PANOS (Process Automation Network Operating System)

Operating System for Ethernet-APL Switches

Software Manual

Your automation, our passion.

PEPPERL+FUCHS

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1 Introduction

1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note

This document does not substitute the instruction manual.

Note

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com.

The documentation consists of the following parts:

- Present document
- Instruction manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Functional safety manual
- Additional documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note

This symbol brings important information to your attention.

Action

1. This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2 Product Description

2.1 Use and Application

This manual describes the software functions of Pepperl+Fuchs industrial Ethernet-APL rail field switches for configuration, commissioning, operation, and maintenance. All rail field switches are using the same software operation system called PANOS. The software functions described in this manual are not supported by all rail field switches. For more information see the datasheet of the specific Ethernet-APL rail field switch.

Ethernet-APL rail field switches are intended to be used in Ethernet-APL networks fulfilling the main requirements for installations in process industries, also in explosion-hazardous areas. The rail field switches are the interfaces between Ethernet-APL field devices and the control system. Depending on the version, PROFIBUS PA field devices are connectable to the spur ports. The type of field device is detected automatically. Rail field switches provide power to the field devices and Ethernet connectivity to the control system.

In addition to standard switch protocols and functions, the Ethernet-APL rail field switches support PROFINET IO device functionality, compliant with IEC 61784-2 CP 3/5 CC-B (Conformance Class B, process automation) supporting real time Ethernet class 1 (RT). The PROFINET IO device function permits network configuration of the rail field switches, diagnosis of the rail field switches, and PROFIBUS PA device connectivity with the control system. With Media Redundancy Protocol (MRP), system redundancy S2, and dynamic reconfiguration (DR) the rail field switches are applicable in PROFINET networks that requires high availability.

The provided functionality permits the use of Ethernet-APL rail field switches in all Ethernet-based network environments:

- Networks using standard Ethernet protocols, e. g., TCP/IP
- Networks using industrial Ethernet protocols, e. g., EtherNet/IP, HART-IP, and OPC
- PROFINET networks supporting Conformance Class B applications
- PROFINET networks in applications requiring high availability

Use the integrated web server, FDI, or FDT/DTM to manage rail field switches.

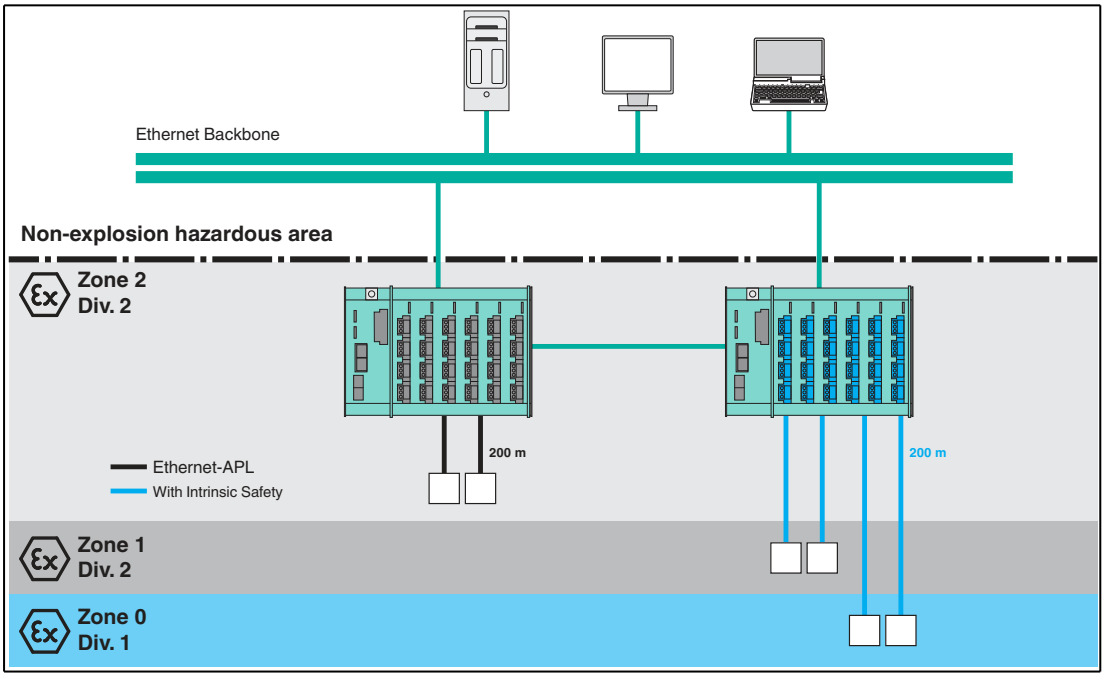

Figure 2.1 Typical network structure using Ethernet-APL rail field switches

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Ethernet-APL Rail Field Switches

The following series of Ethernet-APL rail field switches use the software operation system PANOS:

Type Code

A	**R**	**S**	(1)	(2)	-	(3)

Device	
ARS	Ethernet-APL Rail Field Switch

(1)	Generation number of the rail field switch
1	1st generation
n	n-th generation

(2)	Software functions
0	basic security, basic switch management
1	basic security, basic switch management, PROFIBUS PA integration, physical layer diagnosis
2	basic security, basic switch management, physical layer diagnosis

(3)	More options
options of product versions which are not relevant for the software function	

Related Documentation for the Ethernet-APL Rail Field Switch Series

- Datasheets
- Instruction manual
- Hardware manual
- Certificates
- Manual Pepper+Fuchs Discovery and Configuration Tool (PFDCT)
- CAD drawings

Note

For more information regarding Ethernet-APL see the "Engineering Guideline Ethernet-APL."

Additional Software Items

- GSDML file: For each switch series a PROFINET IO-specific device description for integration into a control system is available.
- Generic and host system specific FDI packages
- DTM: Device Type Manager for integration of the Ethernet-APL switch into an FDT-based engineering tool.
- PFDCT: Pepper+Fuchs Discovery and Configuration Tool to detect and manage Pepperl+Fuchs Ethernet devices

PANOS Software Updates

It is recommended to check regularly on www.pepperl-fuchs.com for software updates. Software updates may include network security relevant changes.

Tip

You can use the Pepperl+Fuchs software PFDCT for bulk software updates in your installation.

All documentation and software can be found and downloaded from the Pepperl+Fuchs website at www.pepperl-fuchs.com.

Open Source Firmware

PANOS includes software covered by free and open-source licenses. The respective license information is downloadable from the website of the rail field switch. With each update package of PANOS, the information of the included license is provided as a text file.

3 Network Management

Ethernet-APL switches provide a comprehensive set of functions and protocols for use in general purpose Ethernet networks. Beside these standard set of features, real time communication protocols for process control are supported. Ethernet-APL switches support PROFINET IO according to IEC 61784-2 CP 3/5 CC-B (Conformance Class B, process automation). The Conformance Class B profile for switches requires the support of features common to Ethernet. These are, e. g., VLAN (virtual networks) or SNTP (time protocol). CC-B also requires PROFINET-specific features.

3.1 Uplink Ports

The rail field switches can be configured using uplink ports, e. g., the ports P1 ... P4 of the Ethernet-APL rail field switch.

The configuration can be done using the web-based management (HTTP and HTTPS), FDI, or partially using PROFINET. The uplink ports support 10 Mbit/s, 100 Mbit/s, and 1 Gbit/s full duplex and half duplex data rates with auto negotiation and auto crossover. For ports P3 and P4, it is possible to use optional SFP transceivers to support data rates with up to 1 Gbit/s. When using PROFINET, the data rate is limited to 100 Mbit/s for ports P1 and P2 and for ports P3 and P4 only 100 Mbit/s SFP transceivers can be used.

For further information of the SFP transceivers, refer to the hardware manual of the Ethernet-APL rail field switch.

3.2 Spur Ports

Each spur port of a switch provides connectivity for one field device. It is possible to use an Ethernet-APL device with a data rate of 10 Mbit/s full duplex or PROFIBUS PA device with a data rate of 31.25 kb/s as a field device. The type of field device is detected automatically.

While the communication of the Ethernet-APL field device is transparently transferred to the uplink ports, the PROFIBUS PA connectivity requires further engineering (see chapter 4). The switch acts as a proxy for the PROFIBUS PA device where the data of one PROFIBUS PA device is represented as one module of a modular PROFINET IO switch.

3.3 Network Redundancy

It is possible to configure any combination of two uplink ports to be used for connecting a switch to one redundant Ethernet ring by using the Media Redundancy Protocol (MRP). The performance of a redundant ring depends on the control system in use. For more information see the documentation of the control system.

3.4 Assigning the IP Address

An IP address has to be assigned, before using a switch. There are several options to assign the IP address in the following sections:

Discovery and Basic Configuration Protocol (DCP)

You can use the PROFINET "Discovery and Basic Configuration Protocol" (DCP) to assign the IP address and the device name to the switch. The engineering tool of the controller uses the DCP with standardized PROFINET engineering procedures. For using DCP, refer to the manual of the controller in use.

Dynamic Host Configuration Protocol (DHCP)

Use the "Dynamic Host Configuration Protocol" (DHCP) when switches use IP addresses temporarily. This is the case, e. g., during the configuration of the switch when no controller is connected that supports DCP.

Pepperl+Fuchs Discovery and Configuration Tool (PFDCT)

The Pepperl+Fuchs Discovery and Configuration Tool (PFDCT) is a software tool that detects Pepperl+Fuchs Ethernet devices on a network. Use this tool to assign an IP address to the switches, even if these switches use the factory default IP address or if the switches use an IP address in another subnet. PANOS firmware can be updated in parallel for multiple switches, which are located in the same subnet. The tool is available free of charge on www.pepperl-fuchs.com.

Web Server / FDI

It is possible to set the IP address with the web server and FDI manually. A valid IP address needs to be assigned using DCP, DHCP, or PFDCT, before accessing the web server the first time.

3.5 Common Switch Management Protocols and Functions

Store and Forward

Ethernet-APL switches store received Ethernet packets temporarily, check the data packets for correctness and forward the frames to the outgoing ports. Erroneous data packets are discarded.

Virtual Local Area Network (VLAN) Bridging

Use VLAN to segment devices into one logical network even if the devices are not connected physically to the same network.

Ethernet-APL switches support VLAN priority handling. VLAN configuration of a network is not supported by the switches.

Media Redundancy Protocol (MRP)

Use MRP to operate the switch in a media redundant network ring. When the network ring is interrupted, communication is reorganized that keeps all devices still reachable by the controller. Pepperl+Fuchs switches do not support MRP as a redundancy manager but as a client only.

IGMP Snooping, IGMP Querier

The Internet Group Management Protocol enables the switches to manage multicast messages intended to be addressed to a configurable choice of connected devices through a shared IP address (grouping). The switches forward messages to those ports, where multicast-group member devices are connected to. Normally a dedicated router/switch is used to configure and manage the IGMP group. Such a device is called an "IGMP querier." Ethernet-APL switches can be configured to act as an IGMP querier. The membership to an IGMP group has to be periodically updated. The time interval for renewal of the membership can be adjusted. Ethernet-APL switches support IGMP version v1, v2, and v3.

IGMP is normally not used in a PROFINET network but, e. g., in an OPC UA network. To setup the IGMP network and configure the switch accordingly, refer to the documentation of the tools used.

Simple Network Time Protocol (SNTP)

SNTP is used to synchronize system clocks of Ethernet devices on an Ethernet network.

Following SNTP features are supported:

- receive SNTP server from DHCP server
- IP entry
- support of up to 4 SNTP servers

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Hypertext Transfer Protocol (HTTP)

HTTP is the protocol to access the web server of the switches. The exchanged data is not encrypted.

Hypertext Transfer Protocol Secure (HTTPS)

HTTPS is the secure version of HTTP. The exchanged data is encrypted. The switch supports user-generated certificates.

Link-Layer Discovery Protocol (LLDP)

Use LLDP to generate a topology view of all connected Ethernet devices of a network supporting LLDP. Information gathered from LLDP-enabled devices are, e. g., identity, capabilities, and neighboring-connected devices.

Simple Network Management Protocol (SNMP)

SNMP permits to exchange information between different Ethernet devices on a network. It is normally used to centrally collect information regarding the devices connected to an Ethernet network. The information can then be used for engineering, management, and status monitoring purposes. Ethernet-APL switches support SNMPv1, SNMPv2c, and SNMPv3. The exchanged data is stored in the "Management Information Bases" (MIBs).

Supported MIBs are:

- MIB-II, only parts required by topology discovery: system, ifTable, ifXTable, IP, SNMP
- LLDP-MIB
- LLDP-EXT-DOT3-MIB
- LLDP-EXT-PNIO-MIB

MAC Address Table

The MAC address table or FDB table (Forward Data Base) contains MAC addresses of devices that are accessible through a specific switch port. The switches forward incoming communication only to the port where the designated network devices is connected to. The table will be updated dynamically.

Pruning

Ethernet-APL switches support pruning of DCP multicast frames to minimize the traffic load on switch ports to which field devices are connected. The Ethernet-APL switch protects the field device resources by reducing the network load.

The PROFINET controller must support the network feature **pruning**. To unfold the effectiveness of pruning, all connected field devices must support pruning. For PROFINET over Ethernet-APL field devices the support of pruning is mandatory.

4 PROFINET IO

Ethernet-APL rail field switches are PROFINET IO devices that provide diagnostics information, alarms, and parametrization of the switch through PROFINET. At the spur ports of the rail field switch, PROFINET over Ethernet-APL field devices and PROFIBUS PA field devices are connectable. While native PROFINET over Ethernet-APL field devices are addressed directly by the PROFINET controller, the PROFIBUS PA field device data will be mapped on the slot/index address room of the field switch, which represents as a single, modular PROFINET device. The GSDML file of the field switch, contains the PROFIBUS PA profile 3.02 specific configuration options for PROFIBUS PA field devices, required to configure the field switch with PROFIBUS PA connectivity in the control system.

4.1 PROFINET IO Communication Profile

The rail field switches are based on the PROFINET communication profile CP3/5 (CC-B) according to IEC/EN 61784-2:2020. This communication profile describes the performance characteristic capabilities of a PROFINET IO device.

PROFINET Performance Characteristics

Feature	Characteristics
Application class	Process Automation
Bridging internal switch	4 priority queues, cut-through switching is not supported
Bridging VLAN	Supports virtual local area network (VLAN) priority handling according to IEEE 802.1Q
Communication class	Supports PROFINET RT communication, RT_CLASS_1
Communication features	5x supervisor device access AR
Communication relationship	Supports 1 IO AR with 1 input CR and 1 output CR with 1440 bytes each
Conformance class	CC-B, application profile process automation
Dynamic reconfiguration	Change of device configuration and PROFIBUS PA field device configuration see chapter 4.6
LLDP	Supports neighborhood discovery acc. to IEEE 802.1AB
Media redundancy	Supports loop prevention, ring redundancy MRP, RED_CLASS_1
Physical layer	100 Mbit/s, 10 Mbit/s full duplex with auto crossover and auto negotiation
Precision time synchronization (PCTP)	Not supported
Security	PROFINET security level 1, netload class II
Shared device	Not supported
SNMP	Supports SNMPv1, SNMPv2c, and SNMPv3
SNTP	Simple Network Time Protocol
System redundancy	Supports simple system redundancy S2

Table 4.1

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4.2 Field Switch Device Model for PROFIBUS PA Device Integration

The field switches are based on the PROFINET IO device model, that represents a modular device.

The field switches follow the guideline "PROFIBUS Integration in PROFINET IO, Amendment 1 for Fieldbus Integration into PROFINET IO." According to the PROFINET IO device model, the switch provides a slot representing its own data and submodules representing the data of PROFIBUS PA devices.

Mapping PROFIBUS PA Device Data to PROFINET

All information provided by the field switch is accessible using fixed slot/subslot addressing. Most of the accessible data is handled by system-specific software as e. g. FDT/DTM package. Therefore, no detailed knowledge on data mapping is required.

Device Data Mapping of the Switch and Connected PROFIBUS PA Devices

Slot	Data
0	Device Access Point (DAP) including all field switch specific information and information on the Ethernet ports
1	Fieldbus Access Point (FAP) including all PROFIBUS PA device data from field switch spur port S1 and PROFIBUS PA segment specific parameters as, e. g., master parameters
2	Fieldbus Access Point (FAP) including all PROFIBUS PA device data from field switch spur port S2 and PROFIBUS PA segment specific parameters as, e. g., master parameters
...	...
n	Fieldbus Access Point (FAP) including all PROFIBUS PA device data from Field Switch spur port Sn and PROFIBUS PA segment specific parameters as, e. g., master parameters. n = the highest spur number of the rail field switch / number of spur ports

Table 4.2

4.3 PROFIBUS PA Device Features

PROFIBUS PA devices according to IEC 61784-1 CP 3/1 and CP 3/2 are supported.

The field switches support the following PROFIBUS communication features for PROFIBUS PA devices:

- SET_CFG
- GET_CFG
- MS1 Acyclic master-slave communication through the cyclic communication channel
- C2 communication
- SLAVE_DIAG, mapping of the PROFIBUS PA device diagnostics to PROFINET diagnostic alarms
- SET_PRM parameters settings
- PROFIBUS I&M1 ... I&M4 if supported by the PROFIBUS PA device
- RD_INPUT
- RD_OUTPUT

The following PROFIBUS features are not supported, because PROFIBUS PA devices do not support them:

- Alarms
- EXT_PRM
- Module PRM parameters for PROFIBUS PA devices using structured PRM
- PROFIBUS PA channel diagnostics

4.4 PROFIBUS PA Device Process Data

The PROFIBUS PA process data is mapped into field switch cyclic device data. For each PROFIBUS PA device, a maximum of 246 bytes of input data and 246 bytes of output data may be used. The type of data transferred depends on the type of process control data of the used PROFIBUS PA field device.

4.5 PROFIBUS PA Device Diagnostics

PROFIBUS PA device diagnostic data is mapped to PROFINET diagnostics alarms. Two different mapping schemes are available:

- Mapping to PROFINET severity
- Mapping to qualified channel diagnosis according to PROFIBUS PA profile 4.02

Channel-specific diagnostics for PROFIBUS PA devices are not supported. See chapter 6.12 for details.

4.6 Dynamic Reconfiguration

Dynamic Reconfiguration (DR) is a PROFINET feature that allows to change the control system configuration and PROFINET device configuration during runtime. Some actions may be executed without having to interrupt the process data communication (bumpless). Examples of actions are, adding, removing, and exchanging PROFINET devices or changing configuration data of the PROFINET devices.

Following table gives an overview about the capabilities and behavior of Ethernet-APL switches during dynamic reconfiguration.

Action	Impact on the process I/O data of the Ethernet-APL switch
Enabling/disabling protocols within the Ethernet-APL switch see chapter 5.2	No impact
Changing the PROFINET diagnosis format see chapter 5.2	No impact
Enabling Ethernet Ports P1 ... P4 and S1 ... Sn	No impact
Disabling Ethernet Ports P1 ... P4	I/O data of all connected PROFIBUS PA devices may be lost depending on the network topology
Disabling Ethernet Ports S1 ... Sn	If a PROFIBUS PA device during data exchange is connected to a disabled port, I/O data of the PROFIBUS PA device is not available anymore
Adding Ethernet ports P3 ... P4	No impact
Changing the configuration of Ethernet ports P1 ... P4	I/O data may be temporarily unavailable depending on the parameter changed
Adding a PROFIBUS PA device	No impact on PROFIBUS PA devices already connected to the Ethernet-APL switch
Removing a PROFIBUS PA device	No impact on PROFIBUS PA devices remaining connected to the Ethernet-APL switch
Changing the PROFIBUS PA master parameters of a port see chapter 5.3.2	No impact if the physical layer of the segment is undisturbed
Changing the cyclic I/O data of a PROFIBUS PA device by adding or removing submodules see chapter 5.3.3	I/O data of the PROFIBUS PA device is temporarily unavailable because the device needs to be reconfigured

Table 4.3

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Note

Dynamic reconfiguration procedures, capabilities, and features are specific for a control system. Refer to the documentation of the control system in use.

Note

Using dynamic reconfiguration requires a PANOS version higher than 1.1.0 and a GSDML version newer than 2022-03-01.

5 Commissioning

To integrate an Ethernet-APL switch into a PROFINET control system, the tools and procedures required are generally specific for a control system. For each rail field switch series, a GSDML file is provided to configure the rail field switch in the control system. The following sections describe the required configuration of the rail field switches in a control system independent manner. For details related to a specific control system, refer to its documentation.

To configure the rail field switch, use:

- the web server
- FDI
- the control system if the rail field switch is used as a PROFINET device

The rail field switch automatically detects the type of connected field device, either a PROFIBUS PA device or a native Ethernet-APL field device. While a network switch needs to be specifically configured to be used as a PROFIBUS PA device, Ethernet-APL field devices are transparently coupled. Commissioning and configuration is specific for the Ethernet-APL field device and the type of industrial communication protocol in use.

5.1 Switch Commissioning with the Web Server

Before using the web server for configuration, an initial setup is required. The steps for initial setup are assigning an IP address, a user role, a login name, and a password.

Assigning an IP Address

1. To set the IP address, use the PFDCP tool, a DHCP server, or a DCP server.

Accessing the Web Server

1. To access the web browser using HTTP or HTTPS, enter the IP address, that you have assigned before.

Assigning user role, login name and password

Note

The initial user has the user role **administrator** assigned. Only the user role **administrator** has the rights to assign user roles and change usernames and passwords. For further information about the supported user roles, see chapter 8.1.

1. When starting the web server for the first time, assign a login name and a password.

Configuring the Rail Field Switch

The rail field switch can be configured in detail using the web server or FDI. Refer to following submenus in the section "Web server":

- Configuration\Diagnosis
- Configuration\Network
- Configuration\Device

5.2 PROFINET Commissioning

The Ethernet-APL field switch provides configuration option that needs to be set during control system engineering.

PROFINET Specific Settings for the Ethernet-APL Field Switch

The Ethernet-APL field switch supports two different PROFINET specific diagnosis formats.

Diagnosis mode:

- ExtChannelDiagnosis
- QualifiedDiagnosis

PROFIBUS PA Field Device Global Setting

Process data status coding

PROFIBUS PA field devices according to PROFIBUS PA profile 3.02 or higher support two different process value status models that describe the quality of process values. With the Status-Mode parameter all connected field devices are configured to use either the “Classic” (detailed) or “Condensed” (reduced NE107 compliant). Refer to the manual of PROFIBUS PA field devices in use.

Status mode:

- Classic
- Condensed

Protocol Management

If the rail field switch is used as a PROFINET device, you can enable/disable protocols or leave the configuration for a specific protocol unchanged. Disabling protocols decreases the vulnerability against security attacks.

- No change: Uses the configuration of the web server
- Enabled: Enables the protocol
- Disabled: Disables the protocol

Protocols that can be enabled/disabled or be left unchanged are:

- SNMP (v1/v2c/v3)
- PFDCP
- HTTP
- HTTPS

5.3 PROFIBUS PA Commissioning

When a PROFIBUS PA device is connected to a spur, the following parameters for each device need to be configured:

- PROFIBUS PA process data status mode of the field devices see chapter 5.3.1.
- PROFIBUS PA master parameters see chapter 5.3.2.
- PROFIBUS PA device identification that defines the type of transferred control data see chapter 5.3.3.

5.3.1 PROFIBUS PA Process Data Status Mode

For each field device the process data status mode can be configured. For details regarding process data status coding see chapter 5.2.

Status mode:

- "Use global setting," use the setting from parameter "Diagnosis Mode" see chapter 5.2
- "Classic"
- "Condensed"

5.3.2 PROFIBUS PA Master Parameters

Each spur contains a PROFIBUS PA master. The parameters of the PROFIBUS PA master are set to default values and cannot be changed. The fixed address of the PROFIBUS PA master with the value of "1" is valid for all spurs. Only the value "maximum retry limit" can be changed individually for each spur master.

