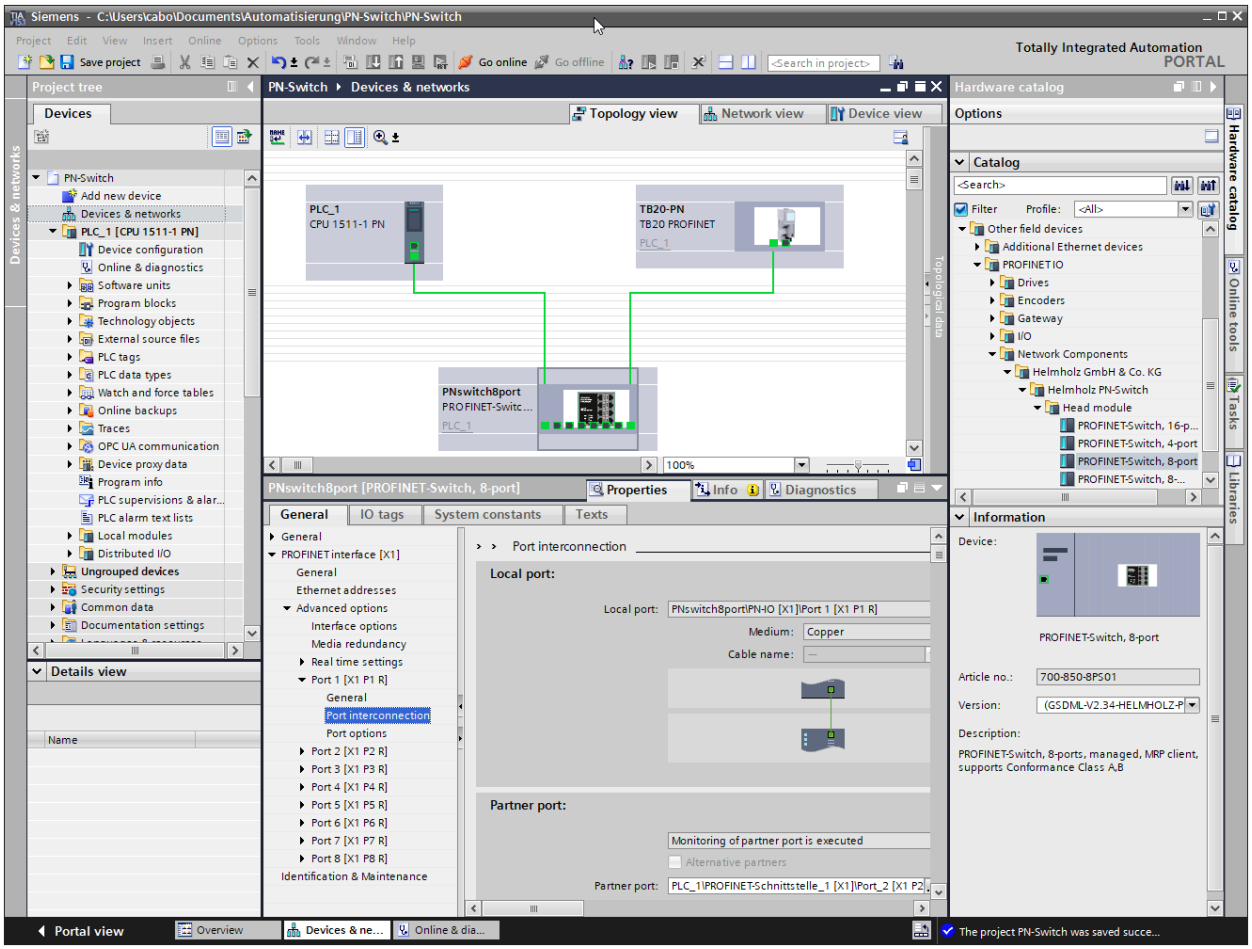
Each port of the PROFINET switch can be individually configured.



“Activate this port”	The port can be switched off here. This option is recommended when the port shouldn’t 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.

5.5 Topology detection

The PROFINET switch supports the mechanisms for neighborhood detection (LLDP). With this function, it is possible to detect the topology of a PROFINET network, or to specify it for purposes of checking for the correct structuring by the configuration.



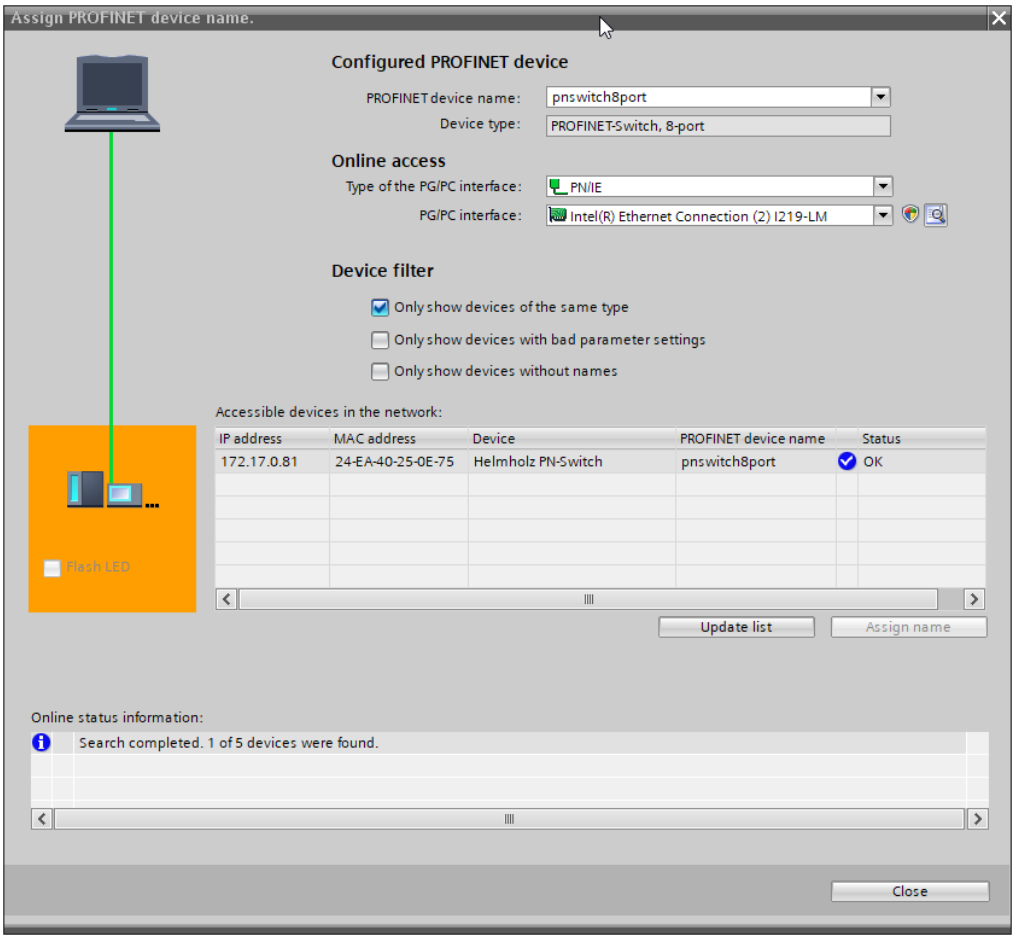
If the topology was prescribed in the configuration, neighboring devices can also be assigned the PROFINET name in the event of the replacement of a device. This makes the recognition and testing of the network topology and the “device exchange in operation” of connected PROFINET participants possible.

5.6 Assign the PROFINET switch a name

When the configuration of the 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 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 front of the 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.

