



## PROFINET switch 4/8/16-port Manual

Version 1 | 20.02.2020 | as of firmware V 1.08.100



Link to the latest version of  
the manual

## Notes

All rights reserved, including those related to the translation, reprinting, and reproduction of this manual or of parts thereof.

No part of this manual may be reproduced, processed, duplicated, or distributed in any form (photocopy, microfilm, or any other methods), even for training purposes or with the use of electronic systems, without written approval from Helmholtz GmbH & Co. KG.

To download the latest version of this manual, please visit our website at [www.helmholz.de](http://www.helmholz.de). We welcome all ideas and suggestions.

Our products contain open source software, among others. This software is subject to the respectively relevant license conditions. We can send you the corresponding license conditions, including a copy of the complete license text together with the product. They are also provided in our download area of the respective products under [www.helmholz.de](http://www.helmholz.de).

We also offer to send you or any third party the complete corresponding source text of the respective open source software for an at-cost fee of 10.00 Euro as a DVD upon request. This offer is valid for a period of three years, starting from the date of product delivery.

Copyright © 2020 by

**Helmholtz GmbH & Co. KG**

Hannberger Weg 2 | 91091 Großenseebach

*STEP, TIA, and SIMATIC are registered trademarks of Siemens AG.*

*Windows is a registered trademark of Microsoft Corporation.*

## Revision record:

Version	Date	Change
1	14.2.20	First version / Firmware V1.04

# Contents

<b>1</b>	<b>General</b>	<b>6</b>
1.1	Target audience for this manual	6
1.2	Safety instructions	6
1.3	Note symbols and signal words	7
1.4	Intended use	8
1.5	Improper use	8
1.5.1	Liability	9
1.5.2	Disclaimer of liability	9
1.5.3	Warranty	9
<b>2</b>	<b>Security recommendations</b>	<b>10</b>
<b>3</b>	<b>Overview</b>	<b>11</b>
3.1	Setup	12
3.2	Buttons	12
3.2.1	“RST” button (Reset)	12
3.2.2	“FCN” button (Function)	12
3.3	LEDs status information	13
3.3.1	LEDs at the Ethernet ports	13
<b>4</b>	<b>Installation and removal</b>	<b>14</b>
4.1	Access restriction	14
4.2	Electrical installation	14
4.3	Protection against electrostatic discharges	14
4.4	Overcurrent protection	14
4.5	EMC protection	14
4.6	Operation	14
4.7	Recycling / WEEE	15
<b>5</b>	<b>Preparing the PROFINET switch</b>	<b>16</b>
5.1	Connection	16
5.2	Install GSDML file	16
5.3	Configuration in the hardware configuration	17
5.4	Setting the port properties	19
5.5	Topology detection	20
5.6	Assign the PROFINET switch a name	21
5.7	Media redundancy protocol (MRP)	22

<b>6</b>	<b>Configuration and diagnosis via the web interface .....</b>	<b>23</b>
6.1	Web interface .....	23
6.2	System Menu .....	23
6.2.1	System Status .....	23
6.2.2	Network .....	24
6.2.3	Restart and reset .....	24
6.2.4	Password .....	25
6.2.5	Event Log.....	25
6.2.6	Firmware Upgrade .....	26
6.2.7	Time settings .....	27
6.3	Menu Agent .....	28
6.3.1	Ethernet-based administration .....	28
6.3.2	Web.....	28
6.3.3	Identification and maintenance.....	28
6.3.4	SNMP .....	28
6.3.5	Ring Redundancy Mode.....	29
6.4	Menu Switch .....	30
6.4.1	Port status.....	30
6.4.2	Port mirroring .....	30
6.4.3	ARP table .....	31
6.4.4	LLDP .....	31
6.4.5	DCP .....	32
6.4.6	Class of Service / Prioritized forwarding of time-sensitive data.....	32
6.4.7	MAC Table / Forwarding rules .....	33
6.5	Network Statistics .....	34
6.5.1	Statistics on transmission errors .....	34
6.6	Web interface logout .....	35
<b>7</b>	<b>FAQ.....</b>	<b>36</b>
7.1	Why do you need a PROFINET switch for a PROFINET network? .....	36
7.2	Is the PROFINET switch “real time-compatible”? .....	36
7.3	What do the LEDs BF and SF mean? .....	37
7.4	What is “Device exchange during operation”, and what role does the PROFINET switch play here? .....	37
7.5	Why should PROFINET devices have PROFINET certification?.....	37
7.6	What is behind the PROFINET conformance classes A, B, C? .....	37

7.7	Can the PROFINET switch also transmit 1 GBit? .....	38
7.8	Can the PROFINET switch also be operated at 10 Mbit? .....	38
7.9	Which Ethernet cable types can be used for PROFINET? .....	38
7.10	Can PROFI-safe be transmitted via the PROFINET switch? .....	38
7.11	Why does the PROFINET switch have its own IP address and a PROFINET name? .....	38
7.12	What are I&M data? .....	38
7.13	Can I also use the PROFINET switch in other industrial networks without PROFINET? .....	38
7.14	What happens with a PROFINET participant when the power supply fails? .....	39
7.15	Why is "Port Mirroring" necessary? .....	39
7.16	More information on PROFINET .....	39
<b>8</b>	<b>Technical data .....</b>	<b>40</b>
8.1	PROFINET switch 4-port .....	40
8.2	PROFINET switch 8-port .....	41
8.3	PROFINET switch 16-port .....	42
8.4	Dimensioned drawing .....	43

# 1 General

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

## 1.1 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 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 is to ensure that the application or the use of the products described fulfills all safety requirements, including all applicable laws, regulations, provisions, and standards.

## 1.2 Safety instructions

The safety instructions must be observed in order 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.

### 1.3 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.

## 1.4 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.

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 in order to protect it against environmental influences. To prevent unauthorized access, the doors of control boxes/cabinets must be closed and possibly locked during operation.