Recommendation: Configure the maximum retry limit to no less than 4 retries when operating the PROFIBUS PA installation under one of the following operation conditions:

- High level of environmental impact
- Vibration or shock

PROFIBUS PA Master Parameters

Parameter	Description	Values
Retry limit	Number of repeated telegrams before a device is dropped from the live list	Min.: 1 Max.: 7 Default: 4

Table 5.1

5.3.3 PROFIBUS PA Device System Configuration

Each PROFIBUS PA device connected to a switch spur is represented by a function block module of the modular PROFINET IO switch. For system integration of the field switches, a PROFINET GSDML file is provided. The GSDML file contains function block module identifier for compact and multi-variable PROFIBUS PA devices, representing the process data and related status according to PROFIBUS PA profile 3.02. Because the standardised PROFIBUS PA devices support these generic identifiers, devices from different manufacturers are interoperable on the process data level. That means, when a field device needs to be exchanged, the new field device does not need to be identical to the replaced one and it can even be from a different device manufacturer. By configuring the switch with PROFIBUS PA 3.02 profile-specific generic module identifiers, no further configuration of the switch or PROFIBUS PA device is required related to the process data communication. Field device specific GSD files are not required to configure the switch.

If a PROFIBUS PA device is required to be used in a manufacturer specific manner, the structure of the process data can be assembled by using the module "Generic PA Device with condensed status" (see chapter 5.3.3.3).

PROFIBUS PA devices may support multiple ident numbers representing the GSD file describing the supported function block module identifiers. The configured or used ident number can be changed with the asset managemnt tool. Refer to the manufacturer documentation of the PROFIBUS PA device in use.

The supported ident numbers of a PROFIBUS PA device are shown in the web server of the rail field switch or FDI. See chapter 8.1.3.3

5.3.3.1 Compact PROFIBUS PA Devices

The GSDML file contains a selection of generic device type module identifiers for compact PROFIBUS PA devices according to PROFIBUS PA profile 3.02. The device type modules define the structure of the process data with its related status used for process control. So devices of the same type from different suppliers are exchangeable without re-configuring the control system. For each type of function block a unique ident number is specified.

To select the correct device module identifier for configuration of the switch, see the documentation of the relevant PROFIBUS PA device.

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5.3.3.2 Multi-variable PROFIBUS PA Devices

Multi-variable devices (Ident_Number 0x9760) are compact or modular devices that consists of a variable number and types of function blocks. For each type of function block, predefined combinations of process parameters are configurable. The combinations are described in the GSDML file and are specified in the PROFIBUS PA profile 3.02. Assign the combinations of process parameters during the switch configuration for the specific PROFIBUS PA devices. You can configure up to 19 variables or combination of variables that are assigned to submodules per PROFIBUS PA device.

To select the correct device module identifier for configuration of the switch, see the documentation of the relevant PROFIBUS PA device.

5.3.3.3 PROFIBUS PA Devices in Manufacturer-specific Mode

Use the module "Generic PA Devices with condensed status" to configure devices with a manufacturer-specific structure of the process data. For this module, the GSDML file provides all combinations of control data for all types of function blocks specified in the PROFIBUS PA 3.02 profile. Up to 19 module identifier can be configured per PROFIBUS PA device. To select the correct device module identifier for configuration of the switch, see the documentation of the relevant PROFIBUS PA device.

If during system configuration the process variable submodules are not continuously assigned to the slots, all free slots until the last slot containing a process variable, must be configured with the module called "Empty."

Manufacturer-specific Use of PROFIBUS PA Devices

When a PROFIBUS PA device is used in a manufacturer specific way, the switch requires additional configuration during system configuration.

Configuration Parameter

Parameter	Description
Ident number	If a PROFIBUS PA device is used in a manufacturer specific manner, the manufacturer specific "Ident Number" is required (default "0000"). See the manual of the PROFIBUS PA device in use.
Condensed status	The use of the condensed status can be enabled or disabled. (default "enabled")
MS1 communication enable / disable	The acyclic master-slave communication through the cyclic communication channel between the controller (master) and the slave can be enabled or disabled (default "disabled"). See the manual of the PROFIBUS PA device in use.

Table 5.2

5.4 PROFIBUS PA Device Address

The valid address range of a PROFIBUS PA device for process data communication is 3 ... 125.

The PROFIBUS PA spur masters scan for PROFIBUS PA devices in the range of 0 ... 126. If a device is found, the following rules apply depending on its address:

- 1 PROFIBUS PA device is found with an address in the range of 3 ... 125:
  The detected address is used to communicate with the PROFIBUS PA device.
- 1 PROFIBUS PA device is found with the address 126:
  The PROFIBUS PA master changes the address of the connected PROFIBUS PA device to 3.

- More than one PROFIBUS PA device is detected at one spur:
  The PROFIBUS PA devices will not be taken into cyclic communication. The spur master will continue to scan the spur.
- 1 PROFIBUS PA device is found with an address in the range of 0 ... 2:
  The PROFIBUS PA device will not be taken into cyclic communication. The spur master will continue to scan the spur.
- No PROFIBUS PA device is found with an address in the range of 3 ... 126:
  The spur master will continue to scan the spur.

5.5 PROFIBUS PA Field Device Configuration

To configurate PROFIBUS PA field devices, use one of the following access options:

- Device DTMs in combination with the provided gateway device type manager (DTM) see chapter 8.3
- Device FDI packages in combination with the Ethernet-APL rail field switch FDI package with specific FDI hosts see chapter 8.4

5.6 Ethernet-APL Field Device Configuration

The switch transparently couples any Ethernet communication between its ports. Access to connected Ethernet-APL field devices is provided by the specific tool chain of the control system and the device integration methods in use, e. g., FDT, FDI, and EDDL.

6 Diagnostic Information and Troubleshooting

Field switches provide various access to information to diagnose and maintain the switch and its network connections.

LED Information

The LEDs on the Ethernet-APL rail field switch provide a simple and fast way to verify the status of the Ethernet-APL rail field switch, see chapter 6.2.

PROFINET Diagnosis Information

Through PROFINET alarms, standardized diagnosis information is accessible to maintain and troubleshoot the PROFINET devices. Device specific diagnosis information is also provided:

- the condition of the Ethernet-APL rail field switch itself
- the condition of Ethernet ports in general
- the condition of spur ports and the connected network if an Ethernet-APL device is connected
- the condition of spur ports and the connected network if a PRFOFIBUS PA device is connected

PROFIBUS PA Device Process Data Status and Alarms

If a PROFIBUS PA device is used at a spur, the rail field switch converts the process data status received by the field device to the PROFINET severity status or qualified channel diagnosis.

Web Server and FDI Package

The web server displays all available diagnostic information provided through PROFINET. Following information regarding network connections can be accessed in detail:

- Ethernet network connections
- Ethernet-APL network connections and physical layer information
- PROFIBUS PA network connections and physical layer information

Relay Output

The relay output provides a summary status and opens if the overall status is either "Fault," "Maintenance demanded," or "Maintenance required."

Physical layer information

The Ethernet-APL rail field switch provides physical layer information on the spurs for Ethernet-APL and for PROFIBUS PA configurations. The physical layer information offers support for one or all three of the following areas of application in process plants:

- **Commissioning**
  After the installation is completed and before loop check commences, check the condition of the segment. A physical layer in a good condition is the basis for a successful loop checking and plant commissioning.
- **Online Monitoring**
  The Ethernet-APL rail field switch compares actual values to the fixed defined limits. Warnings and alarms indicate early on that a fault has occurred or that the quality of the installation is degrading. Take proactive corrective action to prevent unwanted plant shutdowns.
- **Troubleshooting**
  Messages in plain language help the maintenance staff to find possible causes for a problem. Repair work is planned and performed only when necessary. This significantly reduces time to repair and time spent in the field.

6.1 PROFINET Diagnosis

PROFINET, PROFIBUS PA, and NE107 use different status models to describe the status of the process value and the status of a diagnosis alarm.

Ethernet-APL rail field switches map the different diagnosis models to a PROFINET conform diagnosis model.

Ethernet-APL rail field switches support two different diagnosis formats for the Ethernet-APL rail field switch itself and the PROFIBUS PA v3.x field devices specified within the PROFINET specification.

- Extended Channel Diagnosis
- Qualified Channel Diagnosis

The Ethernet-APL rail field switches can be configured during start-up using either of the diagnosis formats.

PROFINET Extended Channel Diagnosis

The Extended Channel Diagnosis provides a severity classification of diagnosis events. The classification is based on the criticality of the diagnosis events or the urgency for countermeasures to avoid disturbance of the plant.

The Ethernet-APL rail field switch maps for PROFIBUS PA profile v3.x field devices the diagnoses following the PROFIBUS PA profile V4.x to the PROFINET severity coding.

PROFINET Qualified Channel Diagnosis

The Qualified Channel Diagnosis expands the extended channel diagnosis with a so called qualifier which provides additional information about the criticality of the diagnosis.

For PROFIBUS PA profile v3.x field devices, the Ethernet-APL rail field switch maps the field device diagnosis to the PROFINET severity and the qualified channel diagnosis according to the tables in the following chapters.

The presentation of the diagnosis qualifier is specific for a control system. Refer to the documentation of the control system in use.

PROFIBUS PA Devices Process Status and Alarms

PROFIBUS PA device process status and diagnostic alarms are mapped to the PROFINET diagnosis severity according to the "Profile for Process Control Devices V 4.02."

PROFINET diagnosis severity	PROFIBUS standard diagnosis status	PROFIBUS PA profile condensed status
Fault	Station non-existent Config fault Ext diag Not supported Parameter fault	Maintenance alarm
Maintenance demanded	-	Maintenance demanded Invalid values
Maintenance required	-	Maintenance required
No error	all others	all others, including function check

Table 6.1

NE107 Status Messages

NE107 status messages are used within the web server and FDI to classify the status of a diagnostic alarm.

Symbol	Meaning
	No problems detected
	Diagnostics disabled
	Failure
	Maintenance required

Table 6.2

6.2 LED Information

LED identification	Description	Color	Status / Possible cause	Troubleshooting
PWR A, PWR B	Status of power supply A and B	Green on	Power available	-
		Off	No power available	• Check power supply and connection to the rail field switch. • Restart rail field switch. If the problem persists, send the rail field switch to Pepperl+Fuchs.
STATUS	Status of the rail field switch	Off	Good	-
		Blue on	Maintenance required	See note
		Red on	Failure	See note
LNK/CHK P1 ... P4	Status of the Ethernet ports	Off	No communication link established	-
		Green on	Communication link established	-
		Green flashing	Communication link activity	-
		Red flashing	Check function	See note
	Locating devices	P1 ... P4: Green simultaneous flashing (1 Hz)	Loacte device function activated	-

LED identification	Description	Color	Status / Possible cause	Troubleshooting
S1 ... Sn	Status of the spurs	Off	No communication link established	Check connection to the field device.
		Green on	Communication link with Ethernet-APL field device established	-
		Green flashing	Communication link activity with Ethernet-APL field device established	-
		Yellow flashing	Communication with PROFIBUS PA field device established.	
		Red flashing	Check function Overload condition Cable is too short Field device takes too much current	See note

Table 6.3

Note

Read the diagnosis information provided by the web server or the asset management tool.

6.3 Communication Statistics

The web server provides additional diagnosis information that is only available through the web server.

For Ethernet-APL and PROFIBUS PA, the Ethernet-APL rail field switch monitors the network traffic by managing counters of sent and received frames through its network ports. By checking these counters, errors on the ports or on the Ethernet-APL rail field switch can be identified.

The counters are provided, e. g., by the web server for further analysis. Refer to section "Diagnostics > Network > Statistics."

Ethernet-APL communication statistics

- **IN packets**
  Number of frames successfully received through a port/ports. Differentiation is made whether the frame type is a unicast packet or a non-unicast packet.
  Display format: Unicast | Non-unicast packets
- **OUT packets**
  Number of frames successfully sent through a port/ports. Differentiation is made whether the frame type is a unicast packet or a non-unicast packet.
  Display format: Unicast | Non-unicast packets
- **IN failures**
  Number of frames received through a port/ports that is dropped by the Ethernet-APL rail field switch. Differentiation is made whether the frame itself is erroneous, e. g., CRC error, or the Ethernet-APL rail field switch must discard the frame, e. g., bandwidth problems.
  Display format: Errors | Discards
- **OUT failures**
  Number of frames that couldn't be sent through a port/ports. Differentiation is made whether the frame itself is erroneous, e. g., cable fault, or the Ethernet-APL rail field switch must discard the frame, e. g., bandwidth problems.
  Display format: Errors | Discards

The following statistic communication statistic counters are only available if a PROFIBUS PA device is connected to a spur port:

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PROFIBUS PA communication statistics

- **IN frames**
  Number of successfully received frames
- **OUT frames**
  Number of successfully sent frames through a port.
- **IN errors**
  Number of received frames through a port, where an error is detected as, e.g., framing error, CRC error
- **No response**
  Number of master requests where no response has been returned
- **Retries**
  Number of consecutively sent master requests where no response has been returned

6.4 SFP Transceiver Physical Layer Information

Not all SFP transceivers support diagnostic monitoring. Refer to the datasheet of the SFP transceiver that you wish to use.

A choice of SFP transceiver provided by Pepperl+Fuchs support fiber-optic diagnostic monitoring in real-time according to the Multi-Source Agreement (MSA). For further details refer to the datasheet of the SFP transceiver from Pepperl+Fuchs.

The limit values used to issue diagnostic alarms vary depending on the SFP transceiver.

Parameter	Description	Explanation	Availibility
RX power	Receive power in [mW] and [dbm]	The RX power is the incoming signal power being received from the far end SFP transceiver.	Web server, FDI package
TX power	Transmit power in [mW] and [dbm]	The optical TX power is the transmit power emitted from a SFP transceiver.	Web server, FDI package
TX bias current	Bias current of the send laser diode in [mA]	The DC current applied to the sending diode. An increase of the bias current is an alteration indicator of the laser diode.	Web server, FDI package
Temperature	Temperature of the transceiver in degree Celcius [°C]	The SFP transceivers operation temperature.	Web server, FDI package

Table 6.4

6.5 Ethernet-APL Physical Layer Information

The rail field switch provides physical layer measurements specifically adapted to Ethernet-APL. The rail field switch compares some of the measured values to fix limit values. If the limits are exceeded, a diagnostic alarm is generated. Some of the physical layer measurements are read-only information on the web server and do not generate diagnostic alarms.

The physical layer measurements results are specific for the hardware implementation of a network switch. Measurement results may differ to measurement results done with an external tool or a network switch from other vendors. "Maintenance required" and "Out of Specification" limit values are based on field experiences and extensive tests with field devices.

Parameter	Description	Explanation	Availability
Spur output voltage	Actual output voltage of a spur in volt [V].	The actual output voltage depends from the type of Ethernet-APL port. Refer to the datasheet of the rail field switch in use.	Web server, FDI package
Spur output current	Actual output current of a spur given in milliampere [mA].	The maximum output current depends on the type of Ethernet-APL port. Refer to the datasheet of the rail field switch in use. The actual output current depends on the current consumption of the connected field device. Ethernet-APL field devices have to consume a minimum of 20 mA.	Web server, FDI package
Signal-to-Noise Ratio (SNR)	The ratio between the power of the field device communication signal and segment noise given in decibel [db].	The SNR is a measure to determine how strong the communication signal is compared to the noise in the signal frequency range. If the communication signal is much stronger than the noise, the communication is stable. If the noise level is near to the communication signal level, devices are not able to differentiate between the signal and noise. So no stable communication is possible. Noise sources can be external disturbers due to, e. g., cross talk from other Ethernet-APL segments. The quality of the cable installation is also an important factor.	Web server, FDI package PROFINET alarm

Table 6.5

6.6 PROFIBUS PA Physical Layer Information

The rail field switch measures and displays the quality of the communication signal and provides physical layer measurements specifically adapted to PROFIBUS PA. The rail field switch compares some of the measured values to fix limit values. If the limits are exceeded, a diagnostic alarm is generated. Some of the physical layer measurements are only shown in the web server.

PROFIBUS PA has been originally designed for bus networks with long cable lengths. Several components like segment coupler, segment protector/field barrier, and field device are connected to one network. Each of these components influence the quality of the communication signal.

The Ethernet-APL rail field switch provides spur connections for one field device with a maximum cable length of 120 m. The segment is well structured, and the impact of the cable and the connected field device is limited. The PROFIBUS PA physical interface of the rail field switch employs superior data detection methods and greatly improved noise rejection. Therefore the specified limit values used to issue "Maintenance required" or "Out of Specification" alarms may be different to what has been experienced in the past in large networks.

Parameter	Description	Explanation	Availability
Spur output voltage	Actual output voltage of a spur in volt [V].	The actual output voltage depends from the type of port. Refer to the datasheet of the rail field switch in use.	Web server, FDI package
Spur output current	Actual output current of a spur in milliampere [mA].	The maximum output current depends on the type of port. Refer to the datasheet of the rail field switch in use. The actual output current depends on the current consumption of the connected field device. Field devices have to consume a minimum of 10 mA.	Web server, FDI package

Parameter	Description	Explanation	Availability
Signal level	The field device communication signal level in millivolt [mV]	Low signal levels lead to reduced immunity against influences on electromagnetic compatibility. Longer cables, wrong cable types, corrosion on terminals and defective field devices cause low signal level.	Web server, FDI package PROFINET alarm
Jitter	The field device communication signal jitter in micro seconds [µs]	Signal jitter is the deviation from the ideal zero crossing point of the transmitted signal curve during the nominal bit duration, measured in relation to the previous zero crossing. The signal jitter is the most important measure to determine the quality of a PROFIBUS PA installation. A high jitter level causes communication problems and a lack of operational reliability. If your system runs at a higher jitter level, the level of immunity against influences on electromagnetic compatibility is reduced. Jitter can have the following causes: Crosstalk, electromagnetic interferences (EMI), bad wiring practice, and use of wrong cable type.	Web server, FDI package PROFINET alarm

Table 6.6

6.7 Switch Device Diagnostics

6.7.1 PROFINET Switch Device Diagnostics

Following table lists possible diagnostic alarms that are associated with the Ethernet-APL switch.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / qualifier	Status web server / FDI NE107 status
Sec/NoWebserverPassword	Web server enabled but no password configured.	For device security, protect the device against unauthorized access. Configure a password or disable the web server.	Maintenance required / Qualifier_12	Maintenance required
Power/NoPowerInputA	Power supply A not available.	The power supply A input voltage is not in the specified range. Check the power supply and the physical connection between the power supply and the Ethernet-APL switch.	Maintenance required / Qualifier_12	Maintenance required
Power/NoPowerInputB	Power supply B not available.	The power supply B input voltage is not in the specified range. Check the power supply and the physical connection between the power supply and the Ethernet-APL switch.	Maintenance required / Qualifier_12	Maintenance required
PN/NoConnection	PROFINET enabled but no connection to controller established.	No physical connection between the switch and the controller. Erroneous configuration of the PROFINET controller. Check the physical connection between the controller and the Ethernet-APL switch. Check if both controllers are working properly	-	no NE107 status, info only

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / qualifier	Status web server / FDI NE107 status
PN/NoRedundancy	Redundant PROFINET connection configured but one connection down	PROFINET S2-redundancy configured but one connection down. Check the physical connections between both controllers and the Ethernet-APL switch. Check if both controllers are working properly.	Failure / Qualifier_30	no NE107 status, info only

Table 6.7

6.7.2 Condition Monitoring

Temperature stress, lifetime prognostics and operating time are important parameters to evaluate a remaining lifetime of the rail field switch. The designed lifetime of the rail field switch is 15 years at an ambient temperature of +40 °C. The lifetime is calculated under maximum load conditions and continuous operation. Depending on the operating temperature and the load condition, the lifetime may be extended or shortened. Temperatures higher than the operating temperature range cause stress to the electronic components of the rail field switch and accelerates the aging process of the components. The rail field switches are typically mounted in enclosures or cabinets that include other components. More heat sources, such as auxiliary power supplies or conventional Ethernet switches, generate temperature hotspots that raise the ambient temperature in the enclosure or cabinet. Terminals and cable trays may affect natural airflow that increases the internal temperature of the rail field switch. Counteractingly, an installed ventilator generates airflow that removes heat from the rail field switch and lowers the temperature of the electronic components. Therefore, monitoring the temperature at a single point in the housing of the rail field switch, enclosure, or cabinet is insufficient for determining the temperature of the electronic components of the rail field switch. With only single point measurement, it is not possible to draw a meaningful conclusion about the stress level of the rail field switch and thus its lifetime.

For that reason, the rail field switch incorporates several temperature measuring points to provide an internal temperature profile. These temperature measuring points are positioned near the electronic components that have the most influence on the lifetime.

The internal temperature profile that is observed throughout time is used for the following:

- The rail field switch continuously compiles a temperature stress assessment.
- The rail field switch determines its lifetime.

The information regarding the temperature stress level and lifetime prognostics is displayed on the web server as a 3-color gradient bar with a flash showing the current value. The colors are green, yellow, and red.

Temperature Stress

- Green: Good, the operating temperature does not negatively impact the lifetime
- Yellow: Attention; if the operating temperature prevails for a longer period of time, the lifetime is shortened.
- Red: Critical; if the operating temperature prevails for a longer period of time, the lifetime is significantly shortened.

Lifetime Prognostics

- Green: Good, the lifetime is as specified 15 years or more.
- Yellow: Attention; the specified lifetime is shortened to approximately 12 years or less.
- Red: Critical; the specified lifetime of the rail field switch is significantly shortened to approximately 6 years or less. If the pointer is on the right end, the lifetime is less than 3 years.

Operating Time

The operating time in years, days, and hours is given since the first power-on. The designed lifetime is 15 years (131400 h) at a maximum ambient temperature of 40 °C. Together with the lifetime prognostics an approximative remaining lifetime can be determined.

Note

The temperature stress and lifetime prognostics data are only meaningful when the rail field switch is mounted horizontally.

The temperature stress and lifetime prognostics data are only available with PANOS version 1.3.0, which was released in June 2024. Prior to this date, the temperature stress and lifetime prognostics for rail field switches in use were not recorded.