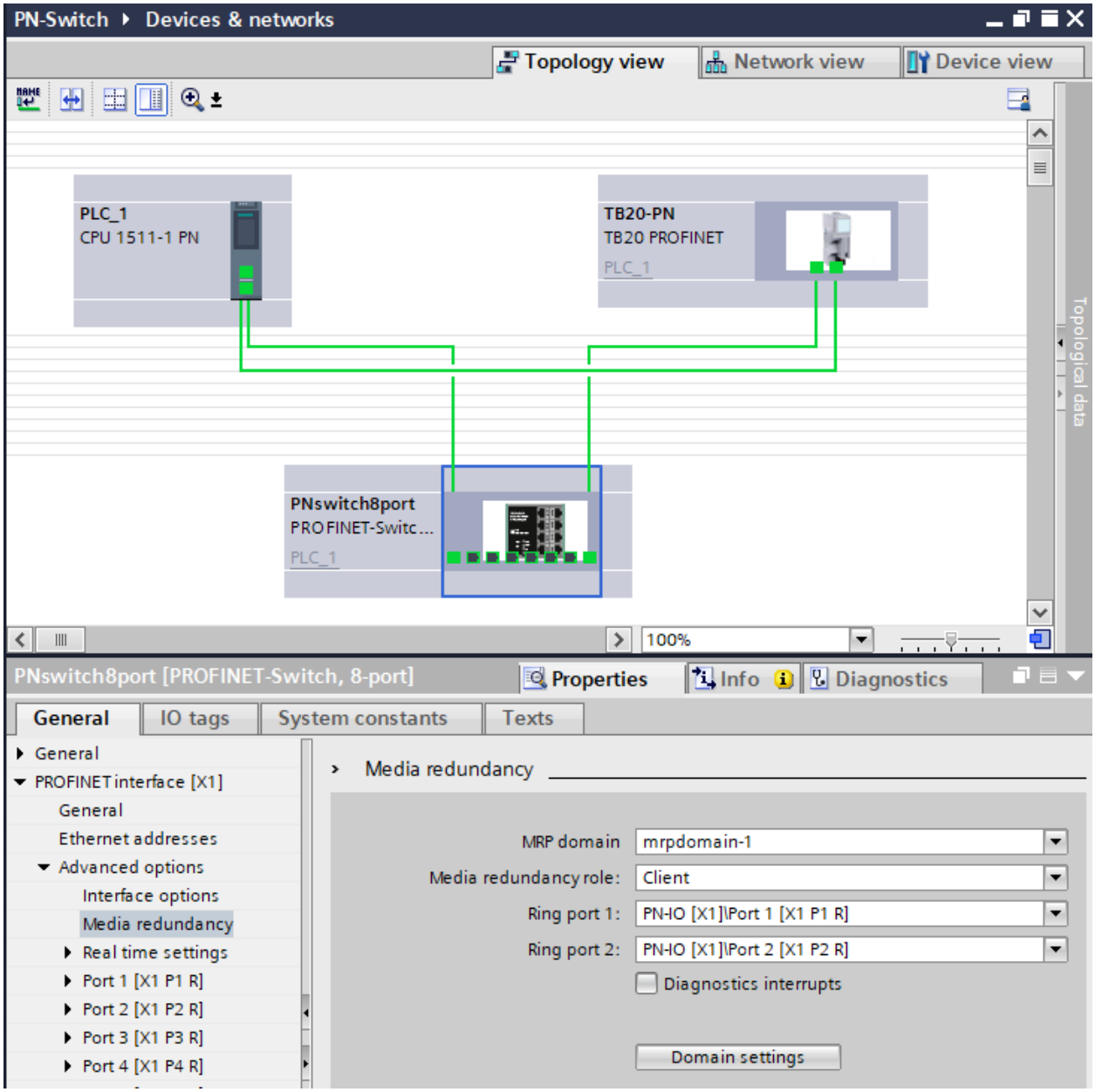
The Helmholz IPSet tool, which can be downloaded at no charge from the Helmholz website, can also be used to set the PROFINET name. Scan the following QR code to download the IPSet tool:

5.7 Media redundancy protocol (MRP)

The PROFINET switch supports the optional media redundancy protocol (MRP) as client. MRP enables ring wiring, which also makes operation of the PROFINET network possible in the event of the failure of a cable or of a participant.

There must be one MRP manager (e.g. the CPU) in an MRP ring. All other participants of the ring are then MRP clients.

To assign the PROFINET switch to an MRP ring, in ”Media redundancy” section ”Media redundancy role” must be set to “Client” and correct ring ports selected as “Ring port 1” and “Ring port 2”.



NOTE

If device is connected in ring topology, without setting the MRP role, this will result in disruption of the PROFINET network!

6 Configuration and diagnosis via the web interface

6.1 Web interface

The configuration can be queried and changed via the web interface. The web interface is operable as soon as the device has a network configuration. The IP address of the device must also be entered as a URL.

Depending on the browser used, a message such as "This is not a secure connection" may appear.

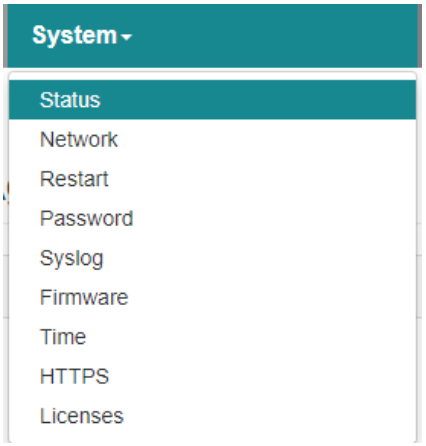
The connection to the website of the Profinet switch is SSL-encrypted, but the certificate of the web interface is a self-generated one, so the bowser cannot check the trustworthiness. The PROFINET switch can later be assigned its own HTTPS certificate (see Chap. 6.2.8).

Allow access to the website in your browser.

A login dialog appears: The Username is “admin” and the password is the serial number of the PROFINET switch, which can be read from the side of the housing of the device. The standard password has to be changed when logging in for the first time.

6.2 System Menu

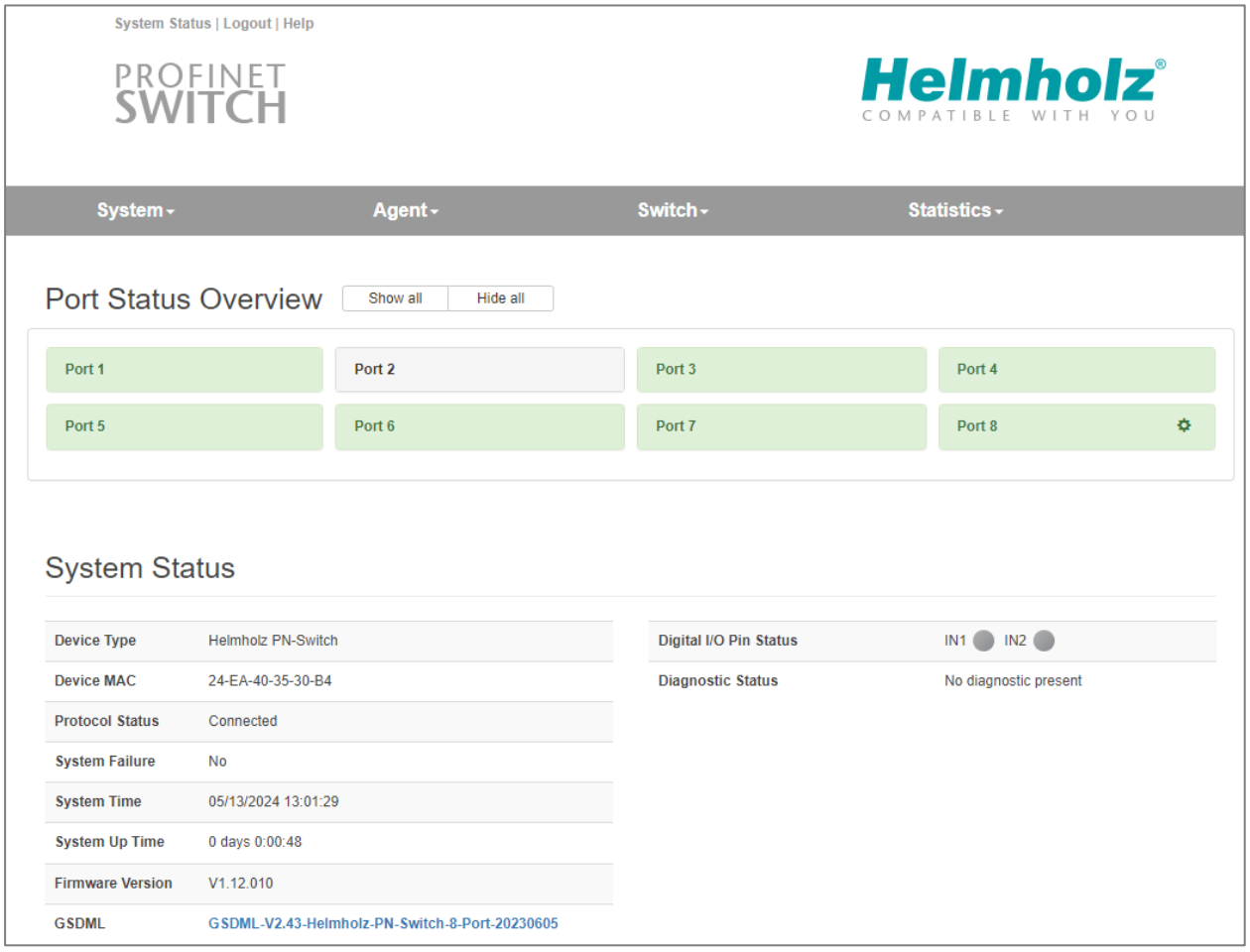
The "System" menu contains basic functions for operating the PROFINET switch.