## 1.5 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!



### **1.5.1 Liability**

The contents of this manual are subject to technical changes resulting from the continuous development of products of Helmholz GmbH & Co. KG. In the event that 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.

### **1.5.2 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.

### **1.5.3 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.

## 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 in order 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 Helmholtz “WALL IE”.

You can find extensive information, for example, 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.pdf](https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/ICS/ICS-Security_kompendium_pdf.pdf)



### 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.  
Information on this topic can be found in section 12.
- Only activate protocols and functions you really need

### Passwords:

- Define rules 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 protected and inaccessible to unauthorized personnel.
- Don’t use one password for various users and systems.

### 3 Overview

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

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 in order to prevent frame losses.

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

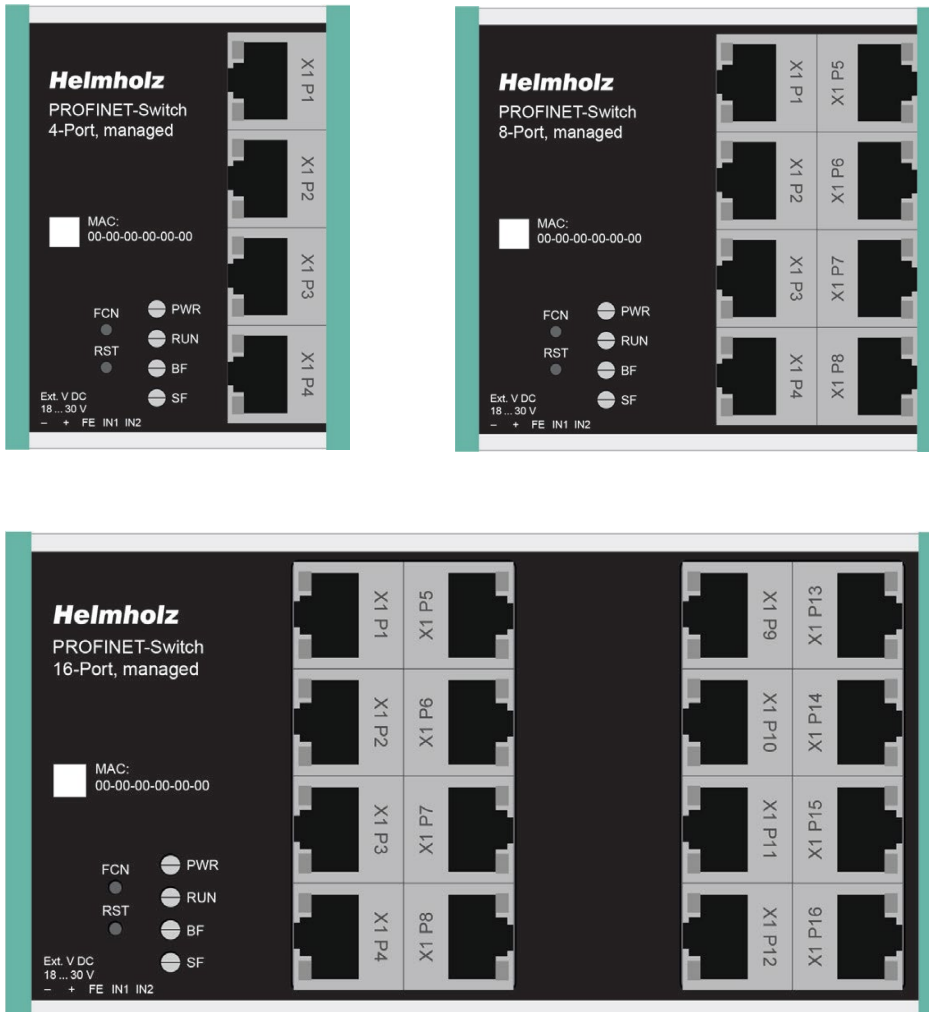
#### **Technical advantages when using a PROFINET switch**

- Prioritizing of PROFINET frames
- Allocation of a network configuration on the basis of 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 (download from [www.helmholz.de](http://www.helmholz.de)) is required for configuration as a PROFINET device. Settings made with the web interface are overwritten by the configuration.

## 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 LEDs status information

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



The **PWR 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 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 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 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 off when no data packages run via the port. It is on 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 Electrical installation

Observe the regional safety regulations.

### 4.3 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.

### 4.4 Overcurrent protection

Overcurrent protection isn't necessary as the device transports no load current. The power supply of the device electronics is to be secured externally with a fuse of maximum 1 A (slow-blowing).

### 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.

### 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.

## 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.

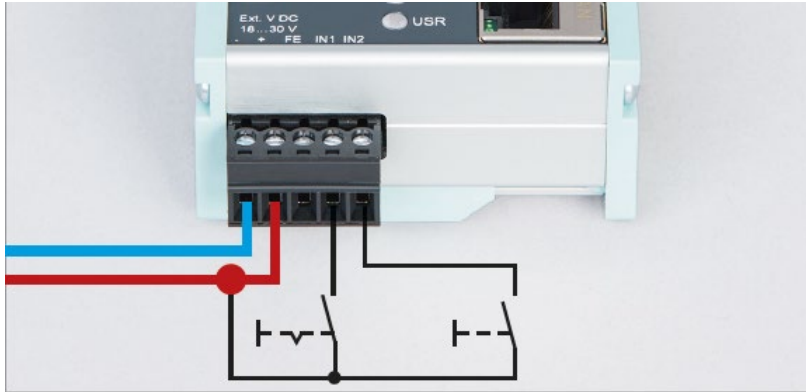


The electrical devices described in this document are to be recycled. Pursuant to Directive 2012/19/EU on Waste of Electrical and Electronic Equipment (WEEE), they may not be disposed of by way of municipal disposal companies.