6.8 Uplink Ports and Spur Ports Diagnostics

The following table shows available standard PROFINET diagnosis information related to all uplink ports and spur ports.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause	PROFINET diagnosis severity / qualifier	Status web server / FDI NE107 status
PN/PeerNameMismatch	PROFINET: Peer station name does not match configured topology	Wrong device is connected; the device name of the connected device does not match the configuration.	Failure / Qualifier_30	no NE107 status, info only
PN/PeerPortMismatch	PROFINET: Peer port does not match configured topology	The connected device was connected to the wrong port. In addition, the "Peer name of station mismatch" error may be pending if the wrong device was connected to this port.	Failure / Qualifier_30	no NE107 status, info only
PN/NoPeer	PROFINET: No peer detected	The neighbor device is not detectable. (e. g., example, link down, or LLDP timeout)	Failure / Qualifier_30	no NE107 status, info only
PN/PeerMauMismatch	PROFINET: Peer link type does not match local link type	Own MAU type does not match the MAU type of the connected port.	Failure / Qualifier_30	no NE107 status, info only
PN/LinkMismatch	PROFINET: Link mismatch	Link state does not correspond to the input. Link state is down.	Failure / Qualifier_30	no NE107 status, info only
PN/MauMismatch	PROFINET: Actual link type does not match configured link type	Detected MAU type does not match the configuration.	Failure / Qualifier_30	no NE107 status, info only

Diagnosis ID	Diagnosis message web server / FDI	Possible cause	PROFINET diagnosis severity / qualifier	Status web server / FDI NE107 status
MRP/Domain-Mismatch	MRP: Actual domain name does not match configured domain name	The configured MRP DomainUUID is different to the MRP DomainUUID of the adjacent port. • MRP domain of the system was reconfigured and all stations have not yet been reloaded yet. • Ring ports are connected incorrectly.	Failure / Qualifier_30	no NE107 status, info only
MRP/NoPeer	MRP: No peer detected	In an MRP ring, it was not possible to recognize the neighbor (e. g., Link down or LLDP timeout).	Failure / Qualifier_30	no NE107 status, info only

Table 6.8

6.9 Uplink Ports Diagnostics

The following table shows diagnosis information related to all uplink ports including the SFP interfaces.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
Link/Down	Port enabled, but link down.	The port is enabled but no device connected. Check the physical connection to the device or disable the port.	Failure / Qualifier_30	Maintenance required
SFP/NoModule	Port enabled but no SFP module plugged.	The port is enabled but no device connected. If a SFP module is plugged, change the module or disable the port.	Failure / Qualifier_30	Maintenance required
SFP/UnsuppModule	SFP module type not supported	The Ethernet-APL rail field switch does not support the plugged SFP module. Use a SFP module that is compatible with the Ethernet-APL rail field switch. Compatible SFP modules are listed in the datasheet of the Ethernet-APL rail field switch and available under www.pepperl-fuchs.com.	-	no NE107 status, info only
SFP/NeedReboot	Ethernet-APL rail field switch reboot required to adapt to plugged SFP module	A SFP module has been changed to a different type. To adapt the new configuration, reboot the Ethernet-APL rail field switch by powering up or by pressing the RESET button for at least 5 seconds.	Failure / Qualifier_30	Maintenance required
SFP/TxBiasCurrHi	SFP module's TX bias current is above the Hi limit	The transmit laser diode is aging or your fiber optic connection is damaged. Check your fiber optic connectors and cables for damage on both ends. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
SFP/TxBias-CurrHiHi	SFP module's TX bias current is above the HiHi limit	The transmit laser diode has reached the end of its lifetime or your fiber optic connection is damaged. Check your fiber optic connectors and cables for damage on both ends. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required
SFP/TxPower-LoLo	SFP module's TX power is below the LoLo limit	The SFP module has an issue. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required
SFP/TxPow-erLo	SFP module's TX power is below the Lo limit	The SFP module has an issue. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required
SFP/TxPow-erHi	SFP module's TX power is above the Hi limit	The SFP module has an issue. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required
SFP/TxPower-HiHi	SFP module's TX power is above the HiHi limit	The SFP module has an issue. Replace the SFP module.	Maintenance required / Qualifier_12	Maintenance required
SFP/RxPower-LoLo	SFP module's RX power is below the LoLo limit	The fiber infrastructure has issues. Check connectors and cables for dirt, moisture, and damage on both ends. Check the length and bending radius of the fiber cable. Check the SFP module at either end.	Maintenance required / Qualifier_12	Maintenance required
SFP/RxPow-erLo	SFP module's RX power is below the Lo limit	The fiber infrastructure has issues. Check connectors and cables for dirt, moisture, and damage on both ends. Check the length and bending radius of the fiber cable. Check the SFP module at either end.	Maintenance required / Qualifier_12	Maintenance required
SFP/RxPow-erHi	SFP module's RX power is above the Hi limit	The fiber infrastructure has issues. Check connectors and cables for dirt, moisture, and damage on both ends. Check the length and bending radius of the fiber cable. Check the SFP module at either end.	Maintenance required / Qualifier_12	Maintenance required
SFP/RxPower-HiHi	SFP module's RX power is above the HiHi limit	The fiber infrastructure has issues. Check connectors and cables for dirt, moisture, and damage on both ends. Check the length and bending radius of the fiber cable. Check the SFP module at either end.	Maintenance required / Qualifier_12	Maintenance required

Table 6.9

6.10 Spur Ports Diagnostics

The following table gives diagnosis information related to spurs port independent if an Ethernet-APL device or a PROFIBUS PA device is connected.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
Link/Down-NoCurrent	Spur enabled, but link down and no current drawn	No field device is connected. Cable wire break. Check the physical connection between the controller and the Ethernet-APL switch.	Failure / Qualifier_30	Maintenance required
Link/DownCurrent	Spur enabled and current drawn but link down	The field device is defective; device draws current but does not create link. Check the field device. If necessary, change the field device.	Failure / Qualifier_30	Maintenance required
Link/Overload	Spur overload / short circuit	The field device connected to the spur takes more current than the port can provide or the cable wires are shorted. Check the physical connection between the controller and the Ethernet-APL switch. Check if the port class of the field device is compatible with the port class of the spur.	Failure / Qualifier_30	Maintenance required

Table 6.10

6.11 Spur Ports Diagnostics with Ethernet-APL Device

The following table gives diagnosis information related to spurs port when an Ethernet-APL device is connected.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
APL/SNRLo	SNR is below low limit	The signal-to-noise ratio (SNR) is less than 22 dB. Communication quality is reduced. The diagnosis is reset if the measured SNR value exceeds 23 dB. Check the installation for correct cable type. Check the installation for correct shielding and wiring. Check the field device. If necessary, change the field device.	Maintenance required / Qualifier_12	Maintenance required
APL/SNRLoLo	SNR is below the LoLo limit	The signal-to-noise ratio (SNR) is less than 20 dB. No stable communication is possible. The diagnosis is reset if the measured SNR value exceeds 21 dB. Check the installation for correct cable type. Check the installation for correct shielding and wiring. Check the field device. If necessary, change the field device.	Maintenance required / Qualifier_12	Maintenance required

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6.12 Spur Ports Diagnostics with PROFIBUS PA Device

The following table gives diagnosis information related to spurs port when a PROFIBUS PA device is connected.

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
FB/CfgFault	Field device parameterization error (CFG_FAULT)	Check the content of the diagnostic message sent by the PROFIBUS PA device for details. Use the asset management access to the PROFIBUS PA devices for further analysis. Check the configuration data of the PROFIBUS PA device.	Fault / Qualifier_30	no NE107 status, info only
FB/DeviceFail	Field device reports "Failure" diagnosis	Check the content of the diagnostic message sent by the PROFIBUS PA device for details. Use the asset management access to the PROFIBUS PA devices for further analysis.	Fault / Qualifier_30	no NE107 status, info only
FB/DeviceFC	Field device reports "Function Check" diagnosis	The PROFIBUS PA device sent a diagnosis with Function Check status. Check the content of the diagnostic message sent by the PROFIBUS PA device for details. Use the asset management access to the PROFIBUS PA devices for further analysis.	FunctionCheck / Qualifier_24	no NE107 status, info only
FB/JitterHi	Field device jitter is above the Hi limit	The field device signal jitter is higher than 2.8 µsec. The diagnosis is reset if the measured jitter value falls below 2.5 µsec. • Wrong cable type, cable impedance not correct. • Field device is defective or does not comply with the specification. Check the cable type. Change the field device.	Maintenance required / Qualifier_12	Maintenance required
FB/JitterHiHi	Field device jitter is above the Hi Hi limit	The field device signal jitter is higher than 3.2 µsec. The diagnosis is reset if the measured jitter value falls below 2.9 µsec. • Wrong cable type, cable impedance not correct. • Field device is defective or does not comply with the specification. Check the cable type. Change the field device.	Maintenance required / Qualifier_12	Maintenance required
FB/MR	Field device reports "Maintenance required" diagnosis	The PROFIBUS PA device sent a diagnosis with Maintenance required status. Check the content of the diagnostic message sent by the PROFIBUS PA device for details. Use the asset management access to the PROFIBUS PA devices for further analysis.	Maintenance required / Qualifier_12	no NE107 status, info only

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
FB/NoDataExchange	Field device not in data exchange	A PROFIBUS PA device has been detected, but the Ethernet-APL switch is not configured by the control system to exchange process data with the connected PROFIBUS PA device. Configure the control system for process data exchange by adding the PROFIBUS PA device to the Ethernet-APL switch configuration.	-	no NE107 status, info only
FB/NoDevice	Configured field device not connected / communication error	No field device has been detected. • The connection between the Ethernet-APL switch and the field device is broken. • Field device is defective. Check the cable connection. Change the field device.	Fault / Qualifier_30	no NE107 status, info only
FB/DeviceOOS	Field device reports "Out of Specification" diagnosis	The PROFIBUS PA device sent a diagnosis with Out of Specification status. Check the content of the diagnostic message sent by the PROFIBUS PA device for details. Use the asset management access to the PROFIBUS PA devices for further analysis.	Advice / Qualifier_5	no NE107 status, info only
FB/PNParamError	PROFINET parameterization error	Parametrization data for the connected PROFIBUS PA device is erroneous. The parameter data sent during the start-up of the Ethernet-APL switch related to the connected PROFIBUS PA devices is not correct, e. g., "Empty" submodule missing if a multi-variable PROFIBUS PA device is in use. Check the parametrization data for the PROFIBUS PA device.	Fault / Qualifier_30	no NE107 status, info only
FB/PrmFault	Field device parameterization error (PRM_FAULT)	Parameter data sent to the PROFIBUS PA device is incorrect. Check the parameterization data of the PROFIBUS PA device.	Fault / Qualifier_30	no NE107 status, info only
FB/SignalLoLo	Field device signal level is below the LoLo limit	The field device signal level is less than 750 mV. The diagnosis is reset if the signal level gets higher than 850 mV. • Terminals are corroded. • Cable resistance is too high. • Field device is defective. Check the terminals at the Ethernet-APL switch and the field device for corrosion. Check the cable type and length. Change the field device.	Maintenance demanded / Qualifier_22	Maintenance required

Diagnosis ID	Diagnosis message web server / FDI	Possible cause Troubleshooting	PROFINET diagnosis severity / Qualifier	Status web server / FDI NE107 status
FB/SignalLo	Field device signal level is below the Lo limit	The field device signal level is between 750 mV ... 950 mV. The diagnosis is reset if the signal level gets higher than 1050 mV. • Terminals are corroded. • Cable resistance is too high. • Field device is defective. Check the terminals at the Ethernet-APL switch and the field device for corrosion. Check the cable type and length. Change the field device.	Maintenance required / Qualifier_12	Maintenance required
FB/SignalHi	Field device signal level is above the Hi limit	The field device signal level is between 1900 mV ... 2100 mV. The diagnosis is reset if the signal level gets lower than 1800 mV. Change the field device.	Maintenance required / Qualifier_12	Maintenance required
FB/SignalHiHi	Field device signal level is above the HiHi limit	The field device signal level is higher than 2100 mV. The diagnosis is reset if the signal level gets lower than 2000 mV. Change the field device.	Maintenance required / Qualifier_12	Maintenance required

Table 6.12

7 Maintenance

Regular maintenance of the Ethernet-APL rail field switches is not required. Required information to determine the health status of a rail field switch is available either through the control system, the maintenance station or the web server.

It is recommended to check regularly on www.pepperl-fuchs.com for software updates. Software updates may include network security relevant changes.

When replacing rail field switches, connected Ethernet-APL devices, or connected PROFIBUS PA devices, follow the engineering procedures of the control system in use.

Ethernet-APL rail field switches support the PROFINET feature "Dynamic Reconfiguration" (DR). Depending on the type of configuration, the change of configurations may be bumpless during runtime. That means, the rail field switch and the process data of connected field devices are available throughout the change of the configuration. See chapter 4.6

Tip

It is recommended to save a configuration file offline, in case a switch needs to be replaced. The configuration file of the switch can be downloaded from the web server under *Configuration/Device/Backup_Restore*. See chapter 8.1.4.3.

Updating the Firmware of the Switch

The firmware and stored documents of Ethernet-APL switches can be upgraded to the latest version using the web server. During the firmware update the switch and its connected field devices are temporarily not available. The firmware update will take several minutes. Observe the web server progress bar.

Tip

You can use the Pepperl+Fuchs software PFDCT for bulk software updates in your installation.

See chapter 8.1.4.3

8 Asset Management

8.1 Web Server

To configure the network functions and to provide diagnostic information of the network and information of the rail field switch itself, the switches support a built-in HTTP/HTTPS web server.

Note

The screenshots shown in the following sections were taken on a PC with the user role "Administrator." For other user roles, the accessible content may be restricted. For further information regarding user roles and user account priviles and rights, refer to section "Configuration > Device > User management." see chapter 8.1.4.3

To access the web server for the first time, see chapter 5.1.

8.1.1 User Interface Basics

Login

1. Enter the IP address of the switch into the address box of the web browser.

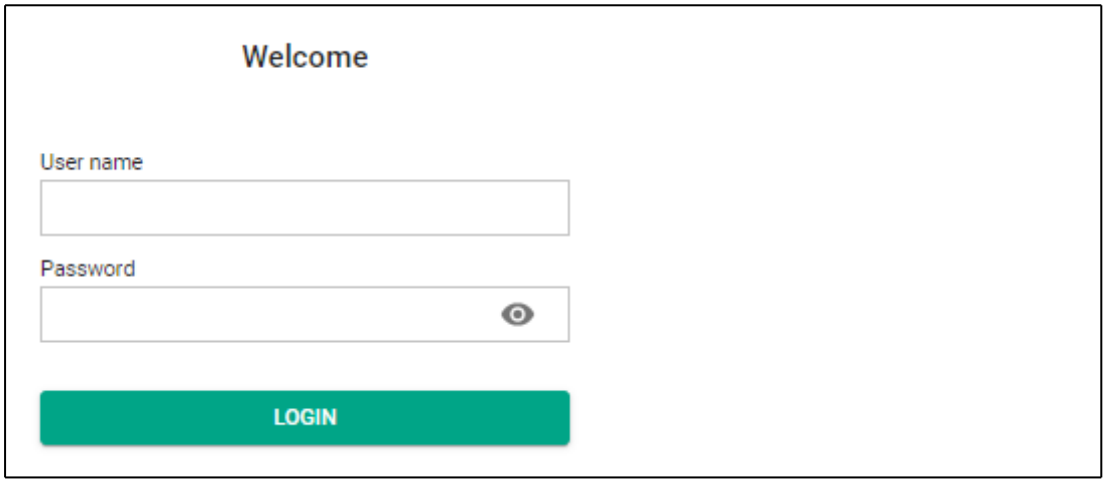

Figure 8.1

2. Enter a user name.
3. Enter your password.
4. The password is hidden via dots. To view the current password, click  .
5. Press the "Login" button.

Window structure

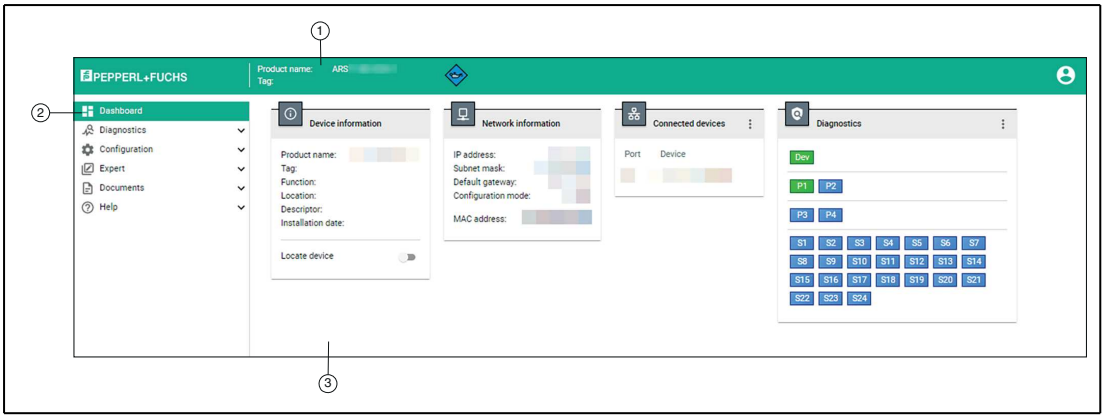

Figure 8.2

1 Title bar
Displays the following

- product name
- device tag description / PROFINET name of station
- current device summary status
- link to the web server access management menu

2 Navigation bar
Displays all menus

3 Main page / content page

Web Server Access Management Menu

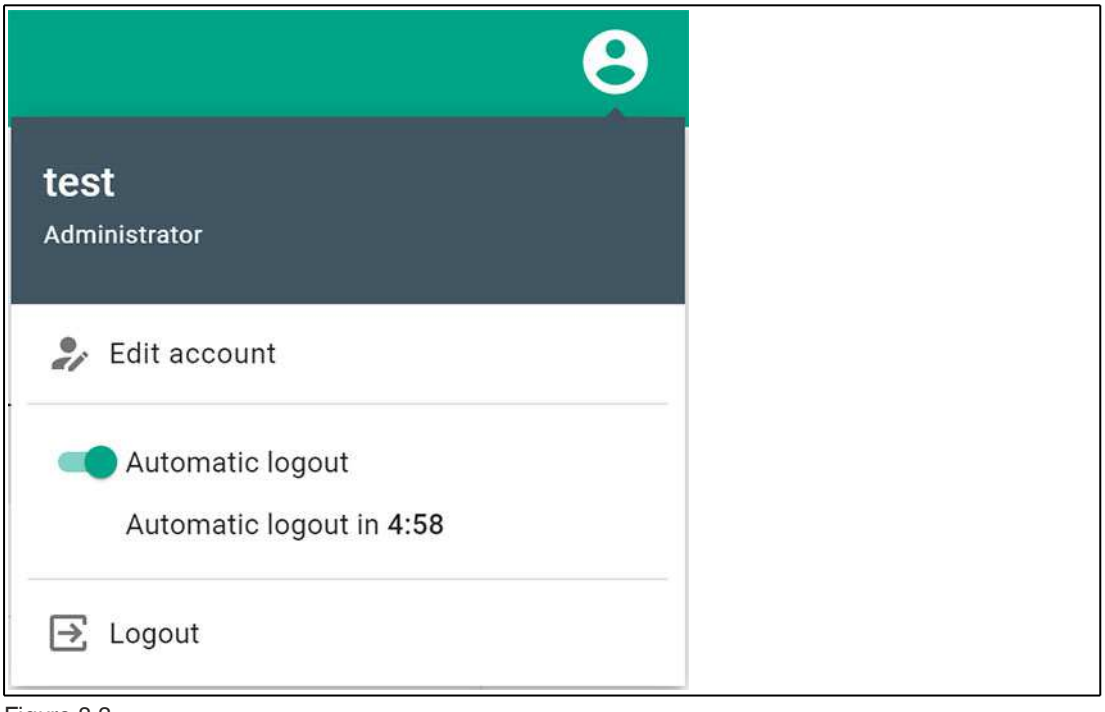

Figure 8.3

To open the menu, press the user icon on the right hand side of the title bar.

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The user can choose the following options:

- Edit account
- Turn off/on the automatic logout after 5 minutes
- Logout

Note

During firmware update and snapshot creation, the automatic logout is disabled. The automatic logout will be delayed until a firmware update or snapshot creation is completed.

Edit Account

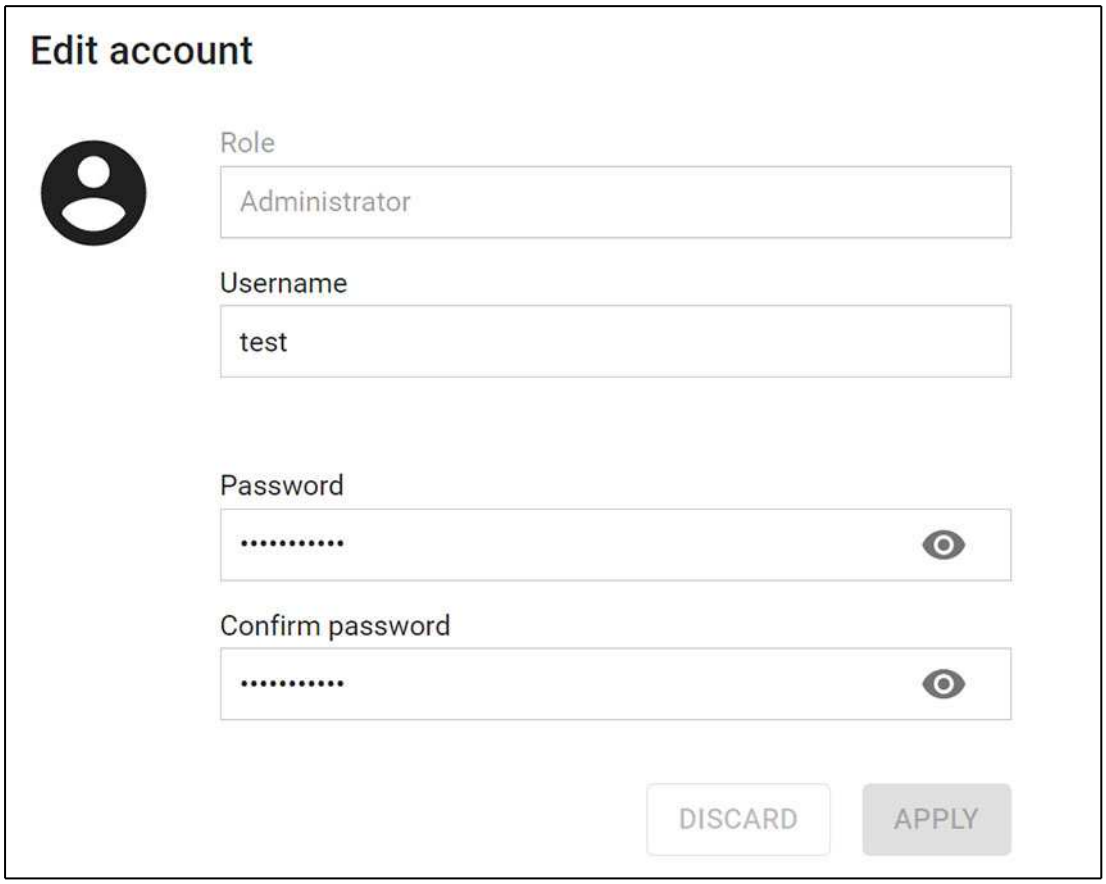

Figure 8.4

To change the username and password of logged-in user, click "Edit account."

For further information regarding user roles, access the user management menu. See chapter 8.1.4.3.

8.1.2 Dashboard

Overview Tab

Figure 8.5

After the login, the start page is the dashboard. The dashboard is an overview of information regarding the device and the Ethernet-APL network where the device is located. Following information is displayed:

- **Device information**
  This widget shows general device information that helps to identify the device in an installation. The displayed product name is the Pepperl+Fuchs product type identification. All other parameters are PROFINET I&M text strings that can be defined by the user using a PROFINET control system.
  By activating "Locate device", the switch port LEDs LNK /CHK P1 ... P4 start to flash green simultaniously with 1 Hz. The flashing stops when you disable "Locate device."
  For further information see chapter 8.1.3.4.
- **Network information**
  This widget shows network information of the device.
  For further information `Configuration / Device / IP settings`.
- **Connected devices**
  This widget shows all connected Ethernet-APL or PROFIBUS PA devices and the ports to which the devices are connected. Information of the connected device is displayed when mousing over it. By clicking on ⋮, a context menu appears. To jump to menu `Diagnostics / Network / Connected devices`, select "Show details... ."
  For further information see chapter 8.1.3.3.
- **Diagnosis**
  This widget shows the diagnostic states of the device at each interface. Diagnostic status of the device is indicated by the color of the respective button and is displayed when mousing over it. By clicking on ⋮, a context menu appears.
  - To collapse the view and to show only interfaces that are in need for action, select "Reduce to significant diagnostic states."
  - To expand the view and to show all interfaces, select "Show all diagnostic states."
  - To jump to menu `Diagnostics / Diagnosis`, select "Show details... ."

  For further information see chapter 8.1.3.1.
- **Port mirroring enabled**
  If the port mirroring function is enabled, the destination and mirrored ports will be displayed.
  By clicking on ⋮, a context menu appears. To jump to menu `Configuration / Network / Port Mirroring`, select "Open configuration... ."
  For further information see chapter 8.1.4.2.

Security Tab

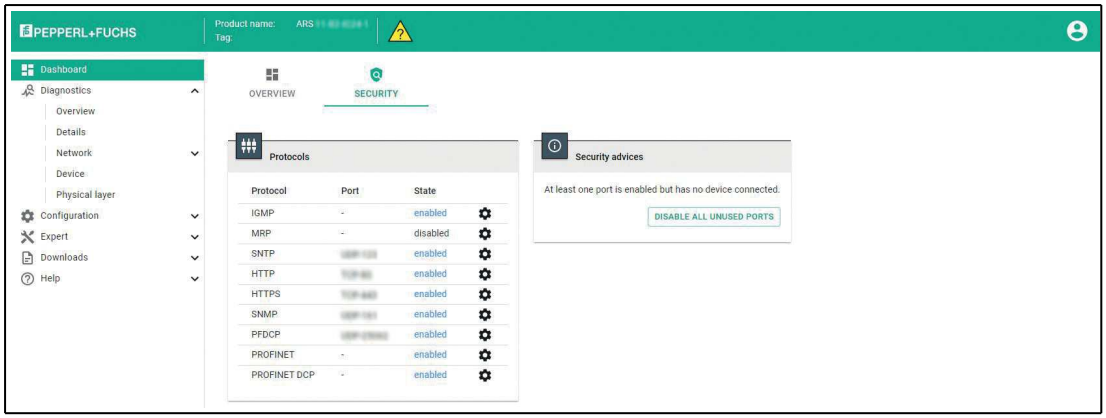

Figure 8.6

The security tab summarizes information and configuration of the device regarding security.