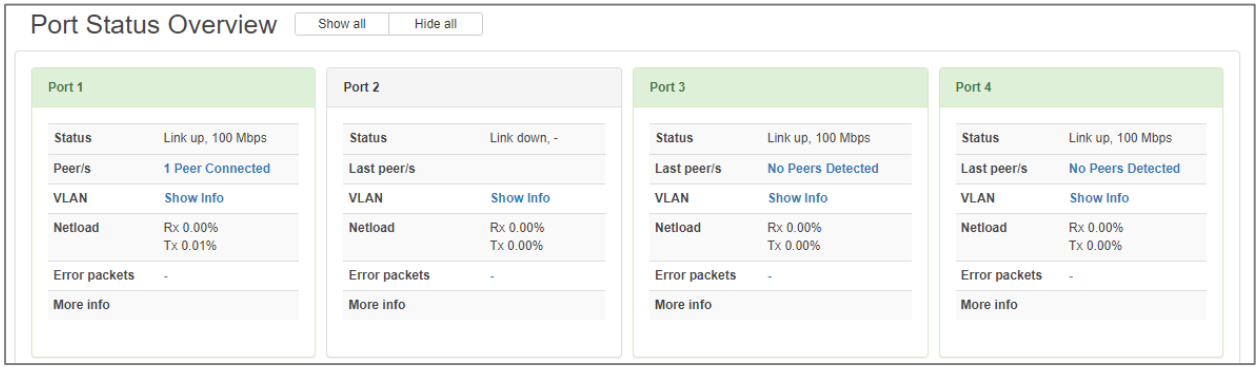
6.2.1 Status

The "System / Status" web page is the start page of the PROFINET switch. It displays the basic system status and information about the switch. This includes the status of all ports, the device type, the MAC address, the firmware version, the system time and the status of the IOs.

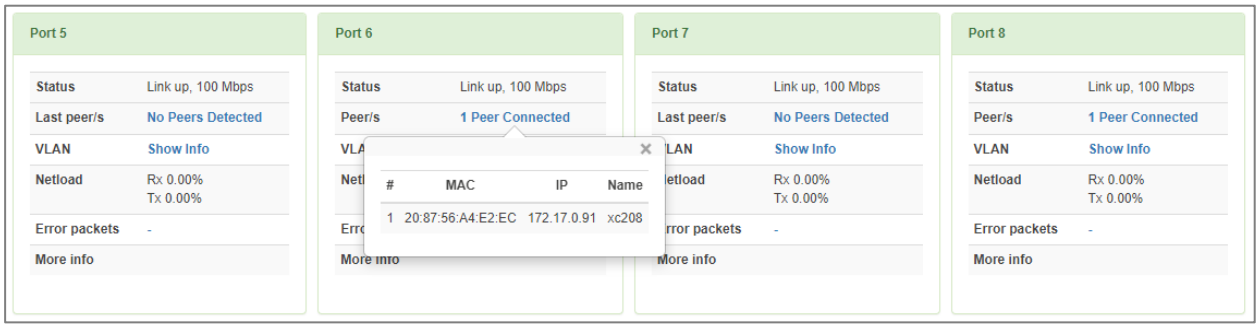
The GSDML file can also be downloaded from the website.



The ports in the port status display can be opened by clicking on them to obtain further information on the port.



By clicking on "Peer Connected" or "VLAN: Show Info", further information on the port can be called up.



6.2.2 Network settings

The network configuration consists of the IP address, subnet mask, standard gateway and the PROFINET device name. The IP address and subnet mask together define the address of the network interface. The standard gateway is required for the transition to other networks.

The PROFINET switch can be run in two operating modes.

1. Configured via PROFINET
2. managed switch without PROFINET

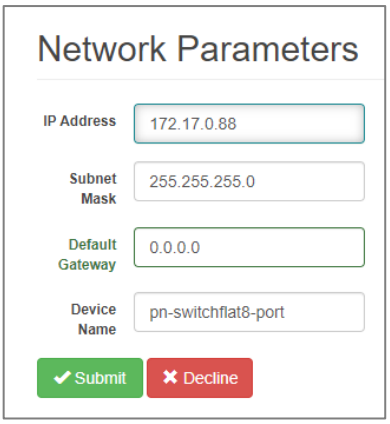
In opearting mode PROFINET configuration, the switch must be assigned a PROFINET name. It then receives its IP address, subnet mask and default gateway from the configuration stored in the PROFINET controller when the PLC starts up.

The PROFINET device name can be set via the PROFINET configuration tool or via the Helmholz IPSet tool (see Chap. 5.6).

HINWEIS

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

In the "Managed Switch" operating mode, the IP address can be set using the "IPSet" tool to access the website for further configuration.



6.2.3 Restart and Factory reset

The device can be restarted or reset to factory settings via the web server or using RST and FCN buttons.

The two functions are available in the web interface under “Restart” (System section).

The restart of the device can also be initiated at any time by pressing the “RST” button on the front of the device.

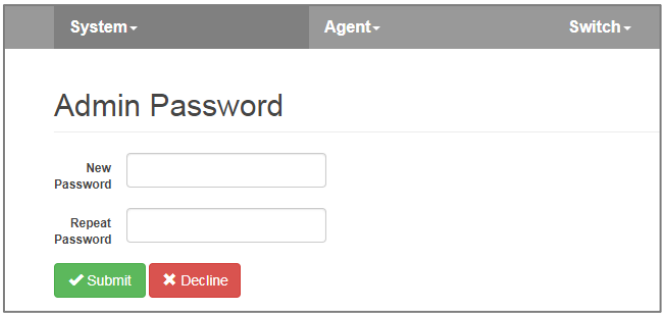
To reset the device to factory settings with the “FCN” button, the following steps are necessary:

3. Switch on or restart the device while pressing and holding the “FCN” button.
4. Wait until the “SF” LED flashes
5. Release “FCN” button

6.2.4 Password

Administrator access to the web interface is protected by a password. The password must be changed after commissioning. The factory-set password cannot be assigned again. Passwords can be between 4 and 20 ASCII characters long.

The password can be changed under "Password" ("System" menu).

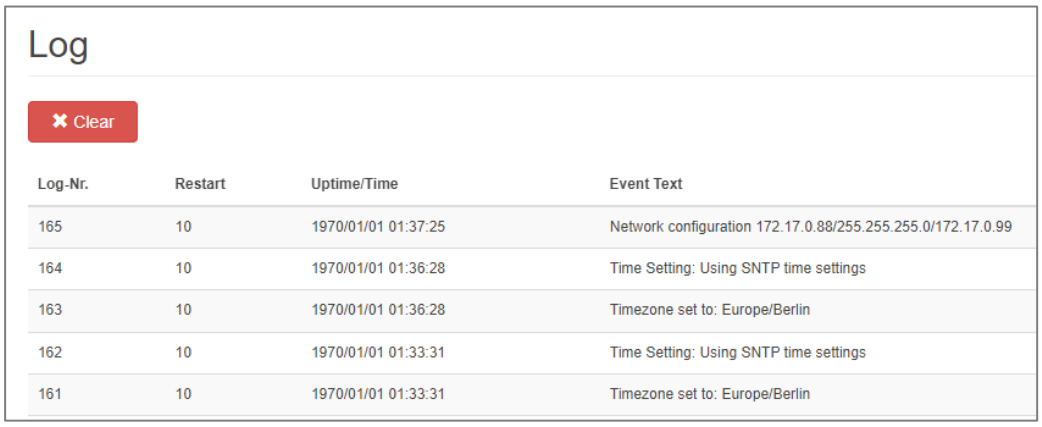


6.2.5 Event Loggin (“SysLog”)

System events are saved in the device and can also be called up following the restart of the device. System events consist of:

- Log number
- Enumeration of restarts
- Point in time (relative to the restart of the system or real time)
- Text with description of the system event.