## 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](http://www.helmholz.de) or scan the following QR code:



PROFINET switch 4-port



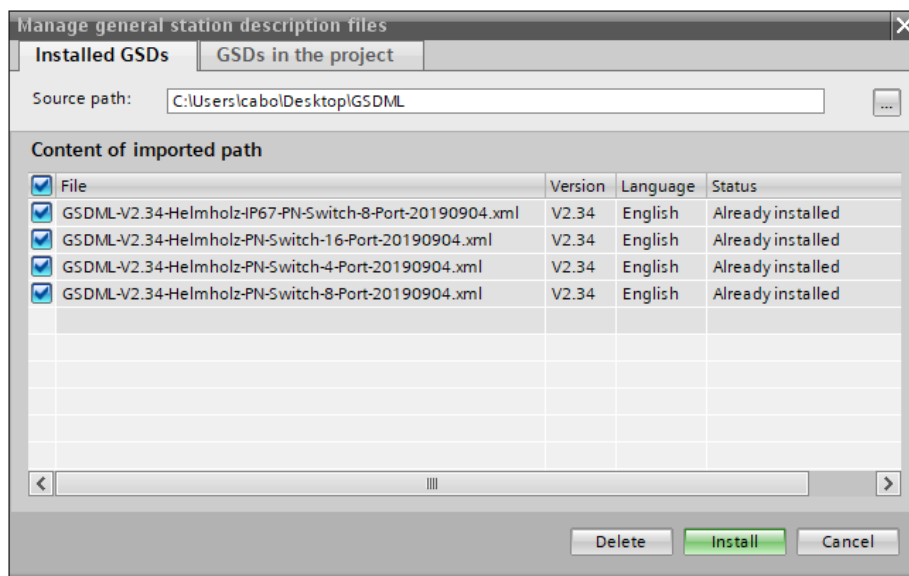
PROFINET switch 8-port



PROFINET switch 16-port

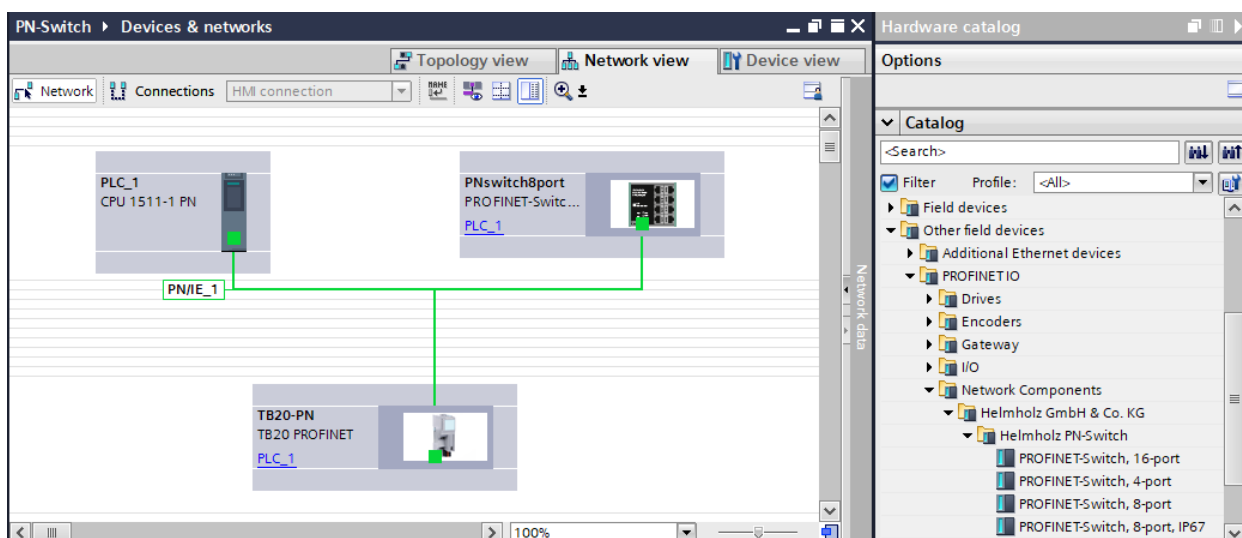


You can find in the “Manage general station description files” dialog in TIA Portal in the menu “Options”.



### 5.3 Configuration 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.



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

PNswitch8port [PROFINET-Switch, 8-port] Properties Info Diagnostics

**General** | IO tags | System constants | Texts

**General**

- Catalog information
- PROFINET interface [X1]
  - General
  - Ethernet addresses
  - Advanced options
    - Interface options
    - Media redundancy
    - Real time settings
    - Port 1 [X1 P1 R]
    - Port 2 [X1 P2 R]
    - Port 3 [X1 P3 R]
    - Port 4 [X1 P4 R]
    - Port 5 [X1 P5 R]
    - Port 6 [X1 P6 R]
    - Port 7 [X1 P7 R]
    - Port 8 [X1 P8 R]
- Identification & Maintenance

**General**

Name:

Author:

Comment:

Rack:

Slot:

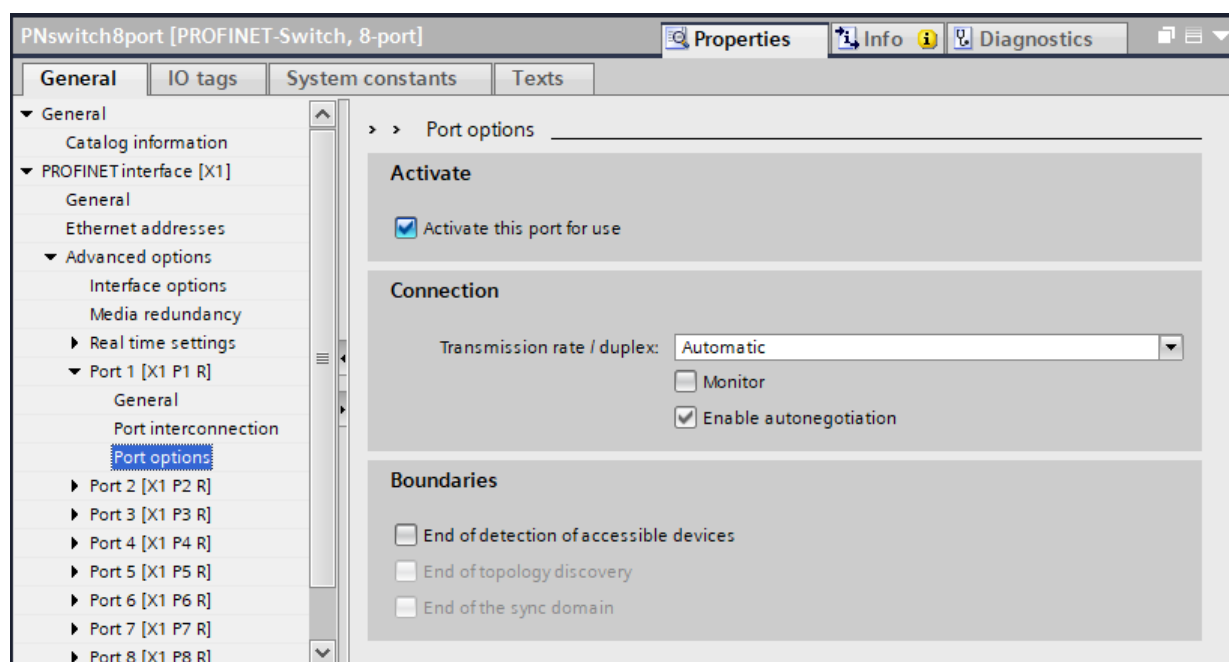
**Catalog information**

Short designation:

Description:

## 5.4 Setting the port properties

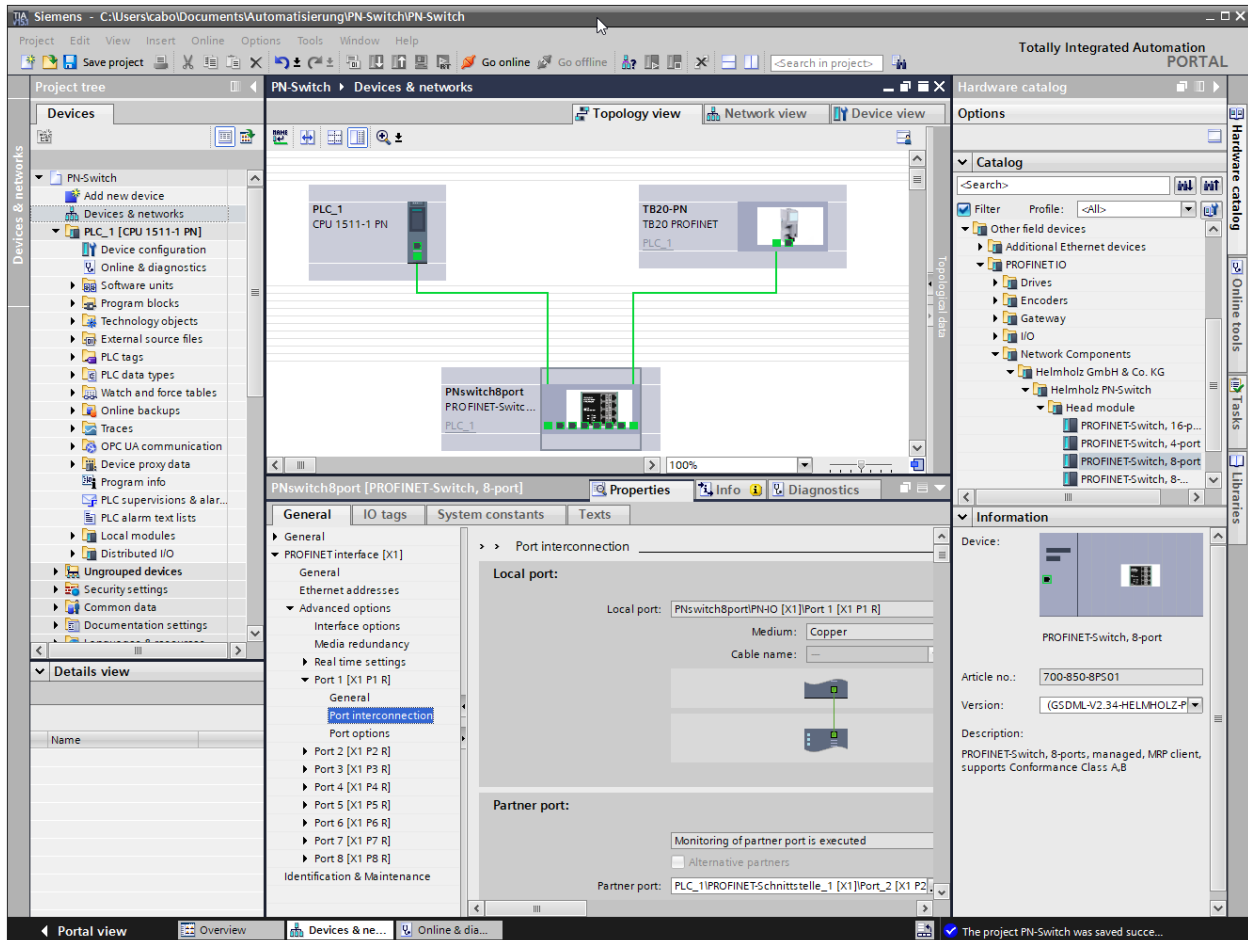
Each port of the PROFINET switch can be individually configured.



“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.