- **Protocols**
  This widget shows the configuration of all Ethernet protocols. To open or to change the configuration of a specific protocol, click ⚙. You are redirected to the specific protocol configuration menu.
- **Security advices**
  Login: If the automatic logout is deactivated, click the button "ENABLE AUTOMATIC LOGOUT" to activate the automatic logout.
  Port locking: If a port is enabled but no device is connected to the port, information is given. To disable all unused ports click the button "DISABLE ALL UNUSED PORTS." Specific ports can be deactivated in the menu `Configuration / Network / Ports`.

8.1.3 Diagnostics

8.1.3.1 Diagnostics / Overview

The menu `Diagnostic / Overview` provides diagnostic information for the device and all ports in a table format.

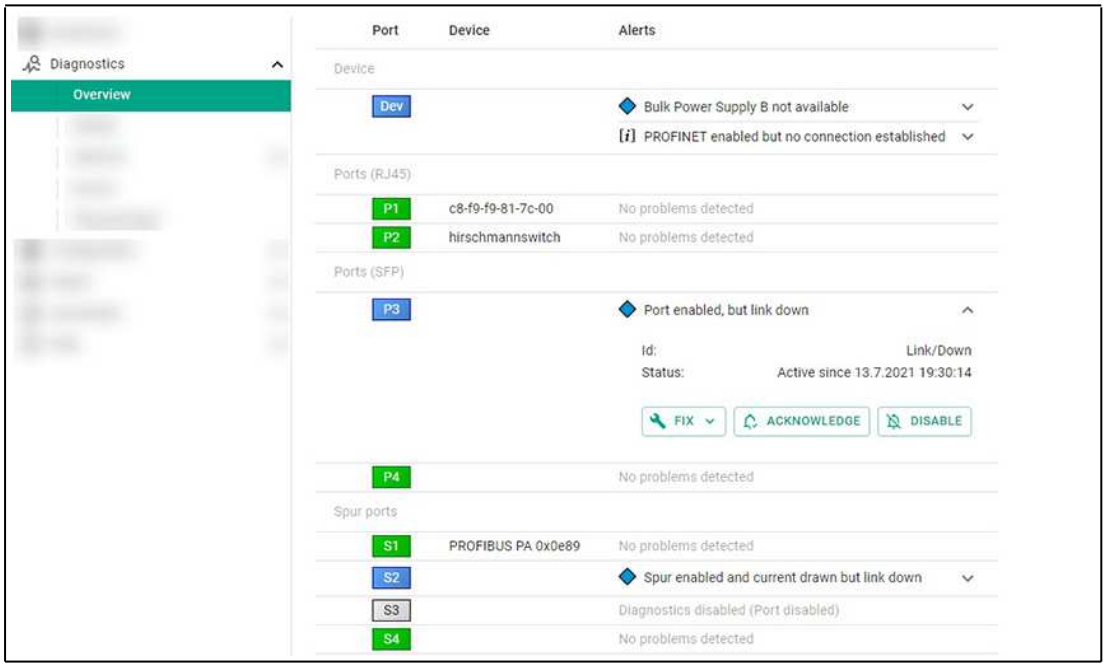

Figure 8.7

Port	summarize the most severe status of the device and the ports.
Device	displays the name of the device connected to the port.
Alerts	shows the list of active diagnostic alerts. Expand the description of the alert for a detailed view. For the explanation of the content of the detailed view see chapter 6.

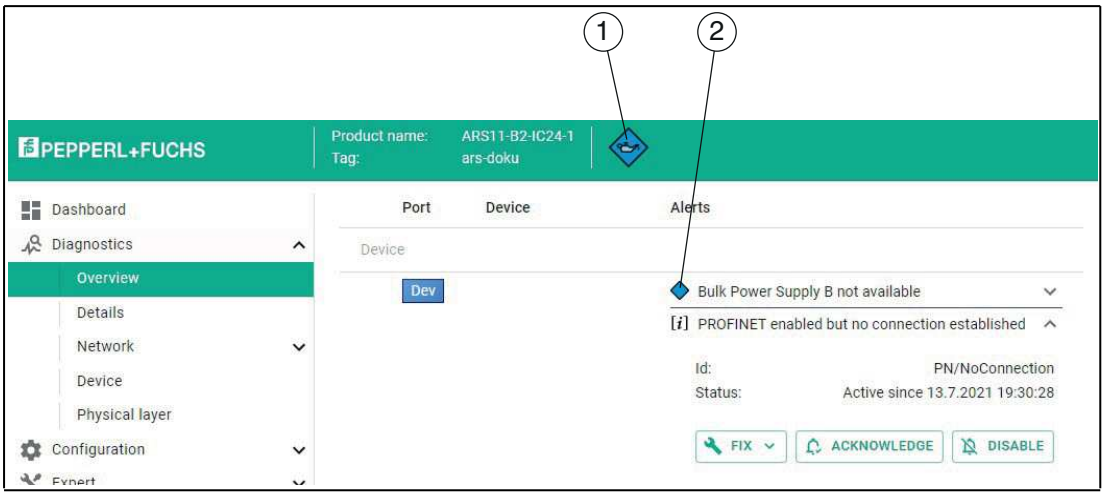

Figure 8.8

1 Diagnostic Alert

2 Details

Diagnostic Alert

An active diagnostic alert is described by:

- the NE107 sign with the description of the diagnostic information,
- an Id of the diagnosis alert as a unique reference,
- the status of the diagnosis alert, and
- the time and date when the diagnosis alert occurred the first time.

Additional alerts, which are classified as "Info only" and shown with the icon [i] are given, see chapter 6. These alerts are not mapped to the NE 107 status scheme but lead to PROFINET alarms. Alert messages following the icon indicate that either one or more alerts are in the state "acknowledged" or "disabled" or the DCS alarming is disable for a specific port or globally for the switch, see chapter 8.1.4.1.

An active diagnosis alert can be fixed, acknowledged or disabled by pressing the according button.

- The button "Fix" offers a solution to fix the condition that causes the alert.
- The button "Acknowledge" deletes the diagnosis alert. As long as the condition, which led to the alert, is still existent, no further alert will be generated.
- The button "Disable" stops this specific type of diagnosis condition from leading to a diagnostic alert for the device or the specific port. The menu "Configuration/Diagnosis" gives an overview on acknowledged alert and allows to enable disabled diagnostic alerts. The configuration of the diagnostic alerts are permanently saved even after rebooting the device.

For the descriptions of diagnostic alerts and troubleshootings, see chapter 6.

Example

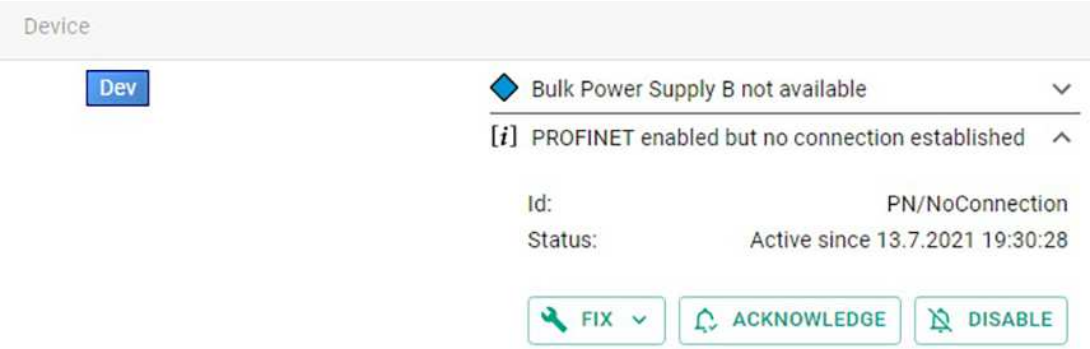

Figure 8.9 Example - Diagnosis alert of the device

Dev Device with background color. Background color indicates the summarized diagnosis status "Maintenance required."

◆ / [i]

- collapsed: NE107 sign "Maintenance required" and short description
- expanded: informational alert and short description
  Informational alerts indicate a slight deviation from the normal state that require no maintenance. Informational alerts do not have an effect on the total diagnosis status.

Id Unique reference ID

Status Status and timestamp

8.1.3.2 Diagnostics / Details

The menu `Diagnostics / Details` provides detailed information with the focus on the device (Ethernet-APL rail field switch) or a specific port.

Access Device Information

1. To see details, click on device button "Dev".

Device: Dev

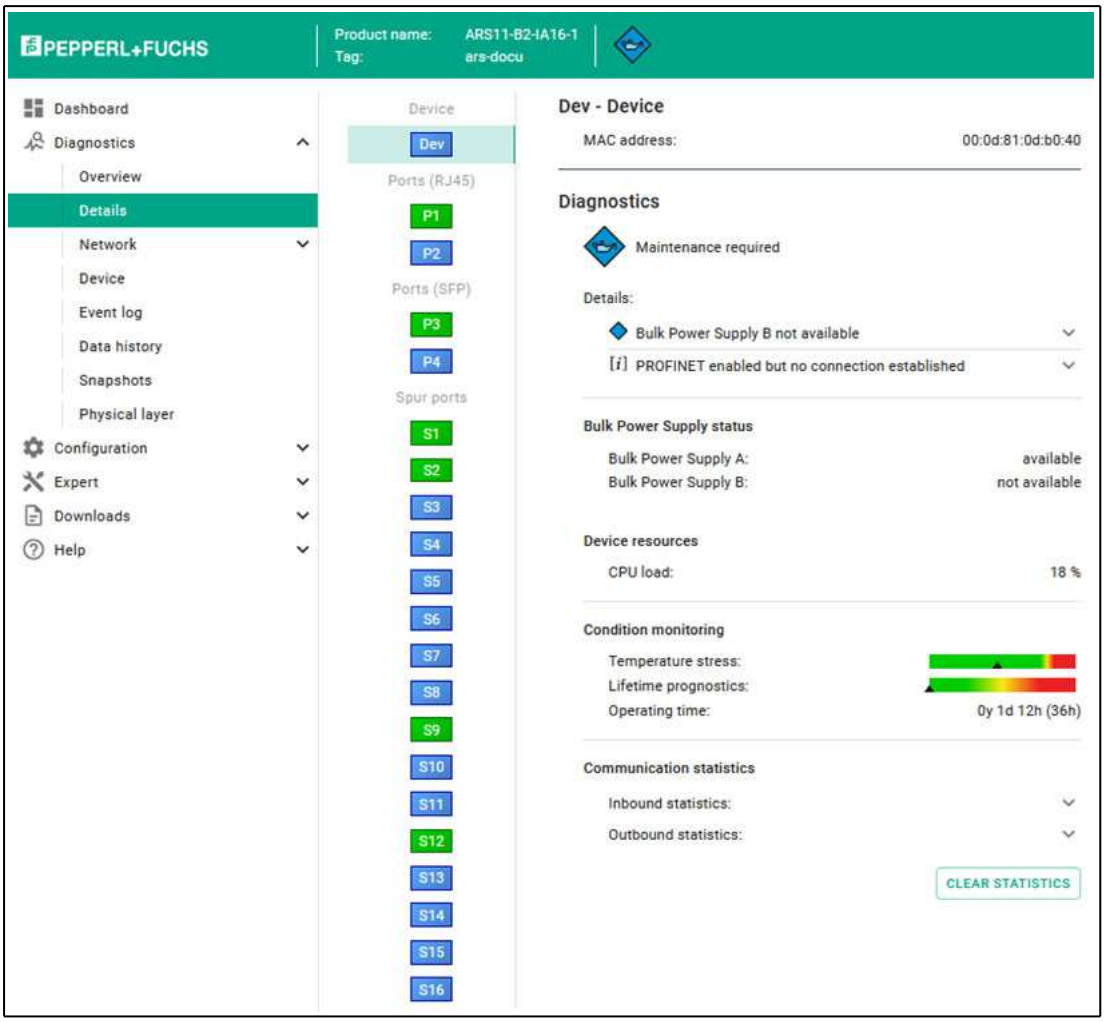

Figure 8.10

Dev - Device

- **MAC address:**
  MAC address of the Ethernet-APL rail field switch

Diagnostics

- **Icon and Sumary status**
- **Details:**
  All active diagnosis alerts are listed. An active diagnosis alert consists of the NE107 sign with the description of the diagnostic information, an Id of the diagnosis alert as a unique reference, the status of the diagnosis alert, and the time and date when the diagnosis alert occurred the first time.
  Additional alerts, which are classified as "Info only" and shown with the icon [i] are given, see chapter 6. These alerts are not mapped to the NE 107 status scheme but lead to PROFINET alarms. Alert messages following the icon  indicate that either one or more alerts are in the state "acknowledged" or "disabled" or the DCS alarming is disable for a specific port or globally for the switch, see chapter 8.1.4.1.
  An active diagnosis alert can be fixed, acknowledged or disabled by pressing the according button.
  For further information see chapter 6.
- **Bulk Power Supply status:**
  If a bulk power supply, feeding an output voltage within the specified voltage range, is connected to the PWR A and PWR B terminals, the status "available" is shown. Otherwise the status "not available" is shown.
- **Device resources:**
  CPU load: Specified in percent.
- **Condition monitoring:**
  Temperature stress: The rail field switch provides a temperature stress assessment based on several, internal temperature measurements. Higher internal temperatures shorten the specified lifetime of the rail field switch. For further information, see chapter 6.7.2.
  - Green: Good, the operating temperature does not negatively impact the lifetime.
  - Yellow: Attention; if the operating temperature prevails for a longer period of time, the lifetime is shortened.
  - Red: Critical; if the operating temperature prevails for a longer period of time, the lifetime is significantly shortened.

  Lifetime prognostics: Specified in percent.
  Based on the measured temperature stress over the operating time, the rail field switch predicts changes to the specified lifetime. For further information, see chapter 6.7.2.
  - Green: Good, the lifetime is as specified 15 years or more
  - Yellow: Attention; the specified lifetime is shortened to approximately 12 years or less.
  - Red: Critical; the specified lifetime of the rail field switch is significantly shortened to approximately 6 years or less. If the pointer is on the right end, the lifetime is less than 3 years.

  Operating time: The operating time in years, days, and hours is given.
- **Communication statistics:**
  The Ethernet-APL rail field switch manages statistics counters to count the number of received and sent frames for each port.
  Inbound statistics: Shows the communications statistics for all received frames and the inbound data rate in Mbit/s and percent of the bandwidth.
  Outbound statistics: Shows the communications statistics for all sent frames and the outbound data rate in Mbit/s and percent of the bandwidth.
  To set the statistic counters to 0, click on the button "CLEAR STATISTICS."
  For further information see chapter 6.3.

Access Port Information

1. To see details, click on port button.

Ports (RJ45) and Ports (SFP): P1 ... P4

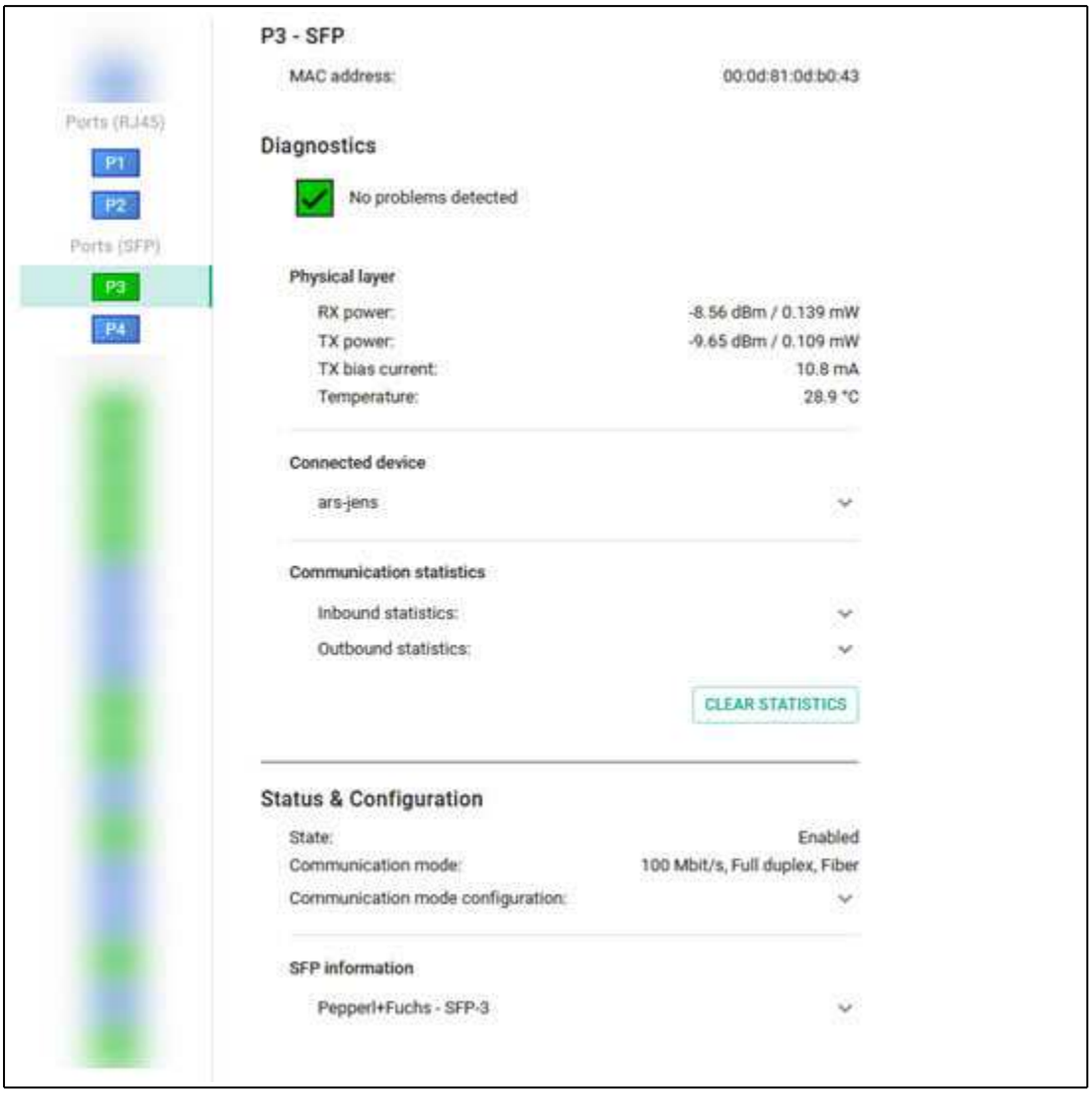

Figure 8.11 Example: P3 - SFP

Port Name - Port type[1]

- **MAC address:**
  MAC address of the port

Diagnostics

- **Icon and sumary status**
- **Details:**
  All active diagnosis alerts are listed. An active diagnosis alert consists of the NE107 sign with the description of the diagnostic information, an Id of the diagnosis alert as a unique reference, the status of the diagnosis alert, and the time and date when the diagnosis alert occurred the first time.
  Additional alerts, which are classified as "Info only" and shown with the icon [i] are given, see chapter 6. These alerts are not mapped to the NE 107 status scheme but lead to PROFINET alarms. Alert messages following the icon indicate that either one or more alerts are in the state "acknowledged" or "disabled" or the DCS alarming is disable for a specific port or globally for the switch, see chapter 8.1.4.1.
  An active diagnosis alert can be fixed, acknowledged or disabled by pressing the according button.
  For further information see chapter 6.
- **Physical Layer (SFP P3, P4 only):**
  If a fiber optic SFP module is inserted in port 3 or 4, the fiber optic diagnosis parameters RX power, TX power, TX bias current, and temperature are displayed. For details, see chapter 6.4.
- **Connected devices:**
  If a device is connected to the port, its identification information is shown.
  For more details, expand view. The information is read from the LLDP data.
- **Communication statistics:**
  The switch manages statistics counters to count the number of received and sent frames for each port.
  Inbound statistics: Shows the communications statistics for all received frames.
  Outbound statistics: Shows the communications statistics for all sent frames.
  To set the statistic counters to 0, click on the button "CLEAR STATISTICS."
  For further information see chapter 6.3.

Status & Configuration Port related configuration information that can influence the diagnosis status.

- **State:** shows whether the switch port is operational or has been switched off.
- **Communication mode:** shows the operational communication status of the port.
  - *No link:* no communication link between the switch port and the port of a connected device is established.
  - If a communication link is established, the used communication mode is shown.
- **Communication mode configuration:**
  - *Configured communication mode:* properties of the actual configured communication mode
    - "Auto," the switch and the connected device automatically negotiate the communication mode.
  - *Supported communication mode:* properties of the supported communication modes depending on the type of port or the type of used SFP module
    RJ45 (P1, P2):
    - 10 Mbit/s, half duplex
    - 10 Mbit/s, full duplex
    - 100 Mbit/s, half duplex
    - 100 Mbit/s, full duplex
    - 1 Gbit/s, full duplex
- **SFP information (SFP P3, P4 only):**
  - *Module supported:* Only SFP modules that have been particularly certified for use in hazardous environments in conjunction with the rail field switch can be used.
  - *Restart required:* If an SFP module is plugged in while the rail field switch is powered on, it may be necessary to restart the rail field switch to make the SFP operational.
  - *Vendor, Name, Revision, Serial number:* Identification information of the plugged SFP module.

1. Port name: P1 ... P4
Port type: RJ45 / SFP

Access Spur Port Information

1. To see details, click on spur port button.

Spur Ports: S1 ... Sn

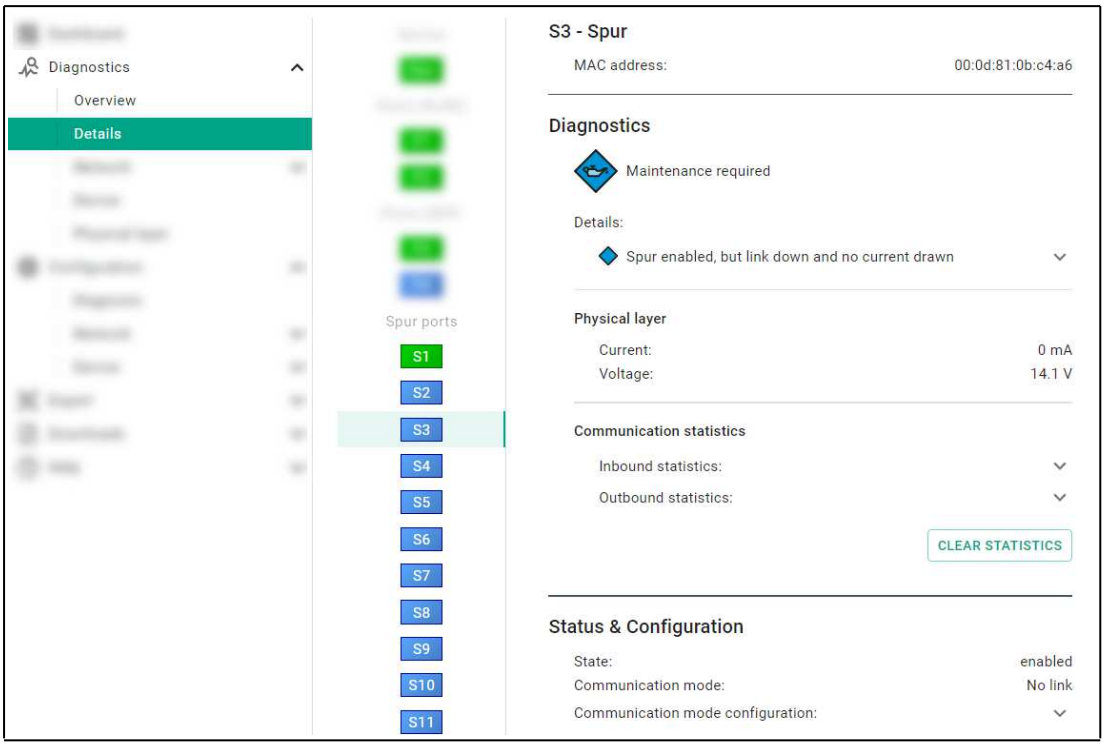

Figure 8.12 Example: S3 - Spur

Spur port[1]

- **MAC address:**
- MAC address of the port

Diagnostics

- **Icon and sumary status**
- **Details:**
  All active diagnosis alerts are listed. An active diagnosis alert consists of the NE107 sign with the description of the diagnostic information, an Id of the diagnosis alert as a unique reference, the status of the diagnosis alert, and the time and date when the diagnosis alert occurred the first time.
  An active diagnosis alert can be fixed, acknowledged or disabled by pressing the according button.
  For further information see chapter 6.
- **Physical Layer:**
  The switch measures and displays physical layer related parameters.
  For further information see chapter 6.5 or see chapter 6.6 depending of the type of connected field device.
- **Connected devices:**
  If a device is connected to the port, its identification information is shown.
  For more details, expand view. If an Ethernet-APL device is connected, the information is read from the LLDP data. If a PROFIBUS PA device is connected, the represented data is the I&M data of the device.
- **Communication statistics:**
  The switch manages statistics counters to count the number of received and sent frames for each port.
  Inbound statistics: Shows the communications statistics for all received frames.
  Outbound statistics: Shows the communications statistics for all sent frames.
  To set the statistic counters to 0, click on the button "CLEAR STATISTICS."
  For further information see chapter 6.3.