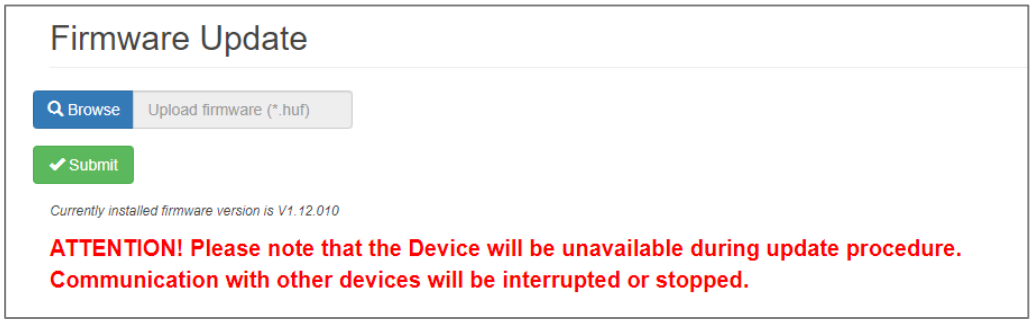
System events can be shown and deleted under “Syslog” (menu “System”).



6.2.6 Firmware Upgrade

Device firmware can be updated. New firmware versions are delivered in files with the ending “.huf” and are available via the Helmholz homepage www.helmholz.de.

After downloading the firmware to local PC, firmware file can be selected under “Firmware” (System section) and loaded into the device. Device restarts once the FW is updated.



ATTENTION

An interruption of the power supply during the update process can make the device unusable, which can only be corrected by sending it in for repair.

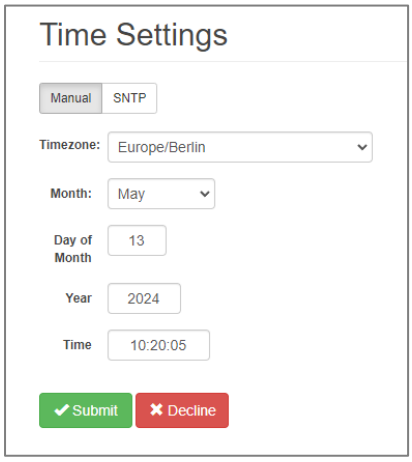
6.2.7 Time settings

The time of the PROFINET switch can be set in the "Time" menu. It is used to display system events. The time can be entered manually or can be synchronized via SNTP.

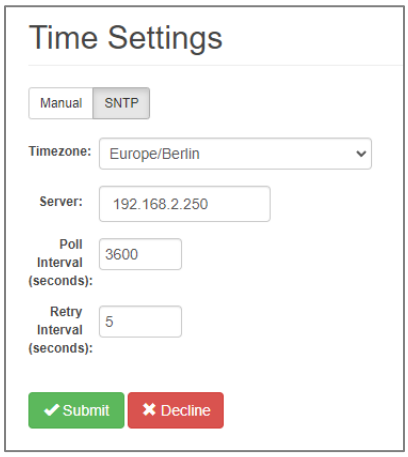
The PROFINET switch does not have a battery-backed clock; if the time is set manually, it is reset by a restart. It is recommended to synchronize the time via the SNTP service.

The configuration of the time of day can be shown and changed under “Time” (System section). Depending upon the selected synchronization mode, the website is presented differently.

If manual synchronization has been selected, a dialog appears with which the current system time can be displayed and changed.



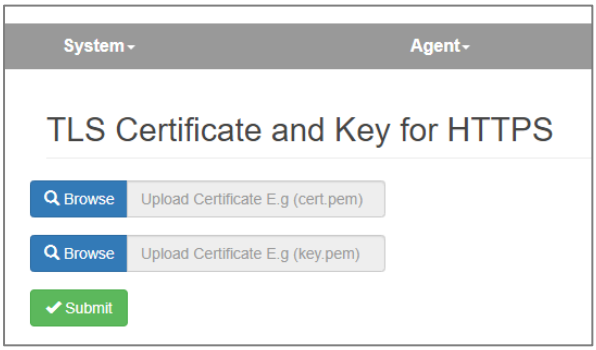
If "SNTP" was selected as synchronization, a dialog appears to configure the SNTP server.



6.2.8 Certificates for website

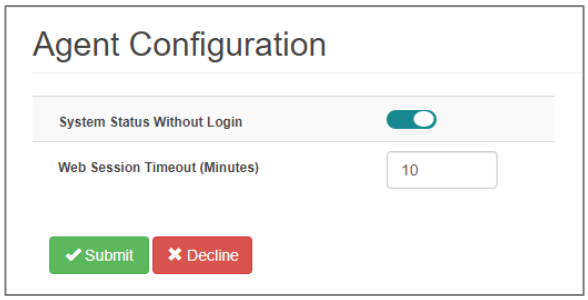
To further secure the SSL-encrypted access to the website, it is possible to store a certificate for the device. The HTTPS access is then not only encrypted, but also with a secure authentication of the website.

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



6.3 Menu “Agent”

6.3.1 Web



The form for displaying and changing the settings for Ethernet-based administration is found under “Agent / Web”.

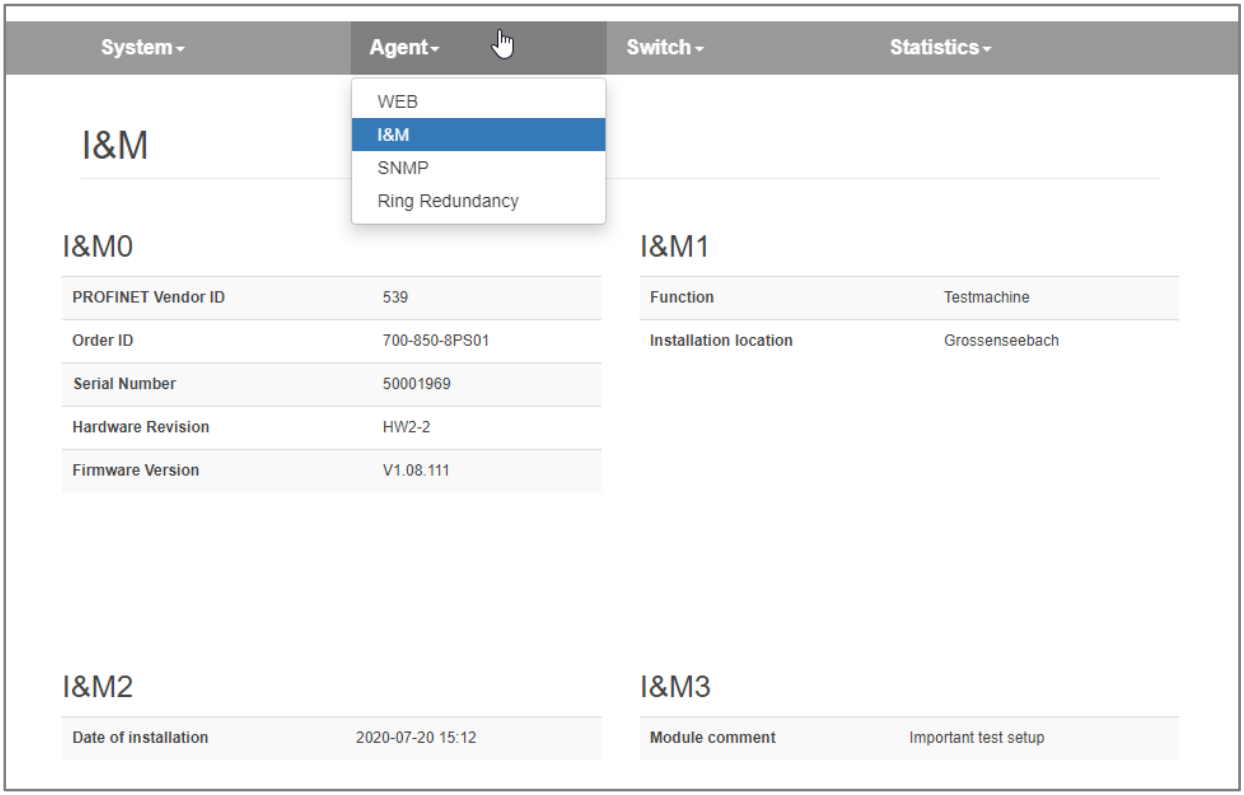
System Status Without Login – if enabled system status will be shown on login page, thus enabling checking device status without logging in.

Web Session Timeout (Minutes) – Defines waiting period for automatic logging off the user due to inactivity. Valid input is 0 – 60, where 0 means no timeout.