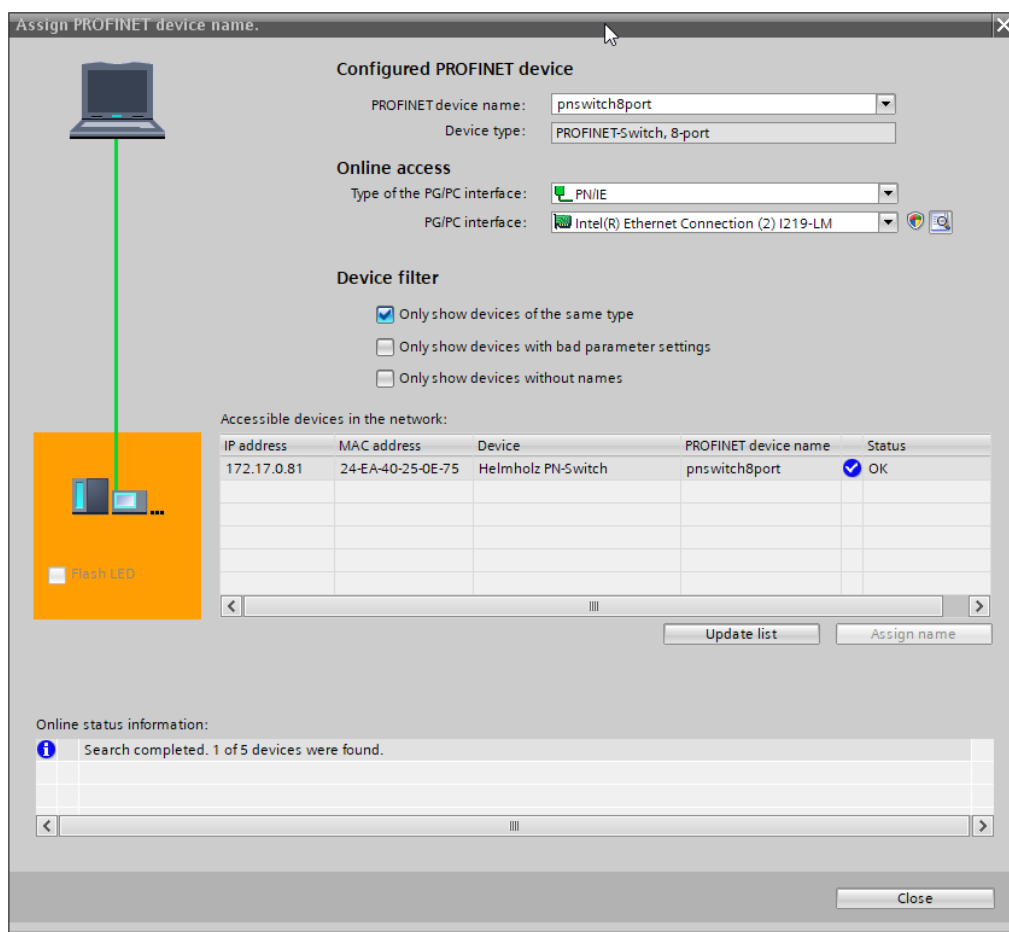
If the topology was prescribed in the configuration, neighboring devices can also be assigned the PROFINET name in the event of the replacement of a device. This makes the recognition and testing of the network topology and the “device exchange in operation” of connected PROFINET participants possible.

## 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 MRP client. MRP stands for “media redundancy protocol”. 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 at least one MRP master (e.g. the CPU) in an MRP ring. All other participants of the ring are then MRP clients.

In order to assign the PROFINET switch to an MRP ring, the “Client” media redundancy role must be set for the “Media Redundancy” option under “General”.

The screenshot displays the 'PN-Switch' configuration interface. The top section shows a 'Topology view' with three devices: 'PLC\_1 CPU 1511-1 PN', 'TB20-PN TB20 PROFINET PLC\_1', and 'PNswitch8port PROFINET-Switch... PLC\_1'. Green lines represent network connections between these devices. The bottom section shows the 'Properties' window for the 'PNswitch8port [PROFINET-Switch, 8-port]'. The 'Media redundancy' tab is selected, showing the following settings:

- MRP domain: mrpdomain-1
- Media redundancy role: Client
- Ring port 1: PN-IO [X1]Port 1 [X1 P1 R]
- Ring port 2: PN-IO [X1]Port 2 [X1 P2 R]
- ☐ Diagnostics interrupts
- Domain settings button



### NOTE

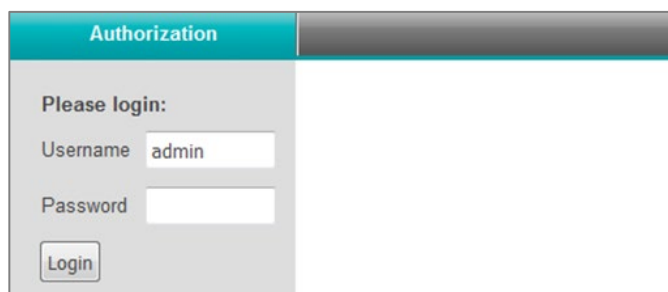
If ring wiring is without the MRP roles being configured for all devices involved, this can result in functional disruptions of the PROFINET network!

## 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.

A login dialog appears:



Up to version V1.00.100, the standard username and standard password is: admin / admin

As of version V1.00.100 of the PROFINET switch firmware: 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 is to be changed when logging in for the first time.

Up to ten web sessions can be opened simultaneously. As soon as this limit has been reached, the opening of a new session is only possible when another session is closed.