Status & Configuration

Port related configuration information that can influence the diagnosis status.

- **State:** shows whether the switch port is operational or has been switched off.
- **Communication mode:** shows the operational communication status of the port.
  - *No link:* no communication link between the switch port and the port of a connected device is established.
  - If a communication link is established, the used communication mode is shown.
- **Communication mode configuration:**
  - *Configured communication mode:* properties of the actual configured communication mode
    - "Auto," the switch and the connected device automatically negotiate the communication mode.
  - *Supported communication mode:* properties of the supported communication modes
    Spur ports (S1 ... Sn):
    - "PROFIBUS," PROFIBUS PA 31.25 kb/s communication
    - "10 Mbit/s," Ethernet-APL full duplex communication

1. Spur port name: S1 ... Sn

8.1.3.3 Diagnostics / Network

Diagnostics / Network / Port summary

The menu `Diagnostics / Network / Port summary` shows the status of all ports related to the network connection.

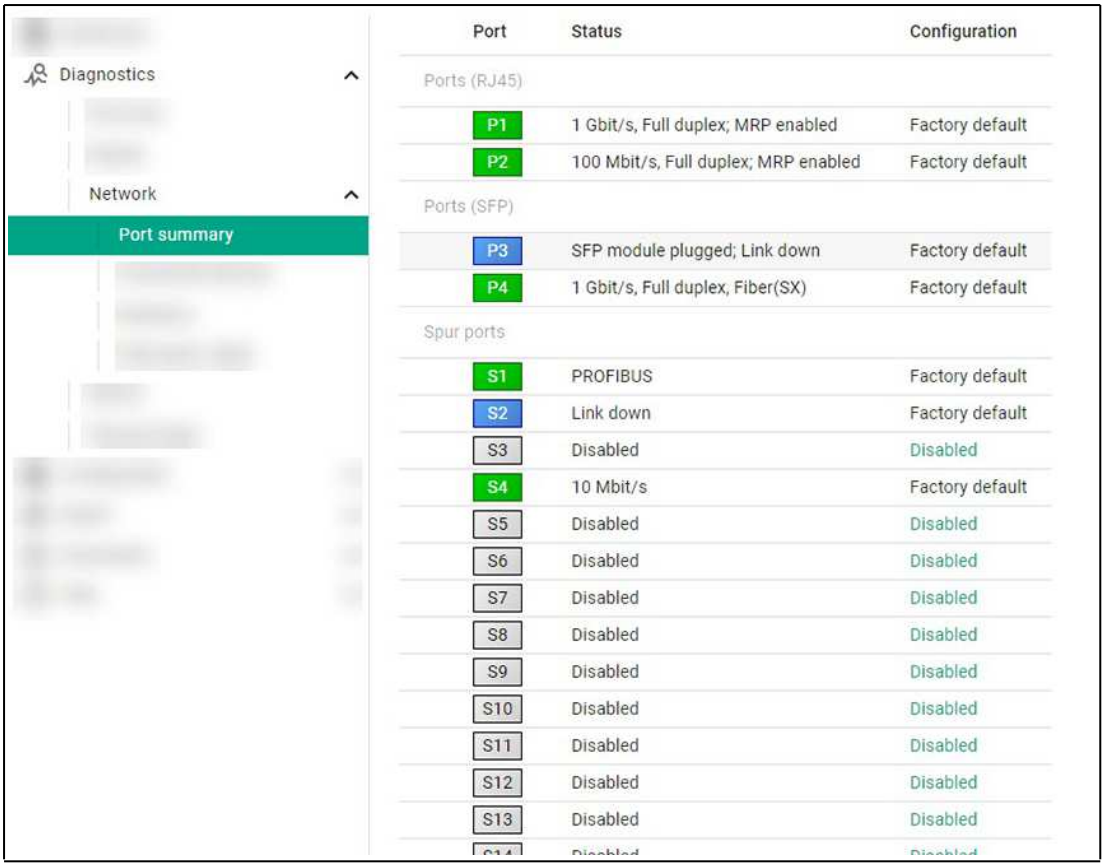

Figure 8.13

Port Port number with corresponding NE107 status

Status Status of the network connection

Configuration Configuration of ports related to the network connection. Clicking on the configuration information will open the menu `Configuration / Network / Ports`.

For possible port status information see chapter 7.

For port configuration options see chapter 8.1.4.2.

Diagnostics / Network / Connected devices

The menu `Diagnostics / Network / Connected devices` shows information about connected devices.

Figure 8.14

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Port	Port number with corresponding NE107 status. Clicking on the port will open the menu **Diagnostic / Details**.
Device	Device name
Address	IP-address or address of a PROFIBUS PA device

Clicking on the pull-down button will show further information:

- Ethernet or Ethernet-APL device
  - LLDP information
- PROFIBUS PA device
  - Device: Information from I&M
  - Address: PROFIBUS address
  - Ident: List of supported manufacturer specific and PROFIBUS PA profile specific ident numbers
  - Device state: Communication state of the device
  - Diagnostic state: Diagnostic state received from the device

Diagnostics / Network / Network load

Figure 8.15

To detect Ethernet network overload conditions that leads to discards or erroneous communication, the following information is given in the menu `Diagnostics / Network / Network load`:

- The device and ports data rate for incoming traffic and outgoing traffic
- The discard ratio, which is the number of discarded frames per second for incoming traffic and outgoing traffic
- The error ratio for incoming traffic and outgoing traffic, which is the number of erroneous frames per second

Diagnostics / Network / Statistics

The menu `Diagnostics / Network / Statistics` shows the communication statistics for Ethernet-APL and PROFIBUS PA in two different tables per port. A table is only shown if at least one field device has been detected.

For details see chapter 6.3 and see chapter 8.1.3.

Diagnostics / Network / FDB (MAC) table

The menu `Diagnostics / Network / FDB (MAC) table` shows the Forward Data Base table (FDB). The FDB stores the MAC address of the device per port (network). Frames addressed to a device with a specific MAC address will only be forwarded to the corresponding port. All other frames will be sent to all ports.

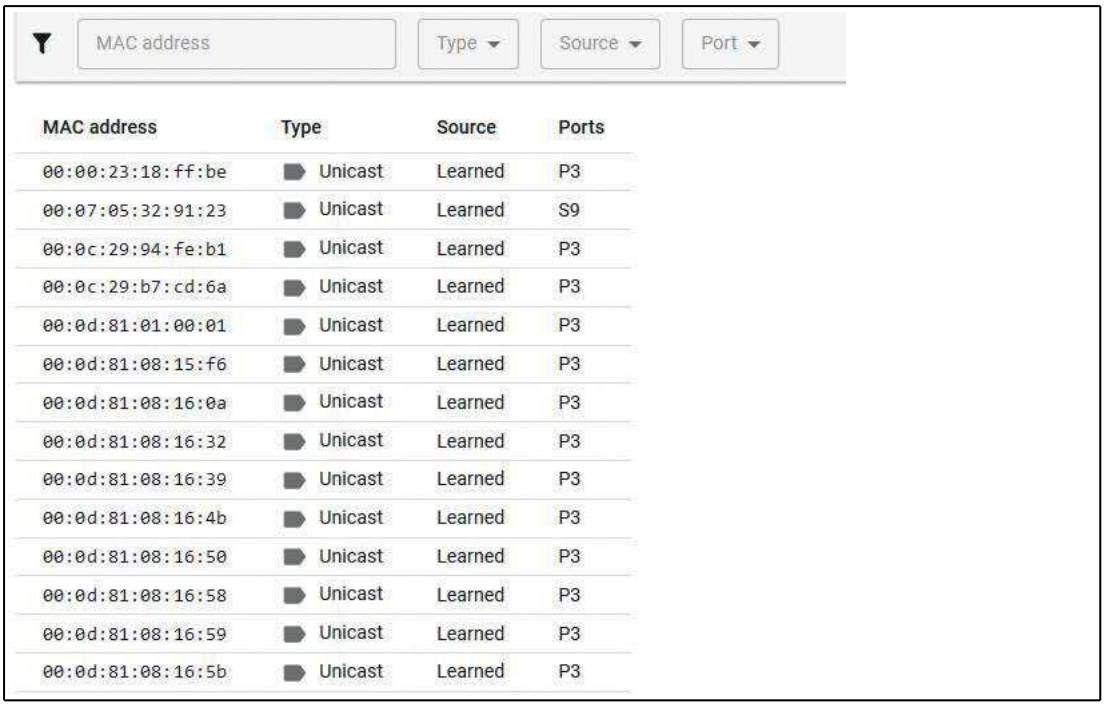

Figure 8.16

MAC address	shows a MAC address
Type	describes the type of service used to address the device
Source	dynamically updated list of MAC addresses. If a MAC address has not been used for a certain, time it will be deleted from the table.
Port	shows the port number the device with a specific MAC address is connected to

The header of the list offers a filter for type, source, and ports.

8.1.3.4 Diagnostics / Device

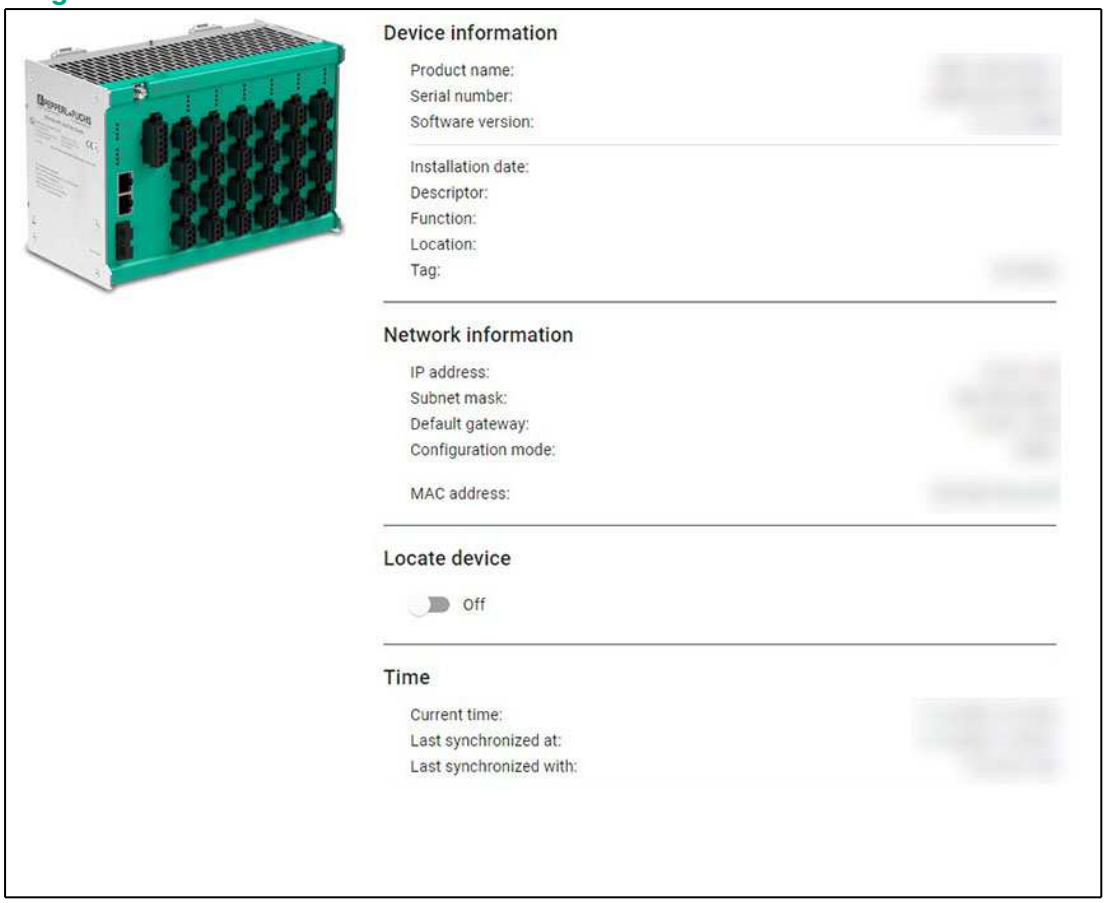

Figure 8.17

Device Information

Name	Description
Product name	Order designation of the device
Serial number	Serial number of the device
Software version	Software version of the device

Table 8.1

Name	Description
Installation date	PROFINET I&M data
Descriptor	PROFINET I&M data
Function	PROFINET I&M data
Location	PROFINET I&M data
Tag	Device tag / PROFINET name of station

Table 8.2

Network Information

Name	Description
IP address	IP address in use
Subnet mask	Subnet mask in use

Name	Description
Default gateway	Default gateway address in use
Configuration mode	Static / DHCP
MAC address	MAC address of the Ethernet-APL rail field switch

Table 8.3

Locate Device

Status	Description
Off	"Locate device" is off. No LEDs are flashing.
Locating...	By activating "Locate device", the Ethernet-APL rail field switch port LEDs LNK /CHK P1 ... P4 start to flash green simultaniously with 1 Hz. The flashing stops when you disable "Locate device."

Table 8.4

Time

Name	Description
Current time	Date of the last synchronization, current time
Last synchronized at	Date and time of the last synchronization
Last synchronized with	IP address of the last server used to synchronize date and time

Table 8.5

8.1.3.5 Event Log

Ethernet-APL rail field switch can store up to 10000 events. The events are chronologically shown in the menu `Diagnostics / Event log`. Events can be booting events, login information to the web server, any changes to the configuration of the Ethernet-APL rail field switch through PROFINET (including the controller or FDI), alarms, events related to the physical layer, and events related to the port connectivity.

When the event is detected by the Ethernet-APL rail field switch, each event is time-stamped with date and time.

If the number of stored events exceeds 10000 events, the oldest entries will be overwritten by new events.

The Ethernet-APL rail field switch prevents the event buffer being flooded by repeatedly occurring events. If the same event is detected more than 4 times in the period of 4 hours, that event will be blocked. After an event is blocked and occurs at least one time in 4 hours, one entry will be made in the event log as a reminder. The flooding protection is deactivated when the event does not occur for at least 4 hours.

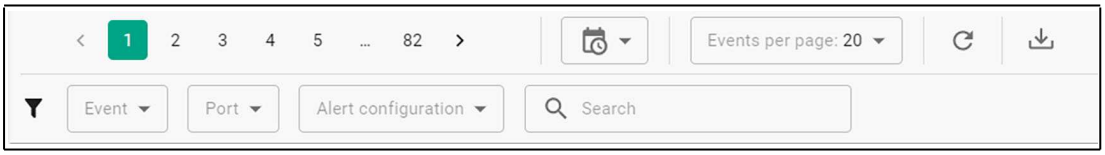

Figure 8.18

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Event Log Navigation

You can navigate through the event log buffer in the following ways:

- **Page number:** Scroll through the event buffer by clicking on the page number or arrows.

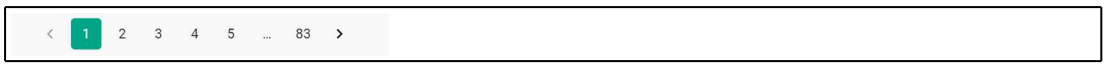

Figure 8.19

- **Time stamp:** Navigate through the event log buffer using a time stamp as reference.

  By clicking on the time stamp icon , the drop-down list displays the event log page number with the time stamp of the first event log entry of each page.
- **Events per page:** Choose the number (10 / 20 / 50 / 100) of event log entries shown on one page.
- **Reload event log:** If the reload icon is green new events occurred. To refresh the event log, press on the reload button.
- **Export event log:** To download the event log in a table form as an html file, click on the download icon. . For example the html file can be imported to Microsoft Excel©.

Event Filter

The event filter can limit the number of events displayed to a subset of available events. Regardless of which filter is activated, the Ethernet-APL rail field switch booting events will always be displayed.

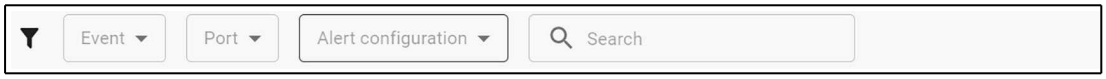

Figure 8.20

- **Event**: Events are categorized and can be filtered. A filter option for an event type is only shown in the drop-down list, if the event log buffer contains at least one event of the specific type.
  - **Information**: Events that are shown as "info only" in the web server or FDI package. See chapter 6
  - **Maintenance required**: Events that lead to a NE107 status "maintenance required"
  - **Overall device status changed**: Occuring events that change the device NE107 status, e.g., status change from "OK" to "maintenance required"
  - **Flooding protection**: Events related to the event log buffer flooding protection.
  - **Configuration changed**: Configuration change of the Ethernet-APL rail field switch, e.g., enable/disable of ports
  - **User authentication**: Events related to user activities like login/logout
  - **System event**: Events that are related to the system, e.g., Ethernet-APL rail field switch booting, firmware update etc.
- **Port**: The port describes to what the event is related to, e.g.:
  - device (Ethernet-APL rail field switch)
  - P1 ... P4 (uplink ports)
  - S1 ... Sn (spur ports)
- **Alert configuration**:
  - **Enabled alerts**: Show all enabled alerts. See chapter 8.1.4.1
  - **Disabled and acknowledged alerts**: Show all user disabled or achnowledged alerts. See chapter 8.1.4.1
- **Search**: Search for a specific term or full text in the event description. All events that contain the term or the full text will be displayed.

List of Events

The event list provides the individual events in chronical order with the related status information. Each event is displayed with an icon, a description text, and a timestamp when the event was recorded.

Figure 8.21

- **Status icons**: The status icons represent the following:
  - the type of event
  - the occurence or disappearence of events

Maintenance required event occured

Maintenance required event disappeared

Information event occured

Information event disappeared

Flooding protection: Event log flooding protection activated

Flooding protection: Event log flooding protection deactivated

Configuration changed: the configuration of the Ethernet-APL rail field switch has been changed

- **Event description**: Description text of the event. See chapter 6
- **Port description**: The source the event is related to, devices, P1-P4, S1-Sn.
- **Timestamp**: Events detected by the Ethernet-APL rail field switch are specified with a timestamp. The timestamp is based on the date and time received by the configured time server. If no time server is configured, the time duration from the last boot is used as time stamp. With the following access of a web server, the switch takes the time provided by the web browser and recalculates all time stamps. The format of the shown timestamps depends on the settings of the web browser you are using. The **timestamp unprecise** icon appears, if the clock of the Ethernet-APL rail field switch has not been synchronized for a long time and may be therefore inaccurate.

Detail View

For more details about the event, expand the view.

Information contents depend on the type of event.

- **Event:** The event type, see event filter above.
- **Event no.:** The event number is a unique number to identify easily the chronical order of the event in the event log buffer and the export file.
- **Event cause:** Reasons for the event occurrence:
  - Alert disappeared
  - Alert appeared
  - Alert is still active after flooding protection was deactivated

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  - Alert inactive after flooding protection was deactivated
  - Event log flooding protection remains active
- **ID:** The ID is identical to the "Diagnosis ID" which describes the diagnosis event type. See chapter 6.1
- **By:** Configuration resource when the device configuration has been changed, e.g., web server, PROFINET, or FDI.
- **User:** The name of the user that performed, e.g., configuration changes.
- **Role:** The role of the user that performed, e.g,. configuration changes.
- **Alert state:**
  - Acitive - the alert condition is still existent.
  - Inactive - the alert condition is gone.
- **Alert configuration:** User configuration of the alert, enabled, disabled or acknowledged. See chapter 8.1.3.1.

8.1.3.6 Data History

The data history allows graphical visualizations of data captured by the Ethernet-APL rail field switch web server. Captured data is persistently stored in the Ethernet-APL rail field switch and is compressed after a specified period of time so that the data history is available for at least 20 years. In each sample period the minimum, average, and maximum value of the physical layer data is calculated and stored. The static values are accumulated for each sample period.

Sample period	Hold time
1 second	7 days
60 seconds	31 days
60 minutes	378 days
12 hours	20 years

The shown data in the graphs updates periodically every 5 seconds.

Figure 8.22

- **Move and Zoom**
  To move the time axis to the left/right, press and hold the graph while moving the mouse. To stretch and compress along the time axis, use the scroll wheel on the mouse.
- **Measurement**
  When activating the measurement tool, a cursor appears that shows the measure data and the time stamp on the position of the graph. To display on all visible graphs the measured values of one specific time stamp, click the left mouse button. When you press and hold the left mouse button, you can move along the time line.
- **Port**
  Choose the port from which you want to see the data history.
- **Measurement Profile**
  Choose the type of physical layer to be analyzed.

- **Measured Values**
  Choose predefined sets of physical layer data and communications statistic data to be visualized as graphs. To add or remove data, activate or deactivate the required check-box.
  For the explanation of the measured values: see chapter 6.5, see chapter 6.6, see chapter 6.3, see chapter 8.1.3.3

- Y Auto Scale ON/OFF 
  The auto scale feature automatically scales the data range of the measured value shown on the y-axis.

8.1.3.7 Snapshots

For a user selectable time period, all physical layer values, data rate and communication statistic counters are captured. This information can be used to document the results of commissioning plus to detect deterioration between snapshots taken at different times.

The snapshot file contains the following data:

- The actual status of the Ethernet-APL rail field switch and ports
- The physical layer values given as minimum, maximum, and average value
- Communication statistic counters given as minimum, maximum, and average value
- Port data rates given as minimum, maximum, and average value
- Information about the devices connected to the spurs

Up to 50 snapshots can be stored in the switch. For further analyzes a snapshot can be downloaded and imported into Microsoft Excel© as an html file. The html file provides the information in a table.

To create and download the snapshot, follow the instructions on the web server.

8.1.3.8 Diagnostics / Physical layer

In this menu, physical layer values for all used uplink SFP ports and all spur ports with a connected device are listed. Depending on the type of connected field device, physical layer diagnostic information for the Ethernet-APL or PROFIBUS PA is available. For further information about the measured values, see chapter 6.5 and see chapter 6.6.

Spur ports - 10 Mbit/s

- Port: Port number with its NE107 status. To jump to menu `Diagnostic / Details`, click on port button.
- Device: name of the connected device
- Voltage [V]: measured segment voltage. The voltage range depends on the type of port in use.
- Current [mA]: current taken from the spur port. The available maximum current depends on the type of port in use.
- SNR [dB]: Signal-to-noise ratio

Spur ports - PROFIBUS

- Port: Port number with its NE107 status. To jump to menu `Diagnostic / Details`, click on port button.
- Device: name of the connected device
- Voltage [V]: measured segment voltage. The voltage range depends on the type of port in use.
- Current [mA]: current taken from the spur port. The available maximum current depends on the type of port in use.
- Signal level [mV]: measured communication signal level of the connected device
- Jitter [µs]: Jitter of the communication signal of the connected device

8.1.4 Configuration

8.1.4.1 Configuration / Diagnosis

Configuration / Diagnosis / Alerts

The menu provides information about all currently acknowledged and disabled alerts for the device and each port.