6.3.2 Identification & Maintenance

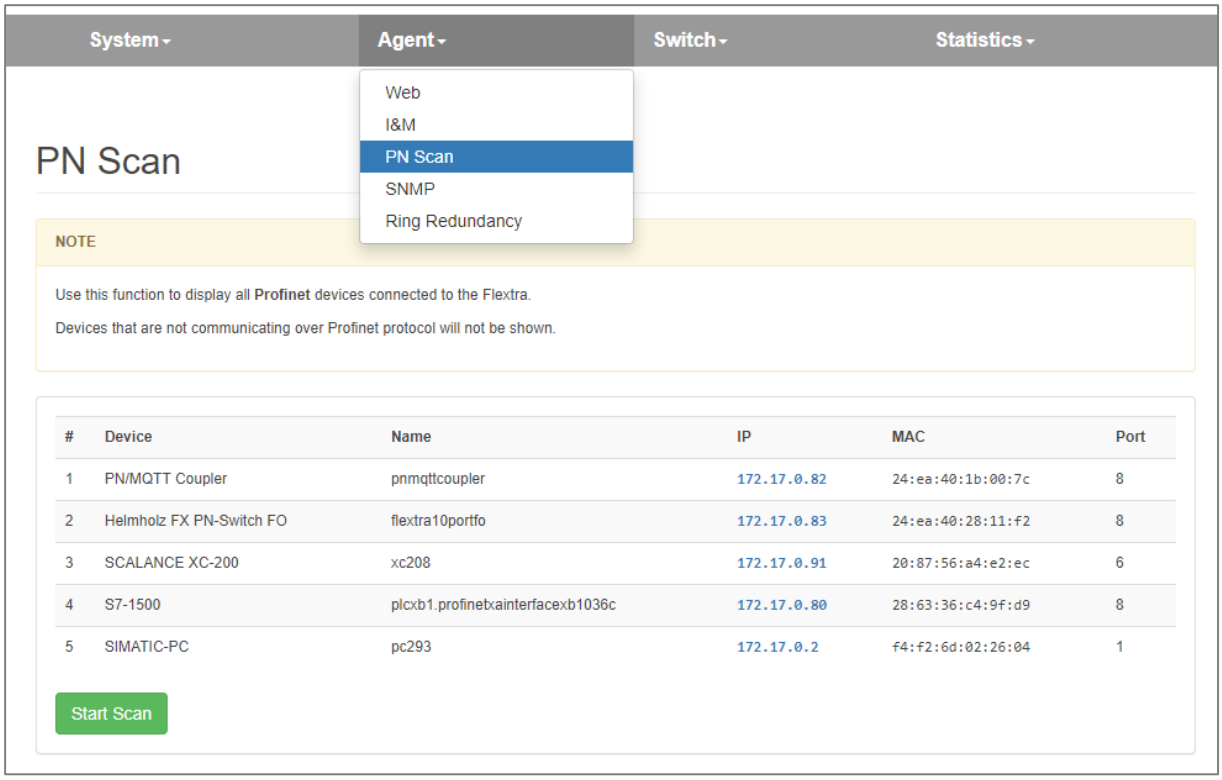
The entries for identification and maintenance (I&M0) encompass the PROFINET Vendor ID, the order ID, the serial number, as well as entries for the hardware and firmware version. The user settable data in IM1 to IM3 are also visible in this screen.

The entries are shown under “Agent / I&M”.



6.3.3 PROFINET Network Scan („PN Scan“)

The "PN scan" function in the "Agent" menu can be used to scan the network for PROFINET devices. All devices found are displayed with their type, name, current IP address and MAC address. The port of the PROFINET switch on which the device was found is also displayed.

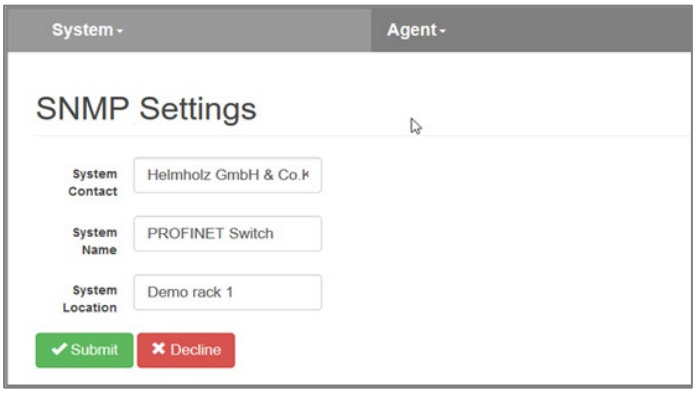


6.3.4 SNMP

SNMP (Simple Network Management Protocol) is an IP-based protocol for the monitoring and control of network components.

The following SNMP attributes can be displayed and changed:

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



The attributes can be displayed and changed under “Agent / SNMP”.

The PROFINET switches in the "FLAT" series support SNMP V2.

6.3.5 Ring Redundancy Mode

The PROFINET switch can be used in a ring topology as a MRP client. Changes to the topology settings are only possible in the hardware configuration in the PROFINET Engineering station.

The actual settings for topology can be shown under “Agent / Ring Redundancy”.

6.4 Menu Switch

6.4.1 Port status

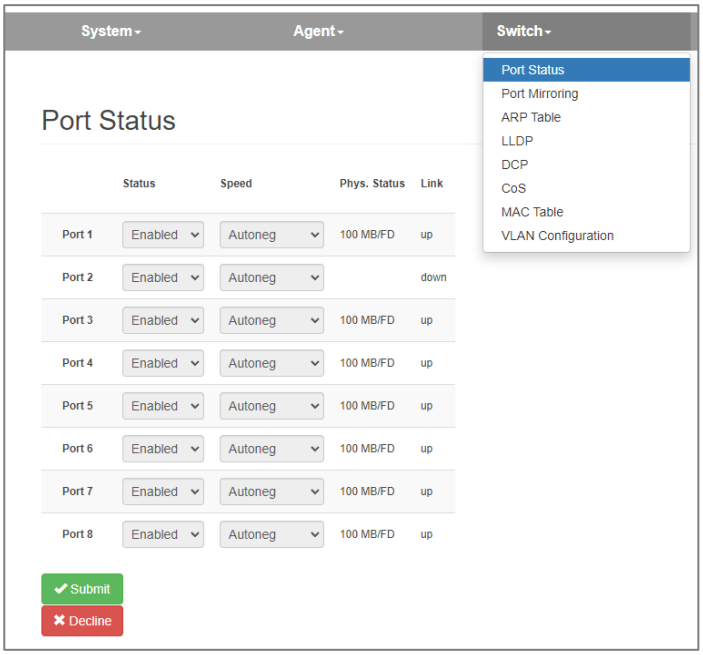
The current status and the settings of the Ethernet ports can be queried and changed.

The form for the display of the port status and for changing the port settings is found under “Switch / Port Status”.

A port can be switched on or off, meaning be deactivated.

A port can work with auto-negotiation (“auto”) or with 100 MBit/full duplex (“100MB/FD”).

With “auto”, the establishing of the Ethernet connection is preceded by a process in which MDI-X is activated and the partners jointly agree upon a speed/duplex.



With “100MB/FD”, both partners have set 100 MBit/full duplex as fixed and MDI-X is deactivated. To use this setting crossover cable is necessary.

NOTE

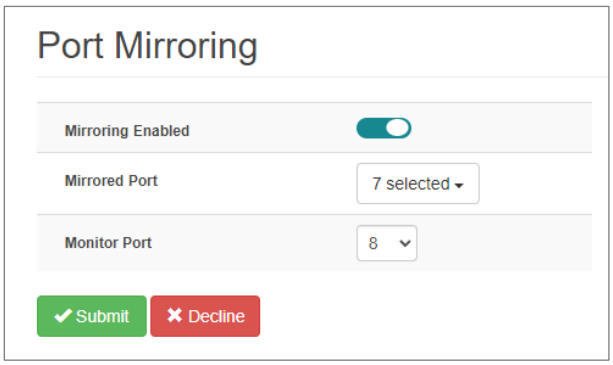
Changes to the port settings are only possible if no PROFINET IO configuration is active.

6.4.2 Port mirroring

The Ethernet ports of the PROFINET switch can be set up so that they mirror the incoming and outgoing data traffic from other ports. The mirrored ports can still be used for their own data traffic without any restrictions.

The dialog for displaying and changing the port mirroring is located under "Switch / Port Mirroring".

Under "Mirrored Port", any 1 to 7 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.

6.4.3 ARP table

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

The ARP table query is found at “ARP Table” (Switch section).

6.4.4 LLDP

PROFINET devices transmit LLDP (Link Layer Discovery Protocol) frames at periodic intervals to the devices with which they are connected via Ethernet. In this way, PROFINET devices receive information concerning with whom precisely they are connected. This information is kept available and forms the basis for determining the network topology.