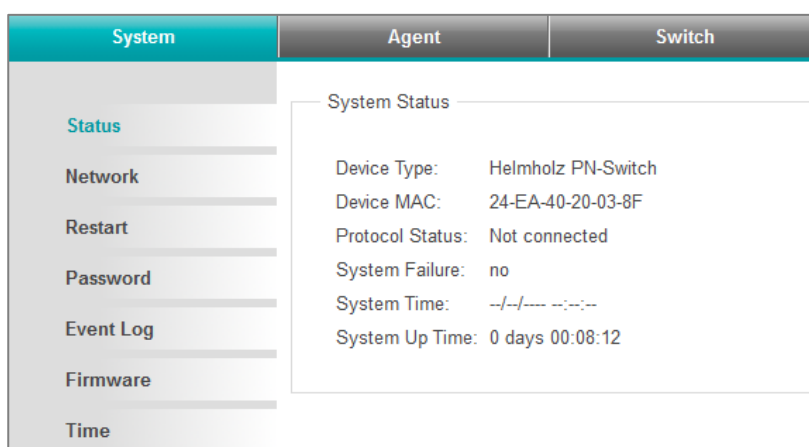
### 6.2 System Menu

#### 6.2.1 System Status

The basic system status can be queried. It consists of the following attributes:

- Device type: “PN switch” (PROFINET product name)
- Device MAC: MAC address of the device
- Protocol status: “Connected” when a PROFINET IO connection exists, otherwise “Not connected”
- System failure: “yes” when a PROFINET alarm is present, otherwise “no”
- System time: current real time of the device, see the Time section for configuration
- System up time: time since the last restart of the device

The system status can be found under “Status” (“System” section).



## 6.2.2 Network

The network configuration consists of:

- IP address
- Subnet mask
- Standard gateway
- PROFINET device name

IP address and subnet mask jointly define the address of the network. The standard gateway is required for the transition to other networks.

Changes to the network configuration are only possible as long as no PROFINET IO connection exists.


The network configuration can be shown and changed under “Network” (System section).

System	Agent	Switch
Status	Network Parameters	
Network	IP Address <input type="text" value="192.168.150.120"/>	
Restart	Subnet Mask <input type="text" value="255.255.0.0"/>	
Password	Default Gateway <input type="text" value="192.168.2.250"/>	
Event Log	Device Name <input type="text" value="pn-switch"/>	
Firmware	<input type="button" value="Submit"/>	
Time		

## 6.2.3 Restart and reset

The device can be restarted both via the web interface and with the button on the device and reset to factory settings.

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

System	Agent	Switch	Statistics	
Status	Reset Operations			
Network	<input checked="" type="radio"/> Restart			
Restart	<input type="radio"/> Factory Reset			
Password	Factory reset will reset all configuration settings to their default values! Access to the webserver will only be possible after assigning an IP address.			
Event Log	<input type="button" value="Reset"/>			
Firmware				

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



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

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

## 6.2.4 Password

Access to the web interface for the administrator is protected by a password. The password must be changed following commissioning. The password preset at the factory cannot be assigned again. Passwords can be between 4 and 20 ASCII characters long.

Up to version V1.00.100, the standard username and standard password is: admin / admin

As of version V1.00.100 of the PROFINET switch firmware: 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 password can be changed under “Password” (System section).

System	Agent	Switch
Status	Admin Password	
Network	New Password <input type="text"/>	
Restart	Retype Password <input type="text"/>	
Password	<input type="button" value="Submit"/>	
Event Log		

## 6.2.5 Event Log

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

- System events consist of:
- Enumeration of the restart
- Point in time (relative to the restart of the system or real time)
- Text with description of the system event. The system events can be deleted.

System events can be shown and deleted under “Event Log” (System section).

System	Agent		Switch	Statistics
Status	Log-Nr.	Restart	Uptime/Time	Event Text
Network	3	28	2019/08/14 14:29:58	port 4: link goes up: 100 FD
Restart	2	28	2019/08/14 14:29:56	Starting up v1.08.002
Password	1	27	0 days 00:04:00	System reset
Event Log				

## 6.2.6 Firmware Upgrade

The firmware in the device can be updated. New firmware versions are delivered in files with the ending “.huf” and are available via the Helmholz homepage [www.helmholz.de](http://www.helmholz.de).

A firmware file can be selected under “Firmware” (System section) and loaded into the device. A restart takes place after loading.



System	Agent	Switch
Status	Firmware Upgrade	
Network	Please specify the image file:	
Restart	<input type="button" value="Browse"/>	
Password	pns switch-4port_helmholz-V1.08.002.huf	
Event Log	<input type="button" value="Send"/>	



### 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 internal clock of the PROFINET switch can be set. It is used for the display of system events.

Synchronization with real time (UTC) can be configured manually or automatically by using SNTP.

Adjustment to the local time zone takes place via a time zone offset (-720 to 840 minutes).

In order to take daylight saving time into account, the day and the hour (24h format) for each year when daylight saving time (+ 1 hour) begins and ends.

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 represented differently.

The forms for the base configuration and the settings for daylight saving time are always present.

When manual synchronization has been selected, a form appears, with which the current system time (UTC) can be displayed and changed.

When “SNTP Poll” has been selected for synchronization, a form appears, with which the SNTP server, the regular interval, and the repetition interval can be shown and configured in seconds in the event of an error.

The screenshot displays the 'Time' configuration page within the 'System' section of the PROFINET switch web interface. The interface features a top navigation bar with tabs for 'System', 'Agent', 'Switch', 'Statistics', and a power icon. A left sidebar lists various system functions: Status, Network, Restart, Password, Event Log, Firmware, Time (highlighted in blue), and Licenses. The main content area is divided into three sections: 'Base Configuration', 'Daylight Saving Time', and 'Manual Time Setting'. The 'Base Configuration' section includes a 'Time Synchronization' dropdown menu set to 'Manual Setting' and a 'Timezone Offset (Minutes)' input field with the value '0'. The 'Daylight Saving Time' section contains a table with columns for 'Year', 'Start', and 'End', each with a corresponding input field (YYYY, MMDDhh, MMDDhh). The 'Manual Time Setting' section shows the 'TIME (UTC)' as '14 August 2019 14:35:27'. Each of these three sections has a 'Submit' button at the bottom.

Base Configuration		Daylight Saving Time		
Time Synchronization:	Manual Setting ▼	Year	Start	End
Timezone Offset (Minutes):	0	YYYY	MMDDhh	MMDDhh
Submit		Submit		

Manual Time Setting				
TIME (UTC):	14	August ▼	2019	14:35:27
Submit				

## 6.3 Menu Agent

### 6.3.1 Ethernet-based administration

Access via Ethernet is protected by password and there is a timeout for web sessions.