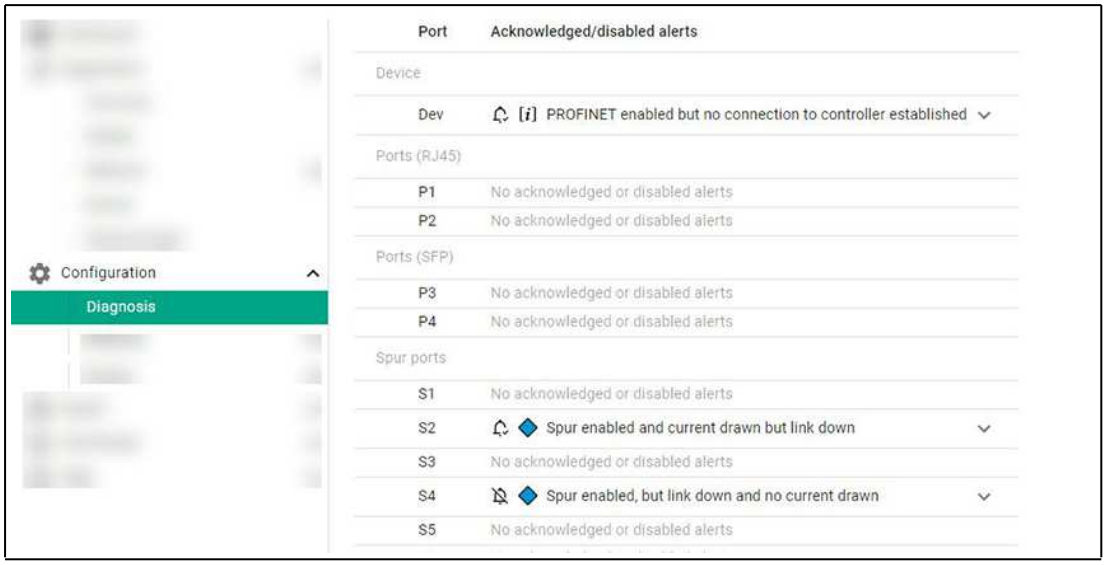


Figure 8.23

The first column in the table show the device or the port the information is related to. The second column shows all acknowledged or disabled alerts. Opening the pull down menu of an alert gives further information related to the alert:

- Acknowledged alert ( ) or disabled alert ( ) with description of the alert
- An Id of the diagnosis alert as a unique reference
- The status of the diagnosis alert and the time and date when the diagnosis alert occured.
- The username who acknowledged or disabled the alert.
- The status of the diagnosis alert and the time and date when the diagnosis alert has been acknowledged or disabled.

Once an alert is acknowledged and the condition that led to the alert continues to exist, no further diagnosis alert is generated. To re-enable alert generation, press the button ENABLE ALERT.

Once a specific alert type is disabled, re-enable alert again by pressing the button ENABLE ALERT.

Configuration / Diagnosis / DCS alarming

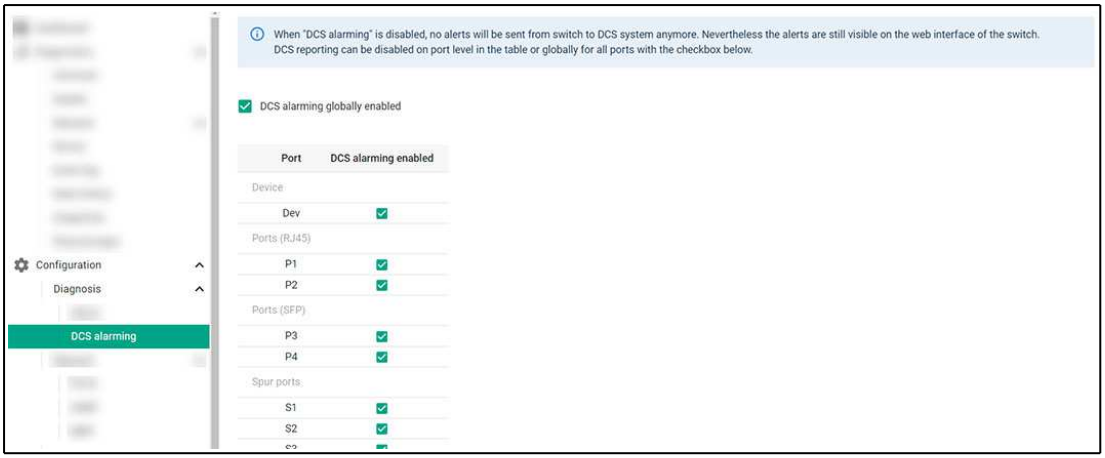


Figure 8.24

The menu `Configuration / Diagnosis / DCS alarming` permits you to enable or disable the alarming to the DCS system. Disabling the alarming to the DCS system may be required during commissioning or when maintenance for field devices are carried out to avoid the flooding of the control system with alarm messages. You can enable / disable the alarming as follows:

- Enabling / disabling alarms globally
- Enabling / disabling alarm(s) of the device or ports individually

Confirm settings with APPLY button or cancel with DISCARD button.

Note

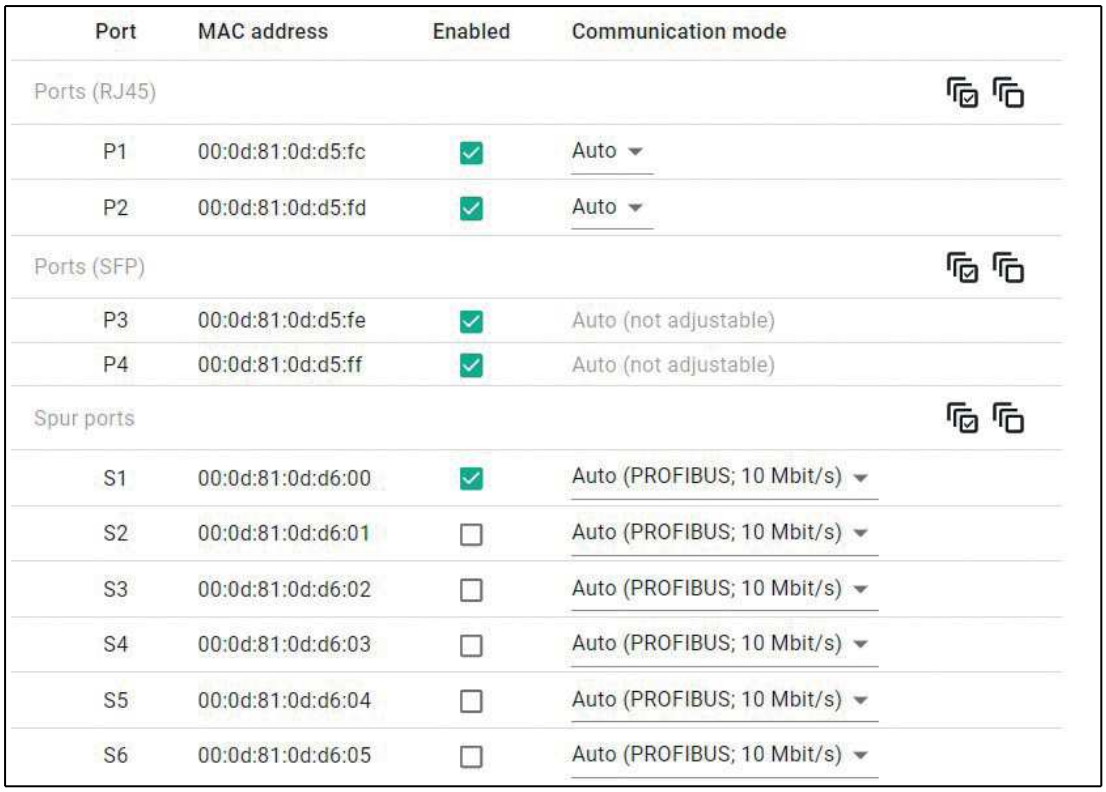
Alarms generated by Ethernet-APL field devices are not suppressed and will be forwarded by the switch.

8.1.4.2 Configuration / Network

The menu `Configuration / Network` with the submenus `Ports`, `IGMP` and `MRP` enables you to configure Ethernet network related functions.

Configuration / Network / Ports

The menu `Configuration / Network / Ports` permits you to enable or disable individual or group of ports and configure the communication mode of uplink and spur ports.



Port	MAC address	Enabled	Communication mode
Ports (RJ45)			
P1	00:0d:81:0d:d5:fc	☑	Auto
P2	00:0d:81:0d:d5:fd	☑	Auto
Ports (SFP)			
P3	00:0d:81:0d:d5:fe	☑	Auto (not adjustable)
P4	00:0d:81:0d:d5:ff	☑	Auto (not adjustable)
Spur ports			
S1	00:0d:81:0d:d6:00	☑	Auto (PROFIBUS; 10 Mbit/s)
S2	00:0d:81:0d:d6:01	☐	Auto (PROFIBUS; 10 Mbit/s)
S3	00:0d:81:0d:d6:02	☐	Auto (PROFIBUS; 10 Mbit/s)
S4	00:0d:81:0d:d6:03	☐	Auto (PROFIBUS; 10 Mbit/s)
S5	00:0d:81:0d:d6:04	☐	Auto (PROFIBUS; 10 Mbit/s)
S6	00:0d:81:0d:d6:05	☐	Auto (PROFIBUS; 10 Mbit/s)

Figure 8.25

Port Identification of the port

MAC address The MAC address of each individual port

Enabled To enable or to disable individual ports, click on the check box. If the green check box with a tick inside is shown the port is enabled, if the empty check box is shown the port is disabled. If a spur port is disabled, no power is provided to the port terminals.

Communication Mode For P1 and P2, the communication speed and the duplex mode may be set to a fixed value, e. g., 100 Mbit/s, Full duplex, or Auto. In communication mode "Auto", the mode is automatically negotiated between the respective switch port and the connected device.
P3 and P4 provide slots for SFP transceivers. The supported communication mode depends on the type of SFP transceiver in use. The communication mode is not configurable and is fixed to "Auto."
When using PROFINET, the data rate is limited to 100 Mbit/s.

Note

The spur ports S1 ... Sn are not configurable and are fixed to "Auto." Depending on the type of rail field switch, only Ethernet-APL or Ethernet-APL and PROFIBUS PA devices are supported. If the rail field switch supports the use of PROFIBUS PA field devices, the rail field switch ports are automatically configured to the communication mode of the connected field device.

Configuration / Network / Port Mirroring

In the menu `Configuration / Network / Port Mirroring` the port mirroring function is configurable.

Port mirroring is used by network administrators and engineers to evaluate and diagnose unforeseen network problems. When port mirroring is enabled, the rail field switch will deliver copies of network packets from the mirrored ports to a single destination port where a communication traffic analysis instrument, such as Wireshark, can be connected.

The destination port can be chosen from the uplink ports P1 ... P4. The remaining uplink ports and all spur ports can be set as mirrored ports. It is possible to specify whether the communication packets received, sent, or both will be copied to the destination port.

Port mirroring enabled: The toggle button is green if port mirroring is enabled and grey if it is disabled. If port mirroring is enabled, information of the port mirroring configuration is shown in the overview of the dashboard.

Note

Communication packets of the spur ports to which fieldbus devices are connected are not mirrored.

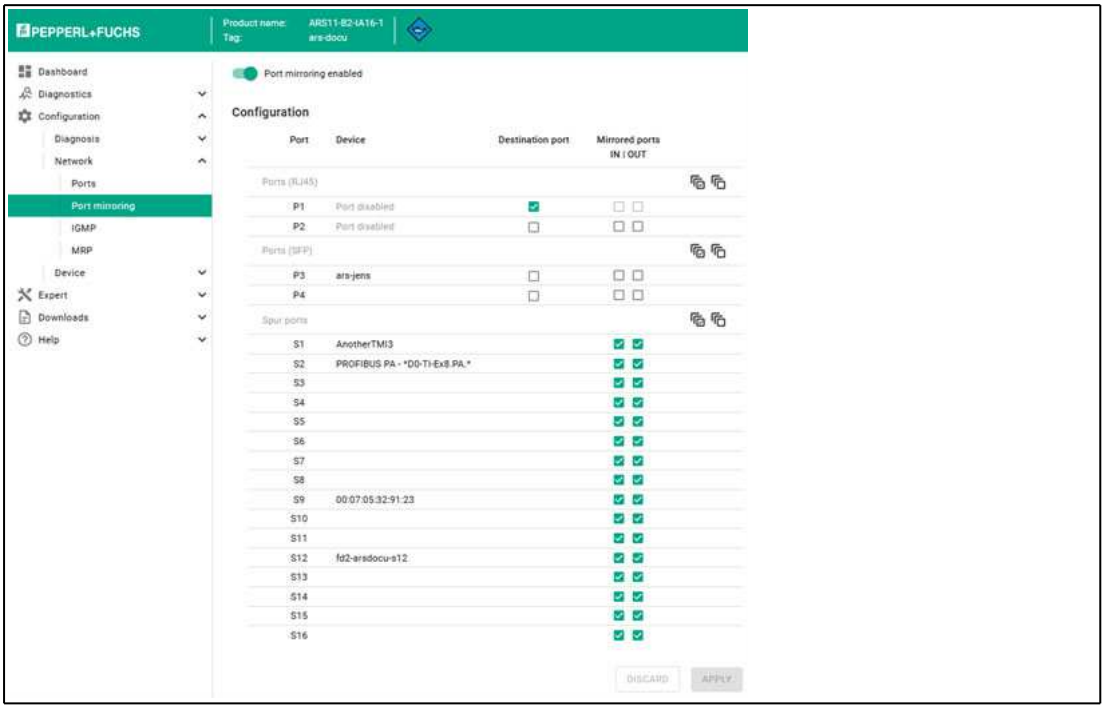


Figure 8.26

Configuration:

Port	Identification of the port
Device	Displays the name of the device connected to the port
Destination port	To enable or to disable one destination port P1 ... P4, click on the check box. Communcation packets will be copied to selected destination port. Choose a destination port that is not involved in communication. On the destination port only communication of the mirrored port will be seen. The packet statistic of the destination port will only include packet statistic of the mirrored port(s).
Mirrored ports IN I OUT	To enable or to disable one or multiple mirrored ports, click on the check box(es) of the transmission direction (IN|OUT) of the communcation packets that you want to copy to the destination port. Available mirrored ports are P1 ... P4 and S1 ... Sn.

Confirm settings with APPLY button or cancel with DISCARD button.

Configuration / Network / IGMP

The menu `Configuration / Network / IGMP` allows to configure options for Internet Group Management Protocol (IGMP).

You can enable or disable IGMP.

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The toggle button is green if IGMP is enabled and grey if it is disabled.

Configuration:

- **IGMP version**:
  Specifies the version of IGMP
- **IGMP timeout** (Group Membership timeout):
  Specifies the timeout in seconds
- **IGMP querier enabled:**
  Click on the checkbox to enable or disable the querier function of the rail field switch.

Configuration / Network / MRP

The menu `Configuration / Network / MRP` allows you to configure the rail field switch for use in a Media Redundant Ring (MRP) network.

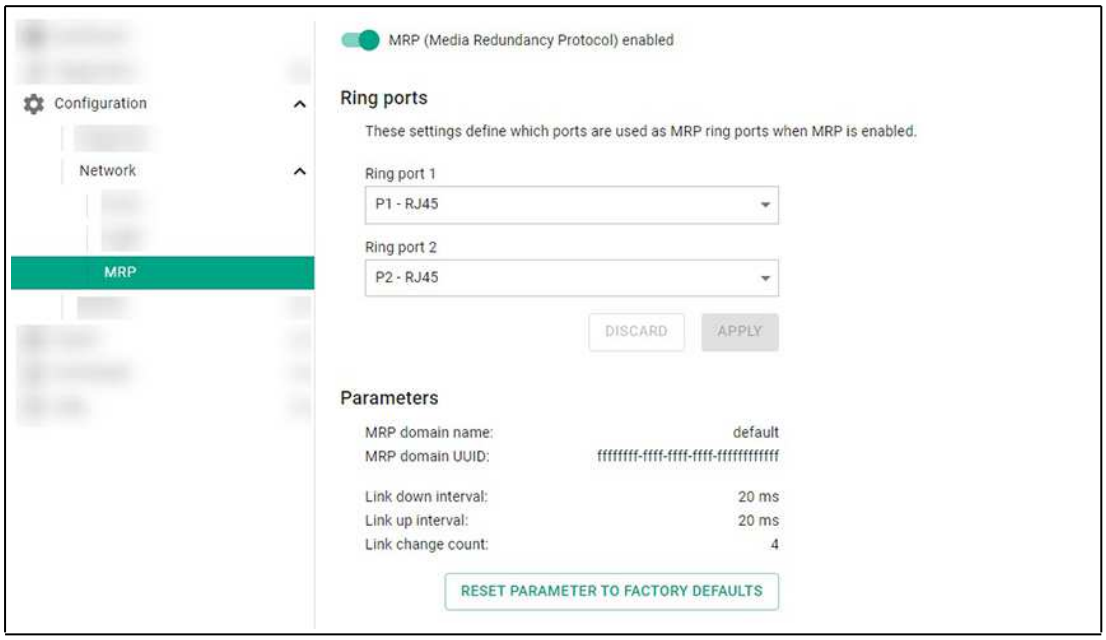

Figure 8.27

Enable/diasable the MRP function	You can enable / disable MRP. The toggle button is green if MRP is enabled and grey if it is disabled.
Ring ports	Select two of the Ethernet uplink ports which are connected to the MRP ring.
Parameters	The rail field switch only works as a MRP client. The MRP manager is either build in in the controller or in external switches forming the ring. The MRP network is configured with respective software tools. Only the two ports, which will be connected to the ring need to be defined.

Note

The following information is read-only. They are set by the configuration tool of the MRP manger device in use. Some devices with MRP manager functionality require the MRP parameter of the devices connected to the ring to be set to default values.

To set the MRP parameters to factory default, press the button RESET PARAMETER TO FACTORY DEFAULTS.

MRP domain name	The logical name of the MRP ring the rail field switch is configured for.
MRP domain UUID	Represents a unique ID the rail field switch is configured for.

Link down interval	Specifies the interval for sending MRP_LinkDown frames on ring ports.
Link up interval	Specifies the interval for sending MRP_LinkUp frames on ring ports
Link change count	Defines the number of MRP_LinkDown/MRP_LinkUp frames to be sent when the respective event occurs

8.1.4.3 Configuration / Device

Configuration / Device / IP Setting

The menu `Configuration / Device / IP Setting` provides options to set the IP address. For further details refer to the documentation of your Ethernet network administration tool.

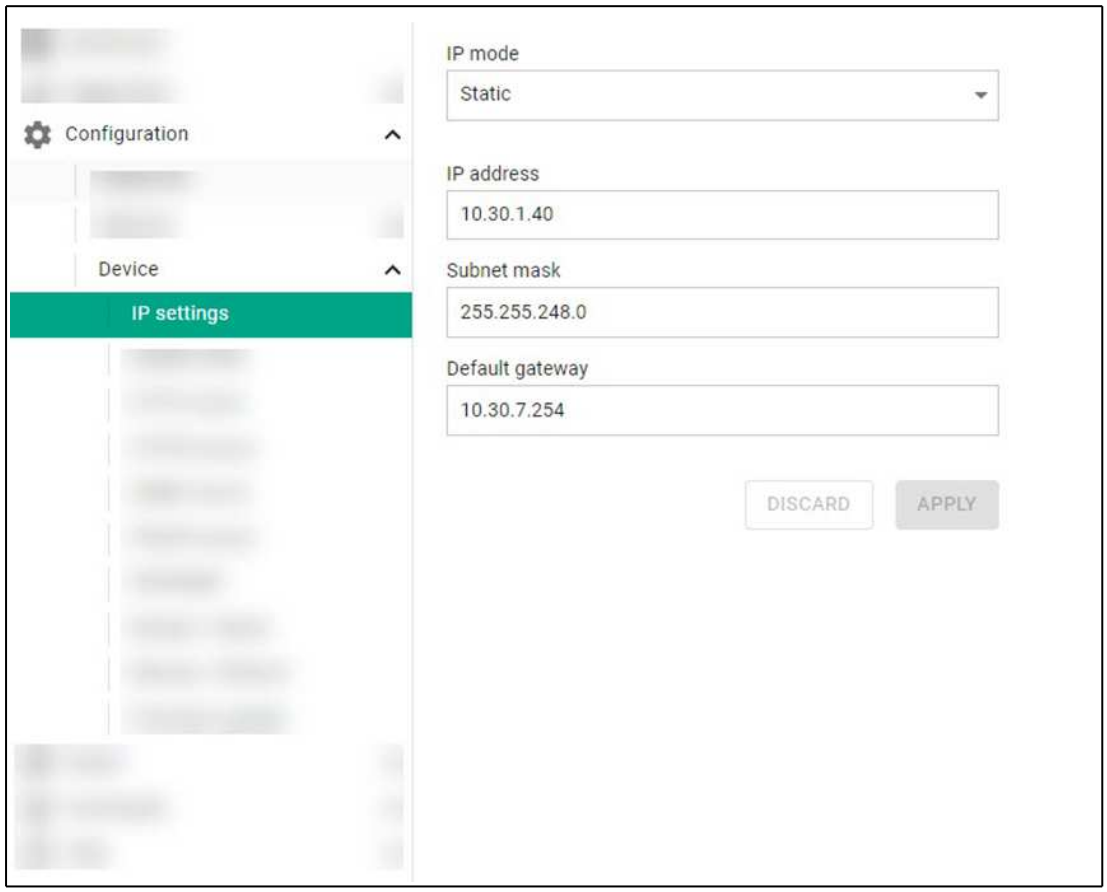

Figure 8.28

IP mode The IP address can be assigned either static or dynamic. If the IP address is static, the IP address is fix and stored non-volatile in the rail field switch. If the IP address is dynamic, it can change occasionally. A dynamic IP address is assigned by a DHCP server and will be reset if no DHCP server is available or the rail field switch is turned off and on again.

- **Static:**
  The IP address is set fix to the value shown in the IP address entry field.
- **DHCP:**
  The IP address is dynamic. The dynamically assigned IP address is shown in the IP address field.

The following IP address details can only be changed if you use the IP mode static. Otherwise the parameters are assigned automatically by the network administration tool in use.

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IP address	The entry field for the IP adress
Subnet mask	Specifies the subnet mask for structuring a network.
Default gateway	The IP address of the default gateway the rail field switch is connected to in the network.

Configuration / Device / User management

The menu `Configuration / Device / User management` allows users with the role **administrator** to create, edit, or delete user accounts. The current user account is also editable.

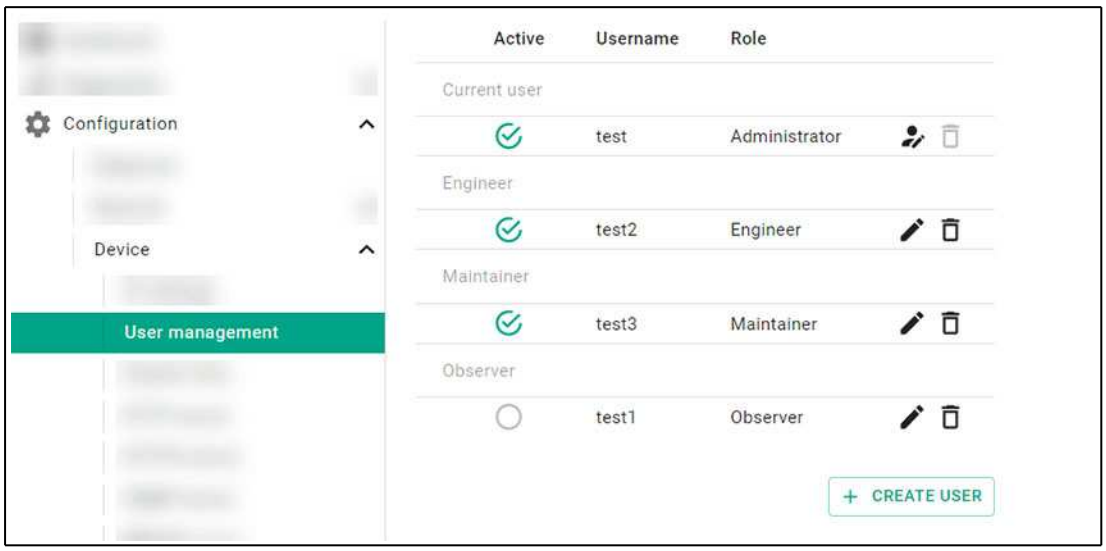

Figure 8.29

PANOS supports four different user roles according to purpose combined with suitable permissions and privileges in order to perform web server management operations. The access rights to the rail field switch data are predefined for a specific user role and are unchangeable.

Observer	The user role **Observer** has read-only access to the rail field switch.
Maintainer	The user role **Maintainer** has all rights of observers. In addtion, maintainers can manage diagnostics, device configuration files, and firmware update.
Engineer	The user role **Engineer** has all rights of maintainers. In addition, engineers can configure the network functions.
Administrator	The user role **Administrator** has full read/write access to the rail field switch. In addition to the rights of the engineers, the administrators can configure user accounts.