When the connected device is not a PROFINET device, the transmission of the LLDP frames and the maintaining of the corresponding information can lead to problems. This function can therefore be deactivated 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-IO-40-20-xx-xx

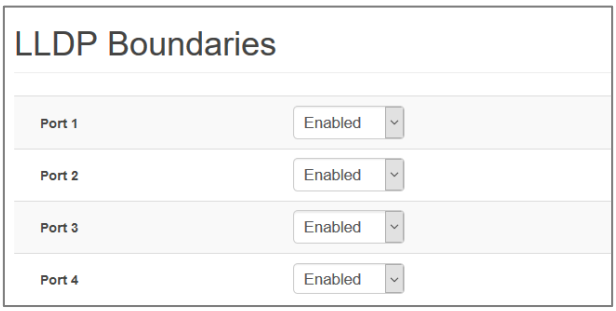
Port 1: 24-IO-40-21-xx-xx

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

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

Port 4: 24-IO-40-24-xx-xx

...



The dialog for changing the LLDP settings is found under “Switch / LLDP”.

NOTE

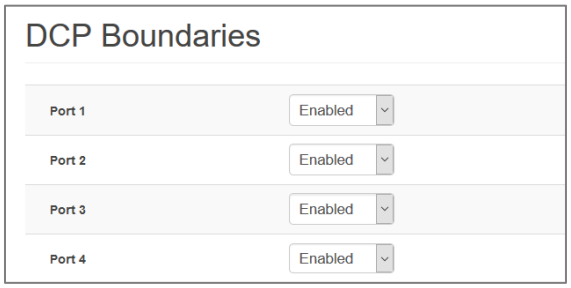
Changes to the LLDP settings are only possible on the website if no PROFINET configuration is active in the switch. This function can also be set via the port configuration in the PROFINET engineering tool.

6.4.5 DCP

PROFINET devices can be recognized in a network with the DCP protocol and provided with basic parameters such as IP address and device name. To this purpose, DCP frames are forwarded to all ports.

When forwarding to a particular port is not wanted, this can be deactivated. The receipt of DCP frames at this port is unaffected by this.

The form for querying and changing the DCP settings is found under “Switch / DCP”.



NOTE

Changes to the DCP settings are only possible on the website if no PROFINET configuration is active in the switch. This function can also be set via the port configuration in the PROFINET engineering tool.

6.4.6 Class of Service / Prioritized forwarding of time-sensitive data

Time-sensitive PROFINET data is sent as Ethernet frames with IEEE 802.1q headers. IEEE 801.2p data containing a priority entry (PCP) is found in this header.

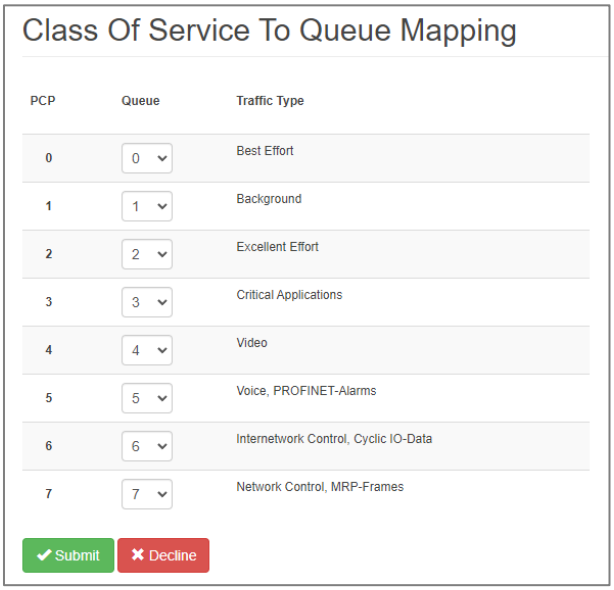
For PROFINET, the following PCP values are used:

Frame	PCP value (0 ... 7)
PROFINET alarms	5
Cyclical IO data	6
MRP frames	7

The PROFINET switch can use this priority entry for prioritized forwarding. This is of particular importance when, among other aspects, larger volumes of data pass through the switch, which are less time sensitive. The configuration enables assignment of the priority entries to four queues. The queues have the numbers 0 to 3, with 0 as the lowest and 3 as the highest priority. Ethernet frames without IEEE 802.1q headers are assigned to queue 0.

The factory presetting ensures the prioritized forwarding of time sensitive PROFINET data.

The form for querying and changing the queue assignment is found under “CoS” (Switch section).



NOTE

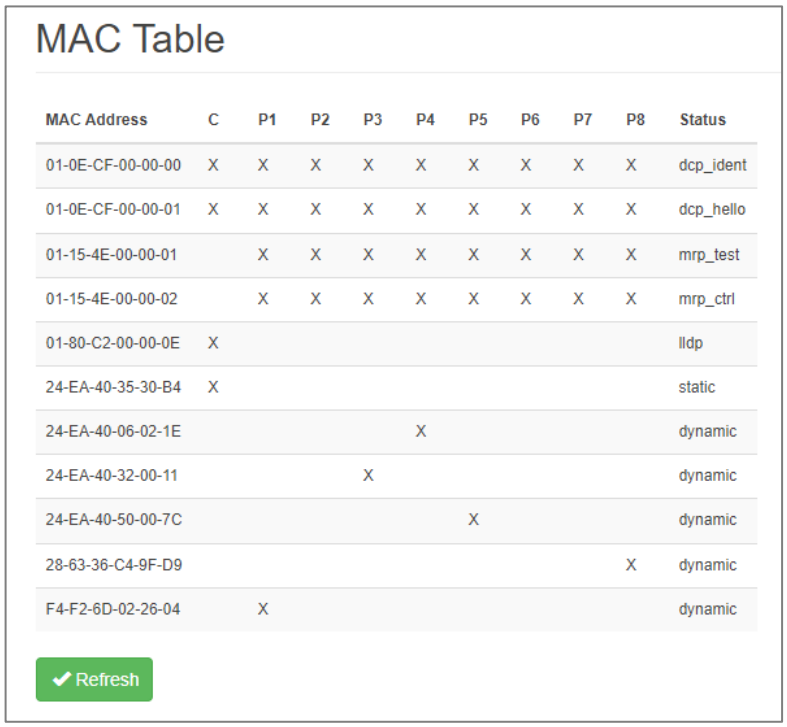
The factory default setting ensures preferential forwarding of time-critical PROFINET data ("Cyclic IO data") and PROFINET alarms.

6.4.7 Forwarding rules (“MAC Table”)

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

In addition to the four external ports, forwarding to the internal interface of the PROFINET switch (“C”) is also represented.

The form for querying the forwarding rules is found under “MAC Table” (Menu “Switch”).



6.4.8 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, all packets in that VLAN - without a VLAN tag - are forwarded to that port.

NOTE

The PROFINET switch 4-port does not support VLAN. If you require VLAN, use a PROFINET switch with 8 or more ports!

NOTE

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

Management-VLAN

In the PROFINET switch, VLAN 1 is the management VLAN. The 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 Switch 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

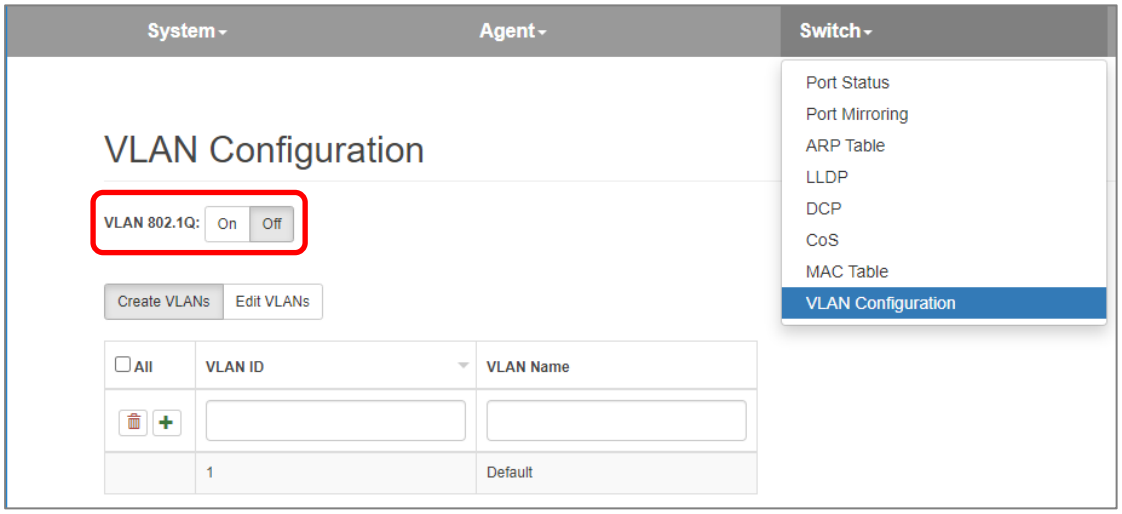
1. It is highly recommended to create VLANs and edit the VLAN membership and port-based settings before enabling the VLAN feature.