When 0 minutes is configured as a timeout, no timeout takes place. It can be configured whether the system status should also be shown in the web interface without a login.

### 6.3.2 Web

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

The screenshot shows the 'Agent' tab selected in the top navigation bar. On the left, a sidebar menu lists 'WEB', 'I&M0', 'SNMP', and 'Ring Redundancy'. The main content area is titled 'Agent Configuration' and contains two settings: 'System Status Without Login' with an unchecked checkbox, and 'Web Session Timeout (Minutes)' with a text input field containing the value '10'. A 'Submit' button is located at the bottom right of the configuration area.

### 6.3.3 Identification and maintenance

The entries for identification and maintenance (I&M) encompass the PROFINET Vendor ID, the order numbers, the serial numbers, as well as entries for the hardware and firmware version.

The entries are shown under “I&M” (Agent section).

The screenshot shows the 'Agent' tab selected. The sidebar menu has 'I&M0' highlighted. The main content area is titled 'I&M0' and displays the following information: PROFINET Vendor ID: 539, Order ID: 700-850-4PS01, Serial Number: 00000732, Hardware Revision: HW2-2, and Firmware Revision: V1.08.002.

### 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 shown and changed under “SNMP” (Agent section).

The screenshot shows the 'Agent' tab selected. The sidebar menu has 'SNMP' highlighted. The main content area is titled 'SNMP Settings' and contains three fields for configuration: 'System Contact' with the value 'Helmholz GmbH & Co. KG', 'System Name' with the value 'PROFINET switch 4 port', and 'System Location' with the value 'Demo rack 1'. A 'Submit' button is located at the bottom left of the configuration area.

### 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 as long as no PROFINET IO connection exists.

The settings for topology can be shown and changed under “Ring Redundancy” (Agent section).

System	Agent	Switch
WEB	Redundancy Mode	
I&M0	Redundancy Mode: MRP Client	
SNMP	First Ring Port: 1	
Ring Redundancy	Second Ring Port: 4	

## 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 “Port Status” (Switch section).

System	Agent	Switch	Statistics
<b>Port Status</b>	Port Status		
Port Mirroring			
ARP Table			
LLDP			
DCP			
CoS			
MAC Table			

	Status	Speed	Phys. Status	Link
Port 1	Enabled	Autoneg		down
Port 2	Enabled	Autoneg		down
Port 3	Enabled	Autoneg	100 MB/FD	up
Port 4	Enabled	Autoneg		down

Submit

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 (“100f”):

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 “100f”, both partners have set 100 MBit/full duplex as fixed and MDI-X is deactivated. A cross cable is therefore necessary to use this setting.

Changes to the port settings are only possible as long as no PROFINET IO connection exists.

### 6.4.2 Port mirroring

The Ethernet ports of the PROFINET switch can be set up such that they mirror the incoming and outgoing data traffic of a different port. A maximum of one port can be set up as a mirror of another. The port thereby remains usable for own data traffic without restrictions.

The form for displaying and changing port mirroring is found under “Port Mirroring” (Switch section).

System	Agent	Switch
Port Status	Port Mirroring	
<b>Port Mirroring</b>	<input checked="" type="checkbox"/> Mirroring Enabled	
ARP Table	Mirrored Port 2	
LLDP	Monitor Port 4	
DCP	Submit	
CoS		
MAC Table		

### 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).

System	Agent		Switch
	IP Address	MAC Address	
Port Status	192.168.140.77	00-1B-1B-2E-21-1C	
Port Mirroring	192.168.140.1	E8-6A-64-29-20-04	
ARP Table			

### 6.4.4 LLDP

PROFINET devices transmit so-called LLDP 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.

Changes to the LLDP setting are only possible as long as no PROFINET IO connection exists.



#### NOTE

The sender address of the LLDP frames can be derived from the MAC address of the device by adding up to the fourth byte.

Example for 4-Port Switch:

Device: 24-IO-40-20-00-00

Port 1: 24-IO-40-21-00-00

Port 2: 24-IO-40-22-00-00

Port 3: 24-IO-40-23-00-00

Port 4: 24-IO-40-24-00-00

System	Agent	Switch
Port Status	LLDP Boundaries	
Port Mirroring	LLDP	
ARP Table	Port 1	Enabled ▼
LLDP	Port 2	Enabled ▼
DCP	Port 3	Enabled ▼
CoS	Port 4	Enabled ▼
MAC Table	Submit	

The form for querying and changing the LLDP settings is found under “LLDP” (Switch section).

### 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 wished, this can be deactivated. The receipt of DCP frames at this port is unaffected by this. Changes to the DCP setting are only possible as long as no PROFINET IO connection exists.

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

System	Agent	Switch
DCP Boundaries		
<b>DCP</b>		
Port 1	Enabled	
Port 2	Enabled	
Port 3	Enabled	
Port 4	Enabled	
<input type="button" value="Submit"/>		

### 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).

System	Agent	Switch
Class Of Service To Queue Mapping		
PCP	Queue	Traffic Type
0	0	Background
1	0	Best Effort
2	1	Excellent Effort
3	1	Critical Applications
4	2	Video
5	2	Voice, PROFINET-Alarms
6	3	Internetwork Control, Cyclic IO-Data
7	3	Network Control, MRP-Frames
<input type="button" value="Submit"/>		



### 6.4.7 MAC Table / Forwarding rules

The forwarding of Ethernet frames takes place on the basis of 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" (Switch section).