Note

The user management supports up to 50 different user accounts.

Up to 20 users can log in to the web server at the same time.

The following table shows the specific access rights of each user role:

User Account Privileges and Rights

User Right	Observer	Maintainer	Engineer	Adminis-trator
User role management				
Initial setup				X
Create/change/delete user				X
Change another user's password				X
Diagnostics				
Clear statistics		X	X	X
Locate device		X	X	X
Acknowledge diagnostic alerts		X	X	X
Disable/enable diagnostic alerts			X	X
Configuration / Network				
Ports			X	X
Port mirroring			X	X
IGMP			X	X
MRP			X	X
Configuration / Device				
IP settings			X	X
User management				X
System time			X	X
HTTP server			X	X
HTTPS server			X	X
SNMP server			X	X
PROFINET			X	X
Restart device		X	X	X
Reset device to default values			X	X
Backup / Restore / Import		X	X	X
Firmware Update		X	X	X
Expert				
Diagnosis data download		X	X	X
Downloads				
Documents	X	X	X	X
Certificates	X	X	X	X
Drivers	X	X	X	X
Licenses	X	X	X	X

Table 8.6 The "X" mark indicates read/write/change access rights, otherwise only read access.

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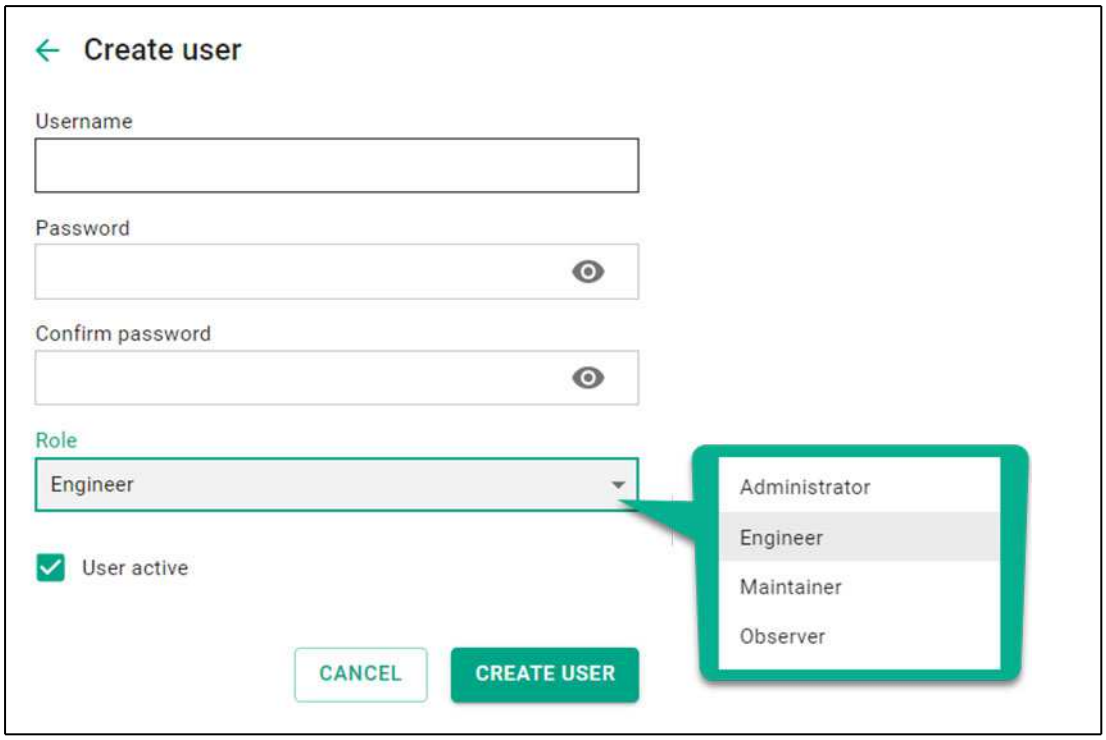
Creating a new User Account

1. To create a new user account, select "+ CREATE USER."



2. Enter a username.
3. Enter and confirm your password.
4. In the **Role** drop-down menu, choose the user account privileges and rights of your choice.

Configuration / Device / System time

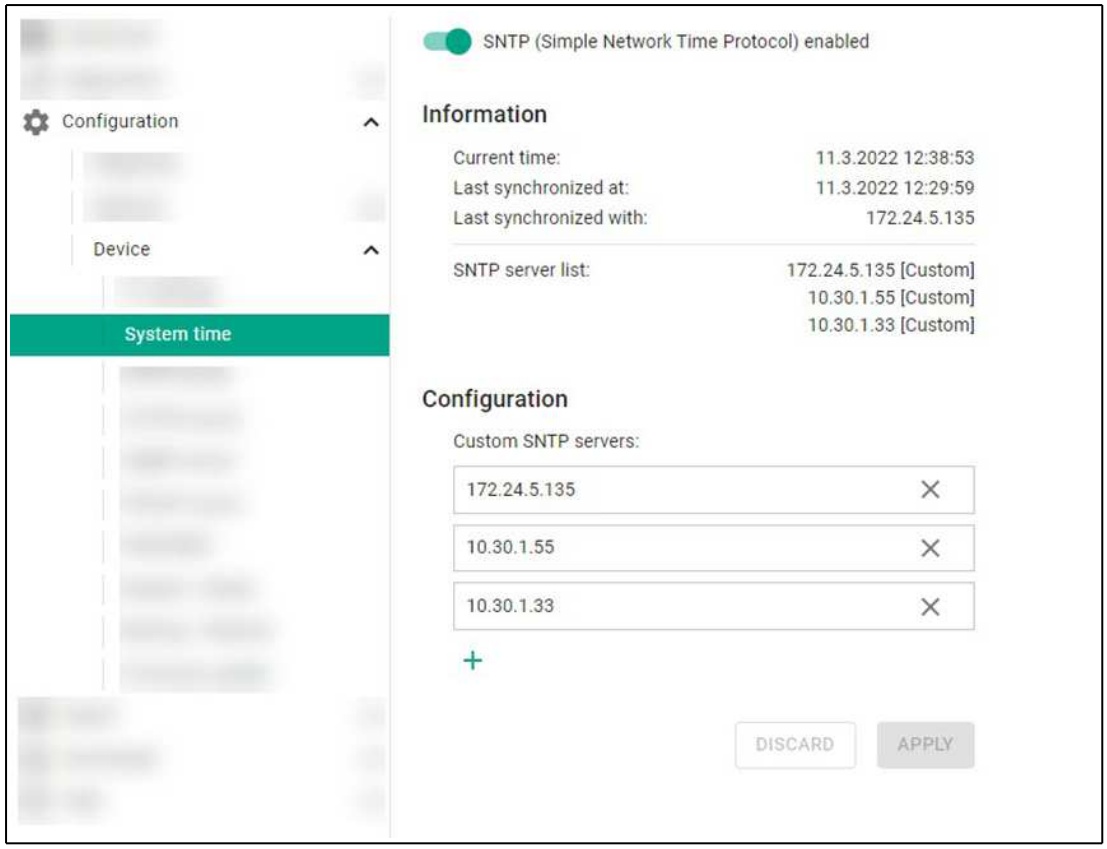


Figure 8.30

Simple Network Time Protocol (SNTP)

Allows synchronization of the rail field switch system time with a SNTP server.

- You can enable / disable SNTP support of the rail field switch.
- The toggle button is green if SNTP is enabled and grey if it is disabled.

Information

- **Current time:**
  The actual system time of the rail field switch.
- **Last synchronized at:**
  The last synchronization date and time of the system time with a SNTP server.
- **Last synchronized with:**
  The IP address of the SNTP server used for the last synchronization.
- **SNTP server list:**
  The list of IP addresses of SNTP servers which are defined to be used for system time synchronization. Adding or deleting a server to or from the list can be done with the entry list under SNTP servers/custom SNTP servers (see below).

Configuration

- **SNTP servers**
  If using a DHCP server that provide its own time server, the sever is listed in the SNTP server list.
  Custom SNTP servers
  For adding a server to the SNTP server list click on the "+" sign and fill in the IP address in the empty entry field.
  For deleting a server from the SNTP server list click on the "X" sign of the respective entry field.

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Configuration / Device / HTTP server

Note

When disabling the HTTP server while being connected via HTTP, the connection is lost. Re-enabling the server through the web server is not possible.

You can enable or disable the HTTP server (Hypertext Transfer Protocol) of the rail field switch.

The toggle button is green if the HTTP server is enabled and grey if it is disabled.

Configuration

- **TCP port**
  Specifies the TCP port number

Configuration / Device / HTTPS server

Note

When disabling the HTTPS server while being connected via HTTPS, the connection is lost. Re-enabling the server through the web server is not possible.

You can enable or disable the HTTPS server (Hypertext Transfer Protocol Secure) of the rail field switch.

The toggle button is green if the HTTPS server is enabled and grey if it is disabled.

HTTPS is the secure version of HTTP by using the encryption communication protocol TLS (Transport Layer Security). HTTPS also provides authentication to access the web server of the rail field switch. Authentication requires a trusted certificate to exchange data between a browser and the web server. The rail field switch comes with a certificate. The rail field switch can generate a new one by itself or can use a third party certificate that can be uploaded to the rail field switch.

Configuration

- **TCP port**
  Specifies the TCP port number
- **Minimum enforced TLS version.**
  Version of the TLS protocol to be used

Certificate

Gives detailed information of the certificate in use.

- **Certificate type:**
  You can either use a certificate that the rail field switch itself has generated or your own certificate that may be issued by a certificate authority. An external certificate needs to be uploaded to the rail field switch.
- **Fingerprint (SHA-256):**
  The fingerprint of the public key in use is shown in SHA-256 format.
- **Fingerprint (SHA-1):**
  The fingerprint of the public key in use is shown in SHA-1 format.
- **Generate new certificate**
  The rail field switch can generate own custom certificates.
  To generate a new certificate, click the button "GENERATE CERTIFICATE."
- **Upload a custom certificate**
  To use your own certificate, upload the certificate to the rail field switch by using drag-and-drop to the marked area or clicking the button "SELECT FILE." When you click the button, the "Open" dialog box appears. Browse to the location of the certificate and double-click the certificate file.
  Click "UPLOAD CERTIFICATE."

Configuration / Device / SNMP server

You can enable or disable the SNMP server of the rail field switch.

The toggle button is green if SNMP is enabled and grey if it is disabled.

Configuration Choose the versions of SNMP protocol you want to use by clicking on the respective line.
Green: SNMP protocol is enabled
Grey: SNMP protocol is disabled

- **SNMP v1 / v2c community strings**
  The community strings are a kind of user ID or password which are sent by the device to the rail field switch to read or to write data of a MIB (Management Information Base). These community strings are normally identical for all devices connected to the same network. It is recommended to change default community names to avoid unauthorized access to the rail field switch.
  - **Read-only community**
    Community string for read access to the rail field switch.
  - **Read-write community**
    Community string for read and write access to the rail field switch.
- **SNMP v3**
  The SNMP v3 server is always enabled when the SNMP server functionality is enabled. The SNPM v3 configuration is done automatically by the client used to manage SNMP information. The SNMP server can only be used for monitoring.
  - **Username:**
    The displayed username can be any defined web interface username.
  - **Authentication:**
    fixed to none. Authentication is not supported.
  - **Privacy:**
    fixed to none. Encryption is not supported.

Configuration / Device / PFDCP server

You can enable or disable the Pepperl+Fuchs Discovery Protocol (PFDCP).

The toggle button is green if PFDCP is enabled and grey if it is disabled.

Configuration / Device / PROFINET

You can enable or disable PROFINET specific communication protocols and functions by clicking on the specific toggle button.

PROFINET DCP The toggle button is green if DCP (Discovery and Configuration Protocol) is enabled and grey if it is disabled.

PROFINET The toggle button is green if the rail field switch acts as a PROFINET IO device. If the toggle button is grey the rail field switch does not support PROFINET IO functionality as a device.
You can configure whether the rail field switch ignores the port activation sent from the PROFINET controller. To ignore the port activation sent by the PROFINET controller, activate **Ignore PROFINET port configuration** in the **Configuration** section.

Configuration / Device / Restart/Reset

Restart device
To initiate a restart of the device, press the "RESTART DEVICE" button. The restart takes approximately 1 minute.
All communication to connected devices will be lost!

Reset device to default values
To set all configurable parameters to factory default values, press the "RESET DEVICE TO FACTORY DEFAULT VALUES." The rail field switch restarts.
The restart takes approximately 1 minute.
All communication to connected devices will be lost!

Configuration / Device / Backup/Restore/Import

With the Backup / Restore / Import function, you can save all configuration date of the rail field switch in a file and restore or transfer the settings to a different rail field switch.

Note

Configuration files created with an older PANOS firmware can be transferred to a rail field switch with a newer PANOS version. However, configuration files created with a newer PANOS version cannot be imported into a rail field switch with older firmware.

Backup device configuration
Description: User text description is used to identify the specific configuration.
To download all configuration data of the rail field switch and save it in a file, press the button "DOWNLOAD DEVICE CONFIGURATION."

Restore or import device configuration

- The **Restore device configuration** function reads all configuration data from a backup file. When replacing the rail field switch, select Restore device configuration function to configure a rail field switch.
- The **Import device baseline configuration** function reads the baseline configuration data from a backup file. Common configuration data can be defined once and then copied to all rail field switches. The creation of the baseline configuration and the pre-configuration of the rail field switches is independent of the type of the rail field switches. Select Import device baseline configuration to pre-configure rail field switches.
  The baseline configuration includes the following data:
  - Network
    - IGMP
    - MRP
  - Device
    - User management (including passwords)
    - System time / time servers
    - HTTP server
    - HTTPS server (certificate excluded)
    - SNMP server
    - PDFCP server
    - PROFINET

After selecting the desired operation, drop the configuration file into the window area or select a file from your PC. Follow the instruction of the web server.

Configuration / Device / Firmware update

Pepperl+Fuchs provides regular updates for PANOS available under www.pepperl-fuchs.com. To upload the firmware file, use drag-and-drop to the marked area or choose a file via "Open" dialog box. Browse to the location of the firmware file and double-click the firmware file.

Follow the step-by-step progress of the firmware update in the menu.

8.1.5 Expert

8.1.5.1 Diagnosis Data Download

For troubleshooting, internal diagnosis data as binary file can be downloaded. The diagnosis data provides switch internal information that can be sent to Pepperl+Fuchs for further analyzes.

8.1.6 Downloads

8.1.6.1 Downloads / Documents

Contains relevant technical documentation.

8.1.6.2 Downloads / Certificates

Contains explosion-hazardous area certificates and the declaration of conformity

8.1.6.3 Downloads / Drivers

Contains device descriptions or drivers that are needed to integrate the device into a control system or an asset management system.

8.1.6.4 Downloads / Licenses

The PANOS software uses open source components. Various license agreements require the publication of the license information together with the product.

This page provides software licenses that are included.

To display licenses, press button "load and show license data."

8.1.7 Help

8.1.7.1 Support

This page provides information about Pepperl+Fuchs-Group contact data.

You can request support via phone and email. Be prepared to provide following information:

- Product name
- Serial number
- Software version

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

8.2 Pepperl+Fuchs Discovery and Configuration Tool (PFDCT)

PFDCT is a Pepperl+Fuchs tool to detect and manage Pepperl+Fuchs Ethernet devices. PFDCT provides access to web servers and firmware updates. PFDCT can be downloaded from the Pepperl+Fuchs website at www.pepperl-fuchs.com. The download package contains an instruction manual.

8.3 Switch Gateway Device Type Manager (DTM)

To access PROFIBUS PA field device for configuration and maintenance, the switch gateway DTM is required. The DTM is part of the DTM collection FieldConnex and is available on the Pepperl+Fuchs website www.pepperl-fuchs.com.

The switch gateway DTM supports the integration of the standard switch FDI package via CodeWrights iDTM. See chapter 8.3.6.

8.3.1 Device Type Manager (DTM): Installation and Commissioning

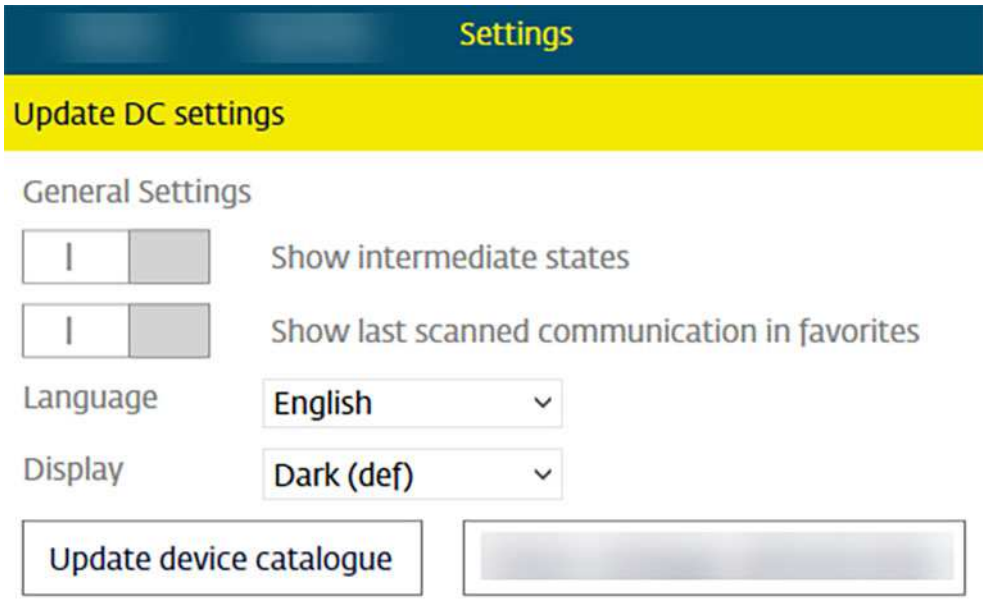
System requirements for installation, commissioning, and operation of the switch device type manager (DTM):

- Hardware requirements based on your FDT frame application
- FDT frame application (FDT specification 1.2)
- Latest version of the Ethernet-APL rail field switch DTM
- 40 MB free hard drive storage

Installing the DTM Package with PACTware™ (Example)

To install the DTM package on your system, proceed as follows:

1. Install the Pepperl+Fuchs-FieldConnex® DTM package.
2. Start the PACTware™ program.
3. Update the device catalog.



↳ The **Create new device catalog** window appears:

4. Confirm with **Yes**.

↳ The device catalog is installed and ready for operation.

8.3.2 PROFINET DTM Project

This section explains how to generate a project tree, using PACTware™.

Creating the PROFINET DTM Project Tree

To create the PROFINET DTM project tree, proceed as follows:

Note

Make sure the latest DTM version is installed and that the device catalog is updated.

1. Start PACTware™.

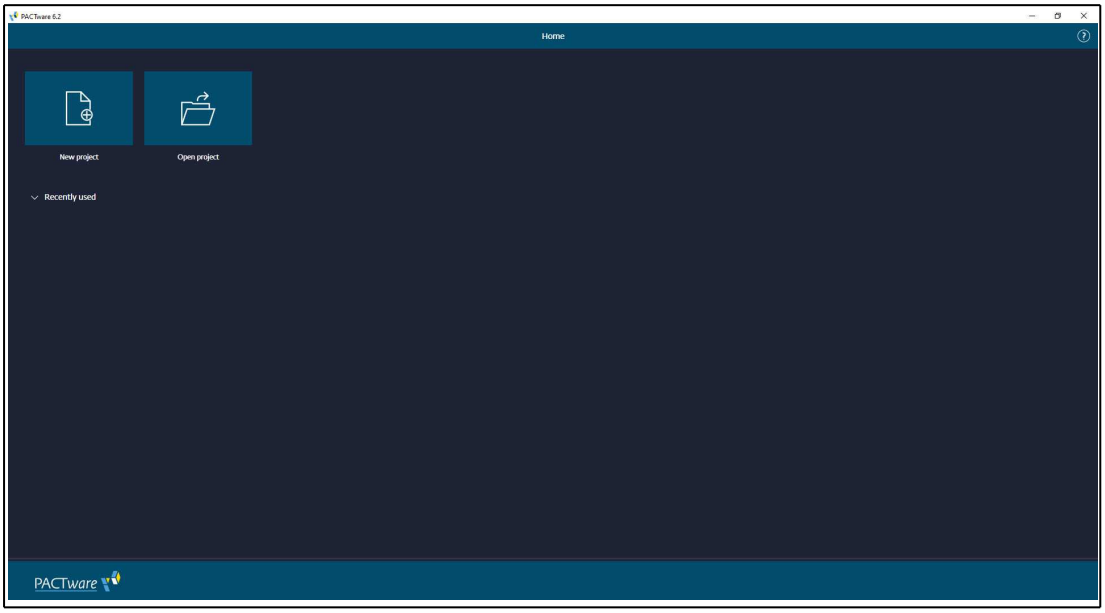


Figure 8.31

2. Open the appropriate project **Open project** or create a new one via **New project**.

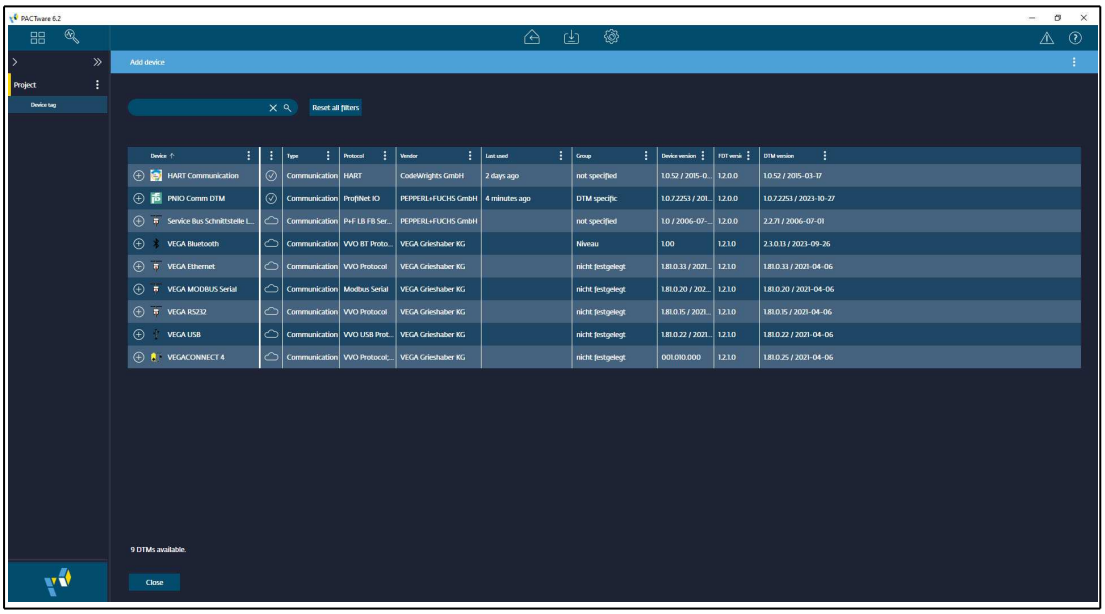


Figure 8.32

↳ The device catalog is displayed.