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.

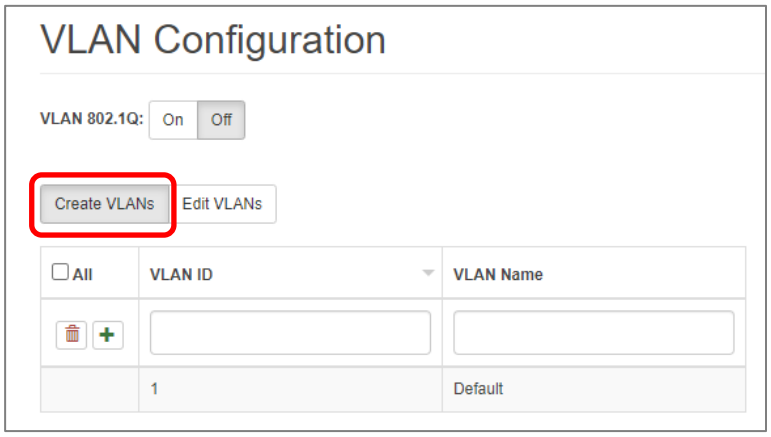
3. It is highly recommended to use only VLAN 1 for the PROFINET network. Only on VLAN 1 the PROFINET functionality of the Switch can be accessed.

The 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.

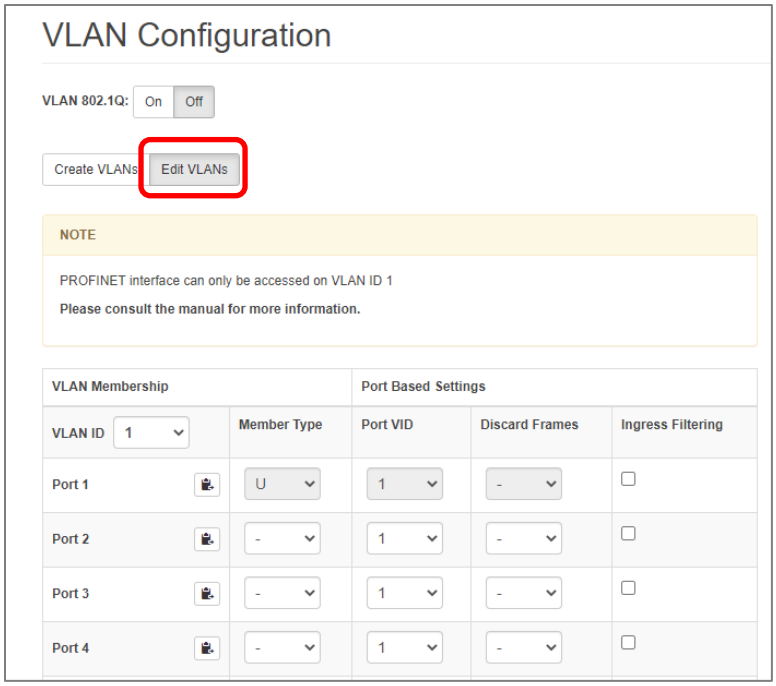


The VLAN ID can be set from 1-4095, the VLAN name is freely selectable.

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.

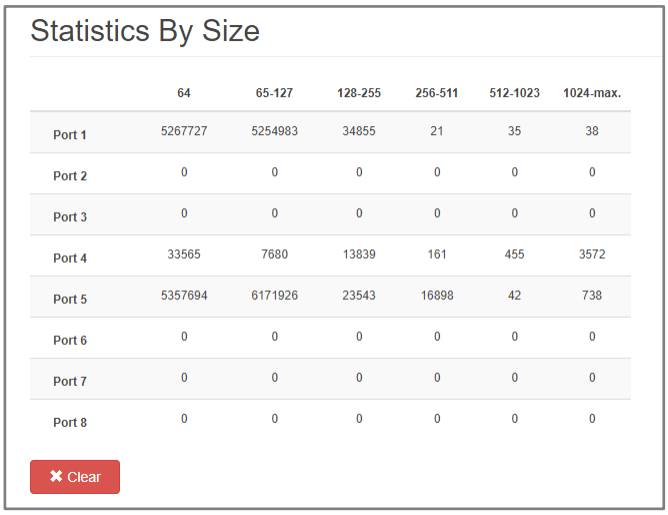
Inactive: All frames are accepted.

6.5 Network statistics

The PROFINET Switch collects statistics for each port. All statistics can be found in Statistics menu. Every statistic data can be cleared.

6.5.1 Statistics By Size

Both RX and TX frames are taken into account. Frames are divided based on their size into 6 divisions: 0-64 Bytes, 65-127 Bytes, 128-255 Bytes, 256-511 Bytes , 512-1023 Bytes und 1024-max.(1500 Bytes).



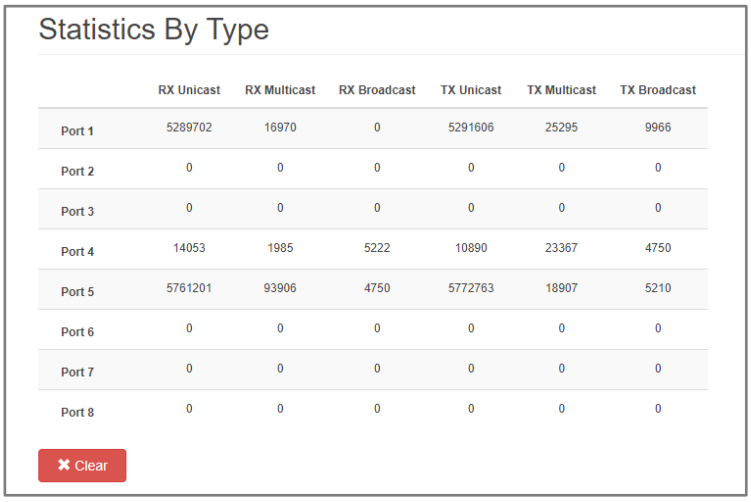
6.5.2 Statistics By Type

In statistics by type frames are first divided to TX (transferred) and RX (received) frames are differentiated, additionally following types are differentiated:

Unicast: Frame addressed to specific device

Multicast: Frame addressed to a group of devices

Broadcast: Frame addressed to all devices in the network.



6.5.3 Statistics By Error

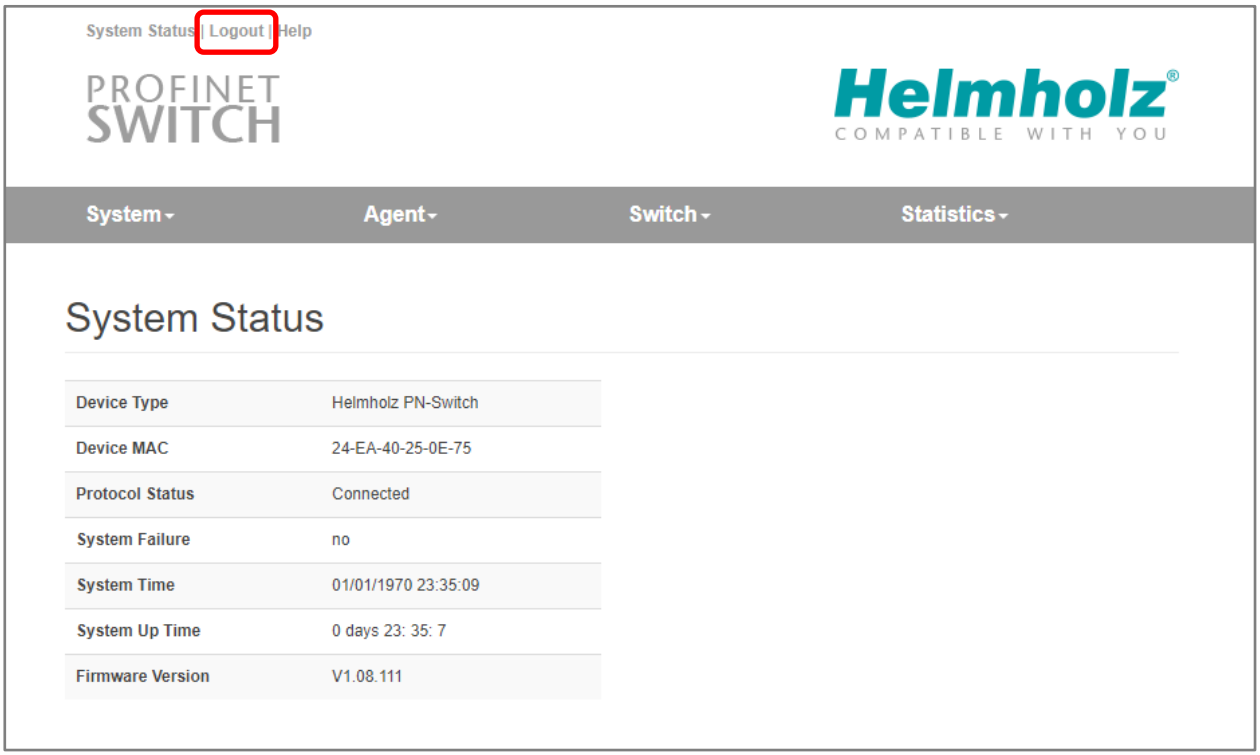
The PROFINET switch collects statistical data about frames that have arrived with transmission errors for each port.