System	Agent	Switch					
	MAC Address	C	P1	P2	P3	P4	Status
Port Status	01-0E-CF-00-00-00	X	X	X	X	X	dcp_ident
Port Mirroring	01-0E-CF-00-00-01	X	X	X	X	X	dcp_hello
	24-EA-40-20-02-DC	X					static
ARP Table	01-15-4E-00-00-01		X			X	mrp_test
LLDP	01-15-4E-00-00-02	X	X			X	mrp_ctrl
	01-0E-CF-00-01-01						static
DCP	01-80-C2-00-00-0E	X					lldp
CoS	00-1B-1B-2E-21-1C					X	dynamic
	00-1B-1B-2E-21-1E					X	dynamic
MAC Table	20-87-56-C5-D0-6C					X	dynamic
	24-EA-40-20-02-DC	X					dynamic
	24-EA-40-24-02-DC	X					dynamic
	E8-6A-64-29-20-04					X	dynamic
Refresh							



## 6.6 Web interface logout

In order to end the web interface session and log out of the PROFINET switch, the last button in the web interface must be clicked.



## 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.

A PROFINET switch enables the replacement of PROFINET components during running operations. 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.

Because many different devices are often installed into automation systems, the "Finding devices via LED display" 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.

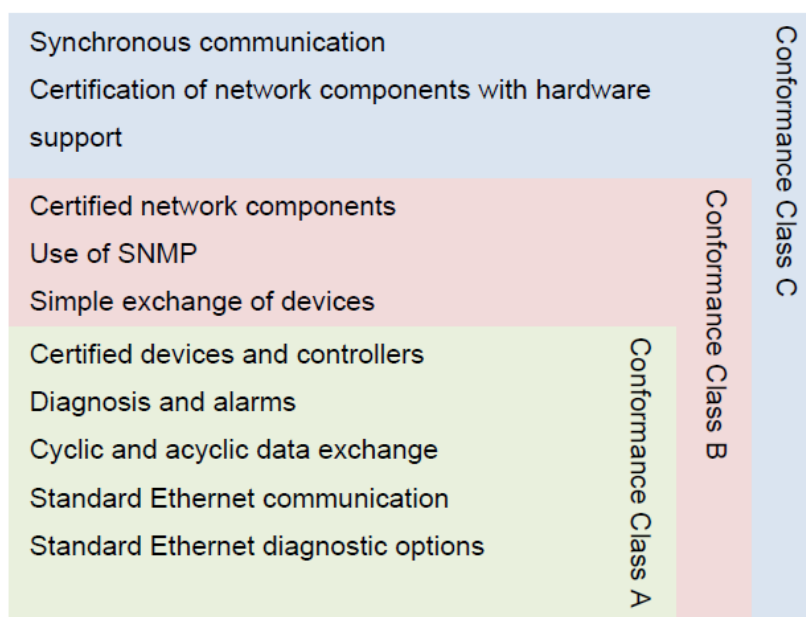
### 7.5 Why should PROFINET devices have PROFINET certification?

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 make a selection of 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 PROFI-safe be transmitted via the PROFINET switch?**

Yes, the PROFI-safe protocol classifies all components between the PROFI-safe controller (CPU) and the PROFI-safe 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 PROFI-safe 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. The website of the PROFINET switch can be reached via the IP address and 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. These are in some cases from the manufacturer (order number, serial number, etc.), but can also be described by the user (location, service contact, etc.).

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 PROFINET website.

### **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 read in an Ethernet network, because expensive coupling hardware is used, which is looped into the line or is configured, or a free port is configured in a switch as a “mirror port”. The mirror port transmits all frames of another port of the switch as a copy. A device or PC can then run on the mirror 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 (<http://www.profibus.de>).

## 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 and Quick Start Guide
Dimensions (D x W x H)	32.5 x 58.5 x 76.5 mm
Weight	Approx. 130 g
PROFINET interface	
Protocol	PROFINET IO as defined in IEC 61158-6-10
Physical layer	Ethernet
Transmission rate	100 Mbps, full duplex
Connection	4 x RJ45, integrated switch
Features	Media Redundancy (MRP), automatic addressing / topology detection (LLDP, DCP)
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	
Installation position	Any
Ambient temperature	-40 °C ... +75 °C
Transport and storage temperature	-40 °C ... +85 °C
Relative air humidity	95 % r H without condensation
Pollution degree	2
Protection rating	IP20
Certifications	CE, UL
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
CE	
RoHS	Yes
REACH	Yes



## 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 and Quick Start Guide
Dimensions (D x W x H)	32.5 x 83.5 x 76.5 mm
Weight	Approx. 190 g
PROFINET interface	
Protocol	PROFINET IO as defined in IEC 61158-6-10
Physical layer	Ethernet
Transmission rate	100 Mbps, full duplex
Connection	8 x RJ45, integrated switch
Features	Media Redundancy (MRP), automatic addressing / topology detection (LLDP, DCP)
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 W
Ambient conditions	
Installation position	Any
Ambient temperature	-40 °C ... +75 °C
Transport and storage temperature	-40 °C ... +85 °C
Relative air humidity	95 % r H without condensation
Pollution degree	2
Protection rating	IP20
Certifications	CE, UL
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
CE	
RoHS	Yes
REACH	Yes

### 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 and Quick Start Guide
Dimensions (D x W x H)	32.5 x 147 x 76.5 mm
Weight	Approx. 320 g
PROFINET interface	
Protocol	PROFINET IO as defined in IEC 61158-6-10
Physical layer	Ethernet
Transmission rate	100 Mbps, full duplex
Connection	16 x RJ45, integrated switch
Features	Media Redundancy (MRP), automatic addressing / topology detection (LLDP, DCP)
Status indicator	4 LEDs function status, 32 LEDs Ethernet status
Voltage supply	24 V DC; 18 ... 30 V DC
Current draw	Max. 290 mA at 24 V DC
Power dissipation	Max. 5.5 W
Ambient conditions	
Installation position	Any
Ambient temperature	-40 °C ... +75 °C
Transport and storage temperature	-40 °C ... +85 °C
Relative air humidity	95 % r H without condensation
Pollution degree	2
Protection rating	IP20
Certifications	CE, UL
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
CE	
RoHS	Yes
REACH	Yes

## 8.4 Dimensioned drawing