Frames are divided into sections:

- Undersize
- Fragment
- Oversize
- Jabber
- CRC

6.6 Web interface logout

For security reasons it is recommended to logout from web interface before leaving the workplace. For convenience Logout button is always accessible in upper left corner.



If "Web session timeout" (see section 6.3.1) is activated, a logout is automatically executed after the set time.

7 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 that jitter in the transmission remains minor. That secures the PROFINET transmission and allows precise regulating in PROFINET systems.

A PROFINET switch supports mechanisms for neighborhood detection (LLDP protocol) in order 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 the 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 on the basis of 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 to this purpose support PROFINET in order to enable this function.

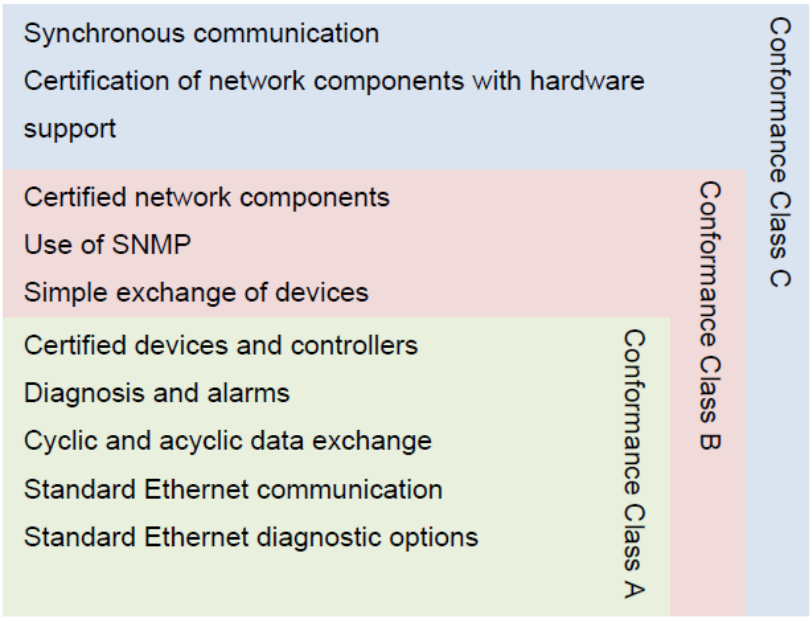
7.5 Why should PROFINET devices have PROFINET certification?

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 Can the PROFINET switch also transmit 1 GBit?

No, because the PROFINET protocol is currently only specified for 100 Mbit.

7.8 Can the PROFINET switch also be operated at 10 Mbit?

Yes, the PROFINET switch also communicates with 10 Mbit participants. However, 100 Mbit are the prerequisite for performant and real time-compatible applications.

7.9 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.

7.10 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

7.11 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.

7.12 What are I&M data?

For PROFINET and PROFIBUS, I&M stands for “Identification and Maintenance”. The I&M data contain 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 in order 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.

7.13 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.

7.14 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, the communication with all participants connected to this switch is no longer possible.

This behavior is clearly different from that of PROFIBUS networks!

7.15 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.

7.16 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 PROFINET Switch 4-port

Order no.	**700-850-4PS01**
Name	PROFINET Switch 4-port, managed
Scope of delivery	PROFINET Switch 4-port, with power supply plug
Dimensions (D x W x H)	32.5 x 58.5 x 76.5 mm
Weight	Approx. 135 g
PROFINET interface	
Number	4
Protocol	PROFINET IO device as defined in IEC 61158-6-10
Transmission rate	100 Mbps, full duplex
Connection	4 x RJ45, integrated switch
Features	PROFINET Conformance Class B, Media Redundancy (MRP-Client), automatic addressing (DCP), topology detection (LLDP), diagnostic alarms, Port-Mirroring, PROFINET-Scan
Status indicator	4 LEDs function status, 8 LEDs Ethernet status
Voltage supply	24 V DC; 18 ... 30 V DC
Current draw	Max. 250 mA at 24 V DC
Power dissipation	Max. 2.4 W
Ambient conditions	
Ambient temperature	-40 °C ... +75°C
Transport and storage temperature	-40 °C ... +85°C
Relative air humidity	95 % r H without condensation
Protection rating	IP20
Installation position	Any
Approvals	CE, UL, PROFINET Conformance Class B
UL	
UL	UL 61010-1/UL61010-2-201
Voltage supply	DC 24 V (18 ... 30 V DC, SELV and limited energy circuit)
Pollution degree	2
Altitude	Up to 2000m
Temperature cable rating	87°C

8.2 PROFINET Switch 8-port

Order no.	**700-850-8PS01**
Name	PROFINET Switch, 8-port, managed
Scope of delivery	PROFINET Switch, 8-port, with power supply plug
Dimensions (D x W x H)	32.5 x 83.5 x 76.5 mm
Weight	Approx. 190 g
PROFINET interface	
Number	8
Protocol	PROFINET IO device as defined in IEC 61158-6-10
Transmission rate	100 Mbps, full duplex
Connection	8 x RJ45, integrated switch
Features	PROFINET Conformance Class B, Media Redundancy (MRP-Client), automatic addressing (DCP), Topology detection (LLDP), Diagnostic alarms, Port-Mirroring, PROFINET-Scan, VLAN
Status indicator	4 LEDs function status, 16 LEDs Ethernet status
Voltage supply	24 V DC; 18 ... 30 V DC
Current draw	Max. 110 mA at 24 V DC
Power dissipation	Max. 2.6 W
Ambient conditions	
Ambient temperature	-40 °C ... +75°C
Transport and storage temperature	-40 °C ... +85°C
Relative air humidity	95 % r H without condensation
Protection rating	IP20
Installation position	Any
Approvals	CE, UL, PROFINET Conformance Class B
UL	
UL	UL 61010-1/UL61010-2-201
Voltage supply	DC 24 V (18 ... 30 V DC, SELV and limited energy circuit)
Pollution degree	2
Altitude	Up to 2000m
Temperature cable rating	87°C

8.3 PROFINET Switch 16-port

Order no.	**700-850-16P01**
Name	PROFINET Switch, 16-port, managed
Scope of delivery	PROFINET Switch, 16-port, with power supply plug
Dimensions (D x W x H)	32.5 x 147 x 76.5 mm
Weight	Approx. 320 g
PROFINET interface	
Number	16
Protocol	PROFINET IO as defined in IEC 61158-6-10
Transmission rate	100 Mbps, full duplex
Connection	16 x RJ45, integrated switch
Features	PROFINET Conformance Class B, Media Redundancy (MRP-Client), automatic addressing (DCP), Topology detection (LLDP), Diagnostic alarms, Port-Mirroring, PROFINET-Scan, VLAN
Status indicator	4 LEDs function status, 32 LEDs Ethernet status
Voltage supply	24 V DC; 18 ... 30 V DC
Current draw	Max. 325 mA at 24 V DC
Power dissipation	Max. 7.8 W
Ambient conditions	
Ambient temperature	0°C ... +60°C
Transport and storage temperature	-40°C ... +85°C
Relative air humidity	95 % r H without condensation
Protection rating	IP20
Installation position	Any
Approvals	CE, UL, PROFINET Conformance Class B
UL	
UL	UL 61010-1/UL61010-2-201
Voltage supply	DC 24 V (18 ... 30 V DC, SELV and limited energy circuit)
Pollution degree	2
Altitude	Up to 2000m
Temperature cable rating	87°C

8.4 Dimensioned drawing