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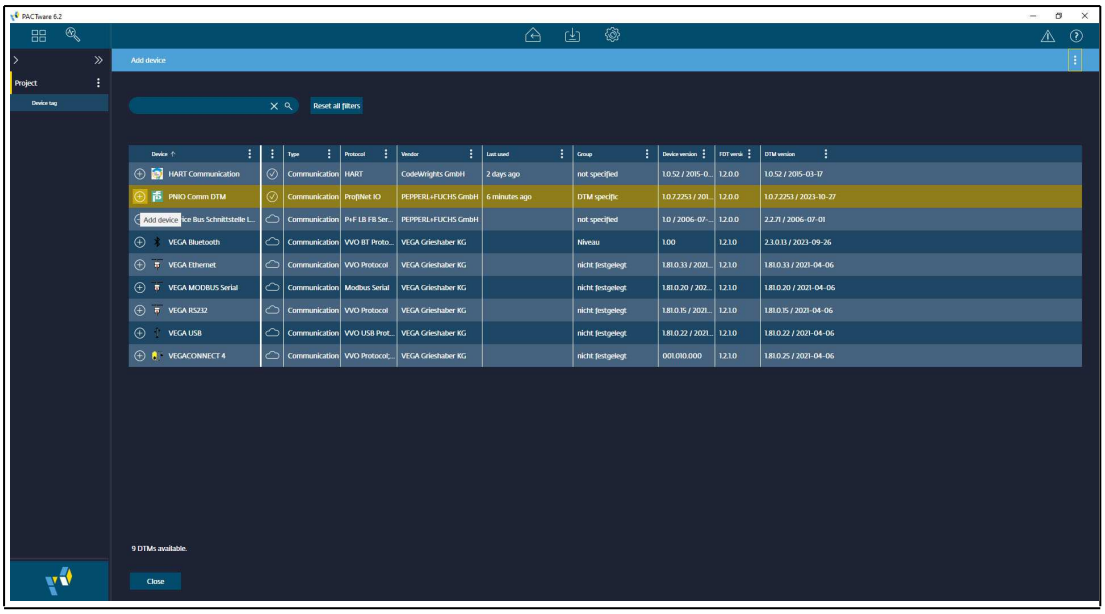


Figure 8.33

3. To add the **PNIO Comm DTM** to your project, click on the "+".

8.3.3 DTM Offline Project Tree

In your FDT application you have the option to generate the project tree in different ways. The following section explains the offline generation.

Creating the Project Tree Offline

Ensure that you have created the PROFINET DTM project tree, see chapter 8.3.2. Ensure that the PNIO Comm DTM line remains active, and proceed as follows:

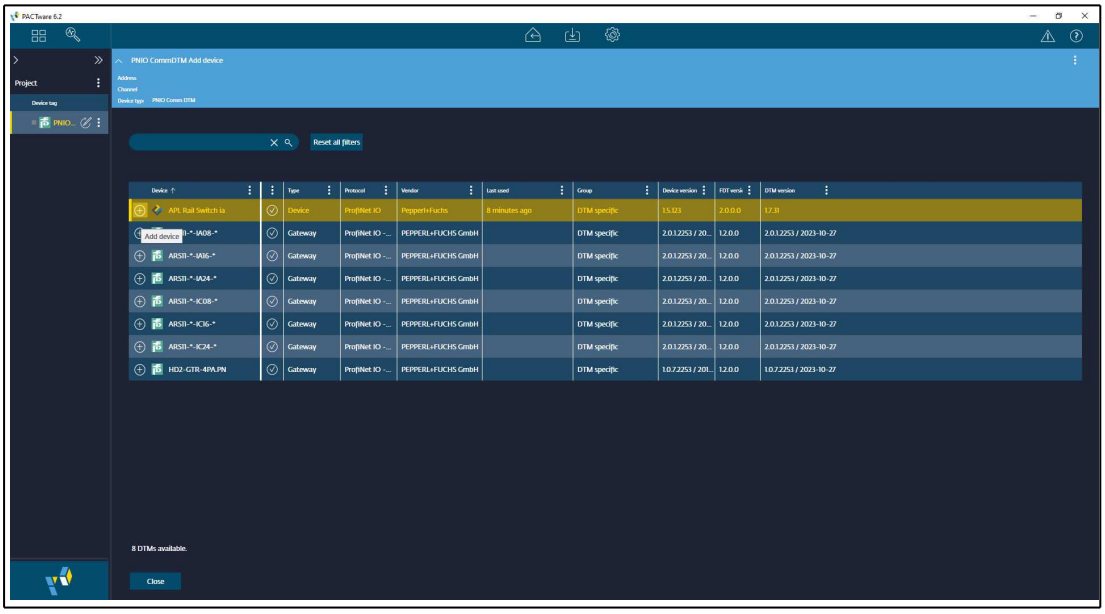


Figure 8.34

1. To add the device to the **PNIO Comm DTM** node in the project window, click on the "+" of the **APL Rail Switch ia**.

2. With the **APL Rail Switch ia** line active, you can now add PROFIBUS PA field devices.

8.3.4 PROFINET Switch Addressing

You can address the PROFINET switch either by entering the assigned tag name or the IP address of the switch into the PNIO Comm DTM. The assigned tag name is the PROFINET name of station assigned by the controller via DCP.

Entering an Assigned Name or IP Address in the DTM

Proceed as follows:

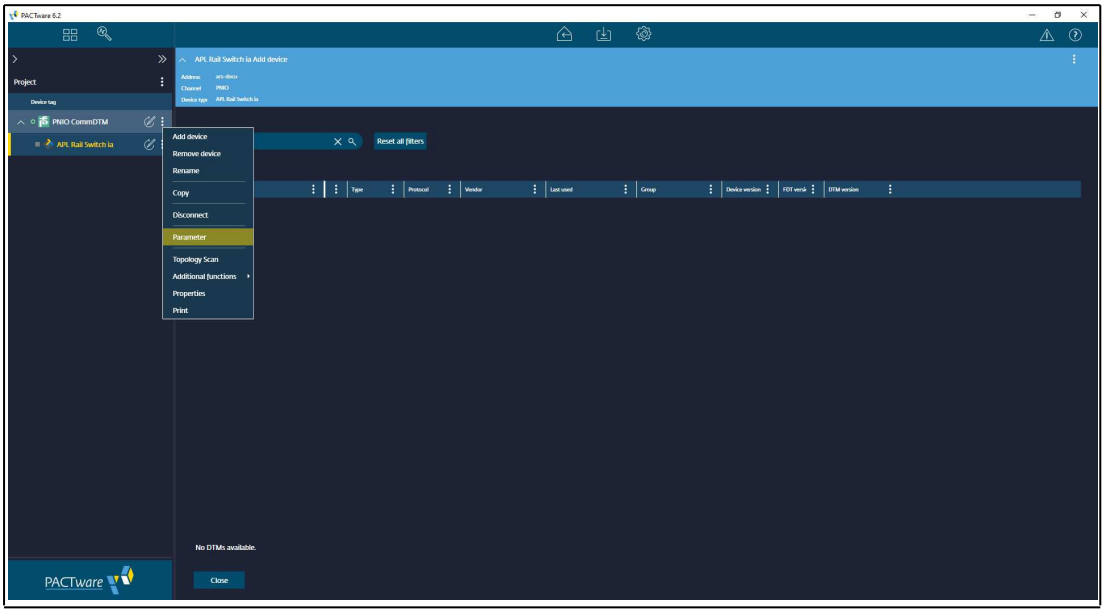


Figure 8.35

1. Right-click on **PNIO Comm DTM** in the project tree and choose the submenu "Parameter".

↳ The Parameter dialog opens.

Note

If you intend to use addressing via tag names, ensure that the IP address field is "{auto}."

2. Set the Ethernet-APL rail field switch address via either of the following options.

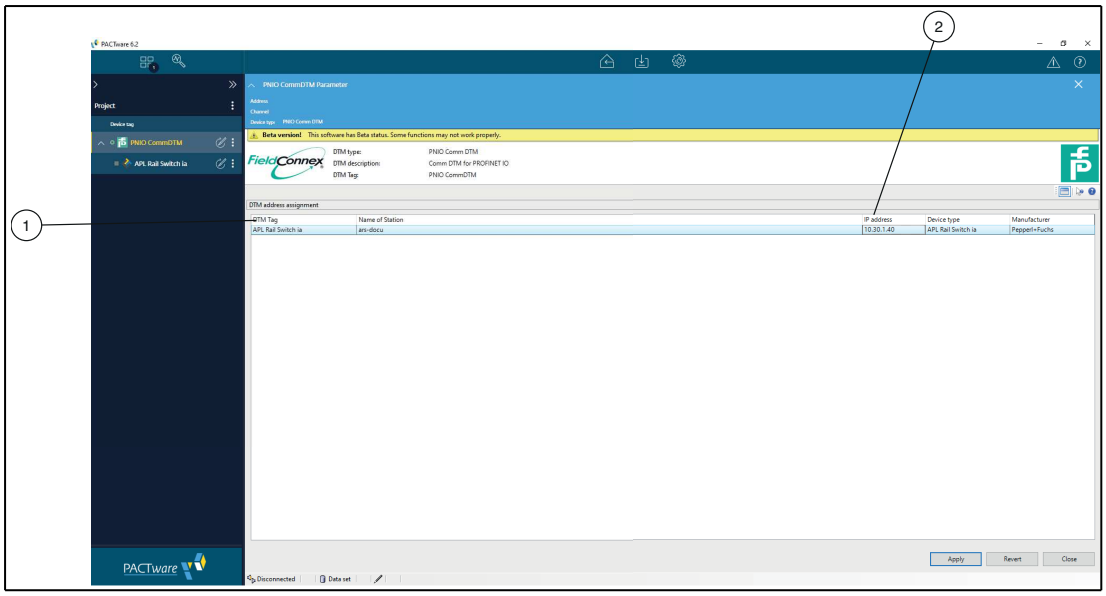


Figure 8.36

1 Tag name / PROFINET name of station assigned to the rail field switch

2 Ethernet-APL rail field switch IP address

↳ If you use PACTware tag names addressing, the DTM checks the device names against the PROFINET naming rules. In case identical device names are found, they are highlighted accordingly. You need to resolve this redundancy accordingly.

8.3.5 Topology Scan

Note

For the Topology Scan, ensure that the system is connected to the same network as the switch.

The DTM provides a topology scan wizard to detect and store the device structure of the scanned network in an FDT project. The scan is performed independently on each level for the communication DTM and the switch.

Once the scan is complete, the wizard shows the differences between the scanned network and the FDT project.

Detected devices are categorized as follows:

- Configured devices: Devices found on the network as part of the FDT project.
- New devices: Devices found on the network without being part of the FDT project. For the devices, DTMs are available in the device catalog.
- Uncataloged devices: Devices found on the network not part of the FDT project. For the devices, no DTMs are available in the device catalog.
- Missing devices: Devices that are part of the FDT project but are not found on the network. If required, select or unselect these devices before completing the network configuration.

Click on **Next** to store the selected network structure in the FDT project or **Cancel** to leave the FDT project unchanged.

Note

The topology scan function on the PROFINET COMM DTM level does only support the scan of Pepperl+Fuchs Ethernet devices supporting the PFDCT protocol.

Creating the Project Tree Online (Topology Scan)

To create the complete project tree online, ensure that you have created the PROFINET DTM project tree, see chapter 8.3.2. Ensure that the PNIO Comm DTM line remains active, and proceed as follows:

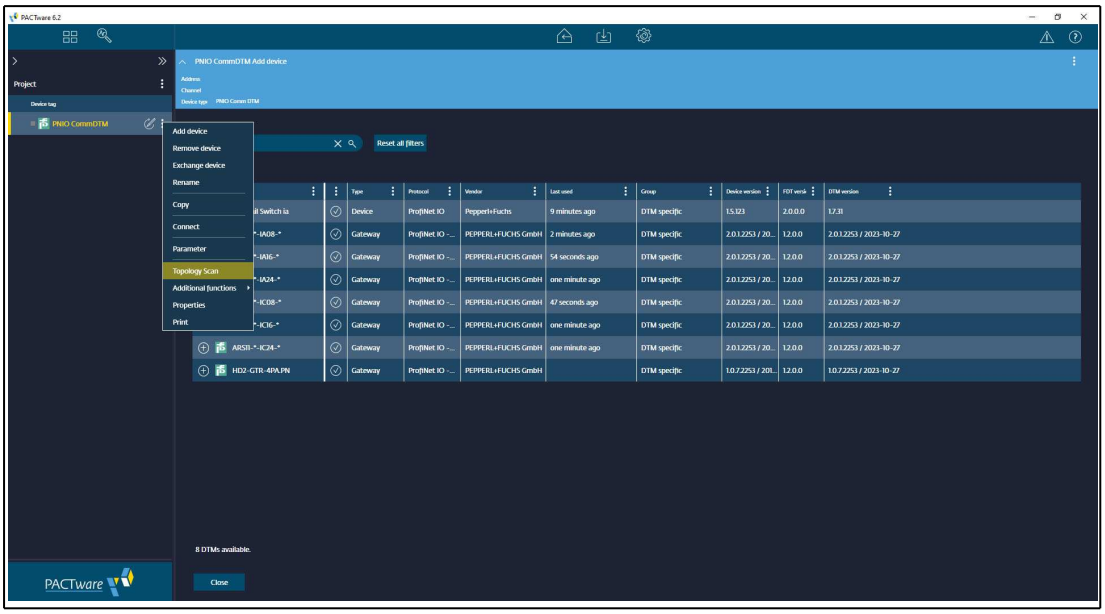
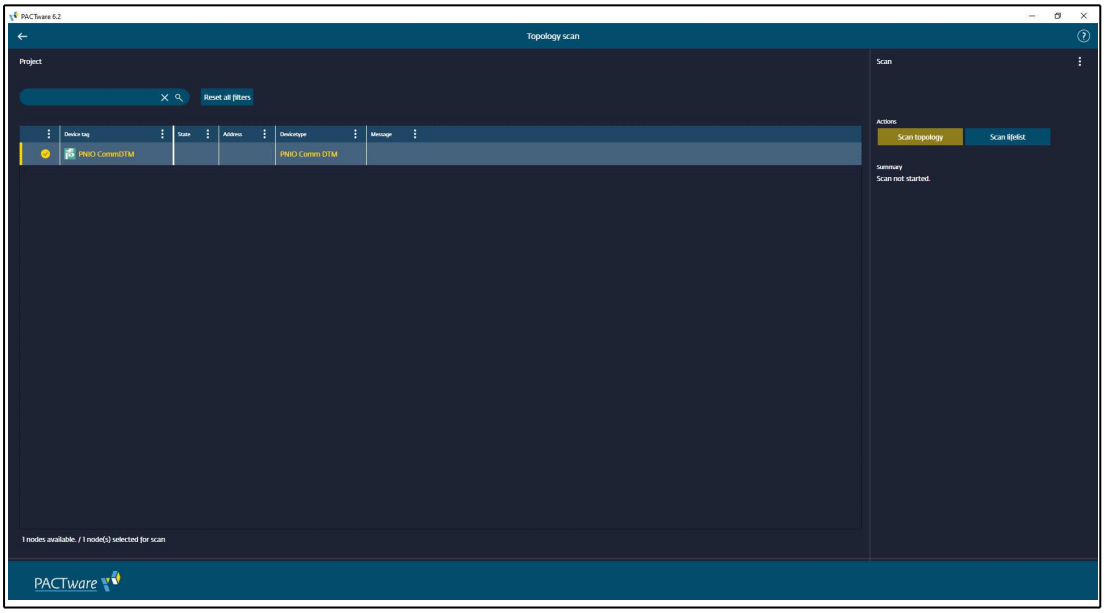


Figure 8.37

1. Right-click on the **PNIO Comm DTM**, and open submenu **Topology Scan**.

   ↳ The topology scan window opens.



2. Click on **Scan topology**.

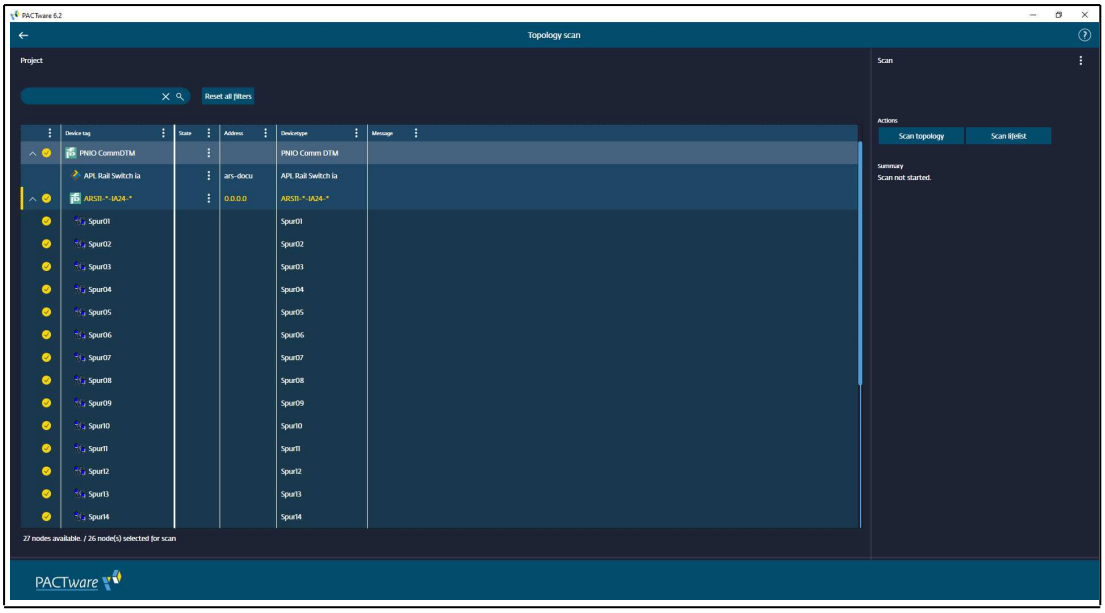


Figure 8.38

↳ The network is scanned and the device topology is detected.

↳ After the scan is complete, the differences between the scanned network and the content of the FDT project is displayed.

3. Choose whether to select/unselect all missing devices or new devices etc.

4. Once the Ethernet-APL rail field switch is detected, activate the checkbox of the rail field switch and have it added to your project tree. To close the Topology Scan dialog, go back to the project tree.

Scanning the Switch for Field Devices

1. In the project tree, right-click on the PNIO Comm DTM and click **Connect**.

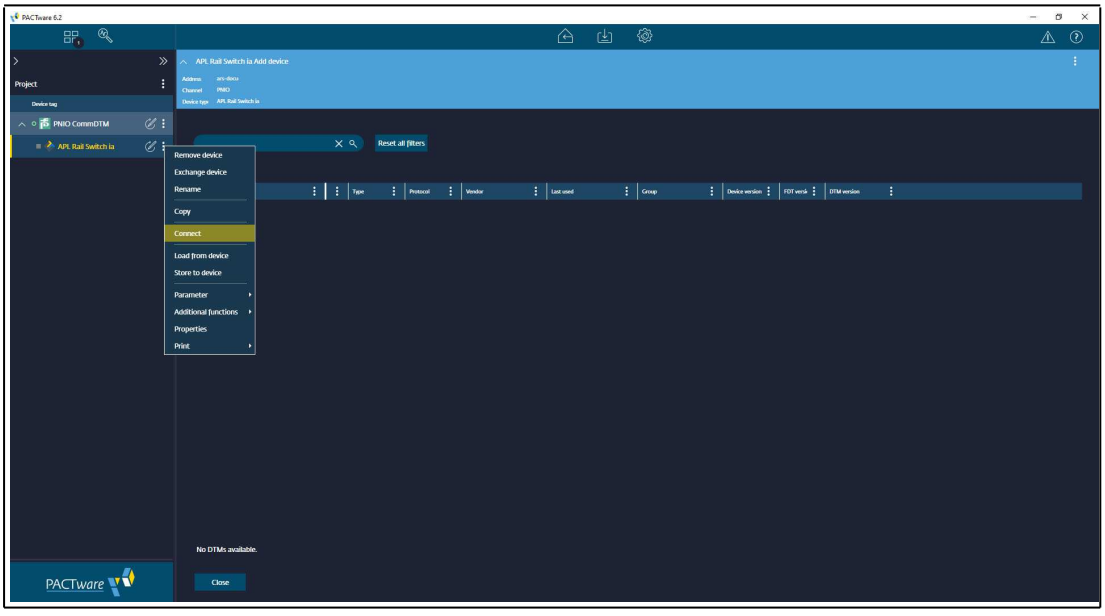


Figure 8.39

2. In the project tree, right-click on rail field switch and click **Connect**.

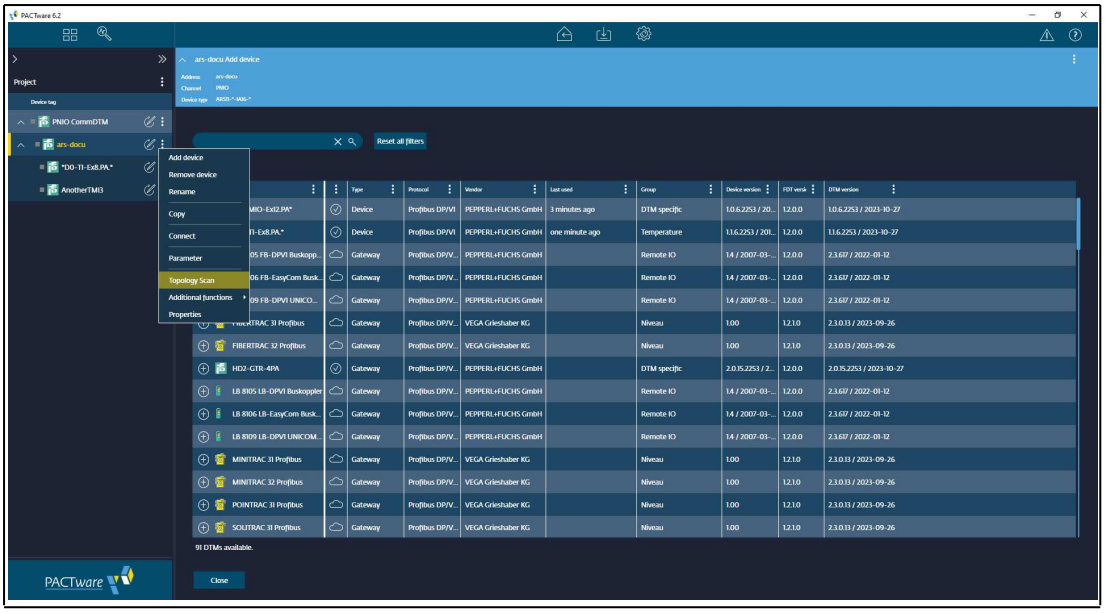


Figure 8.40

3. To scan the topology for the field devices, from the context menu, select **Topology Scan**.

↳ The Topology Scan dialog opens.

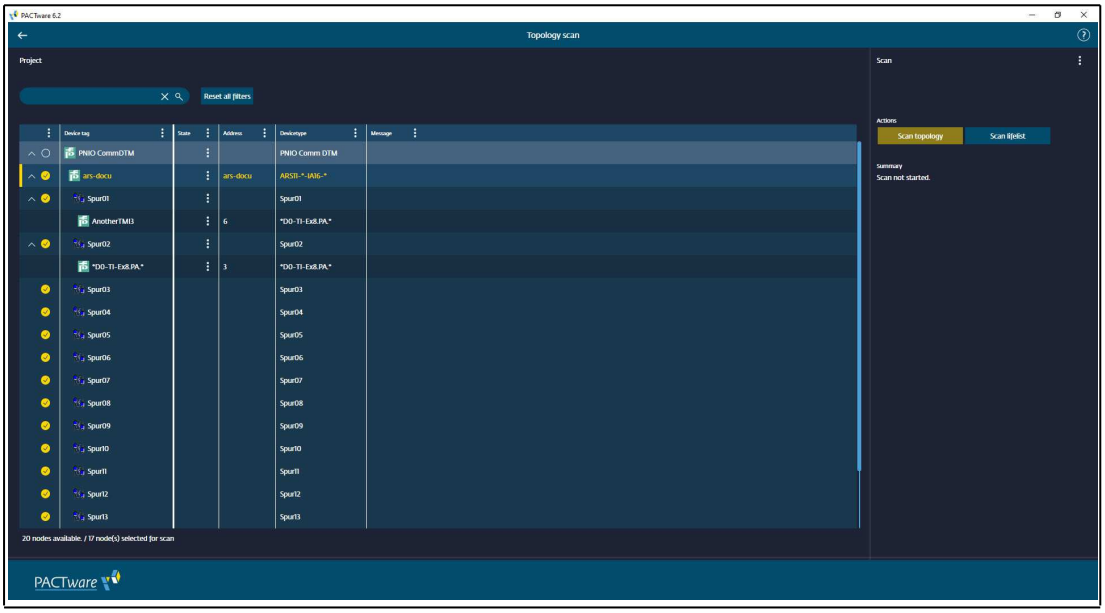


Figure 8.41

4. To start the Topology Scan, click on "Scan topology".

↳ The Topology Scan detects all field devices connected to the rail field switch.

↳ Field devices are added to your project tree.

8.3.6 PROFIBUS PA device manual address assignment

Manual address changes are not required in normal operation because the switch manages them automatically. Using the Ethernet-APL Rail Switch DTMs, you can manually change the address of connected PROFIBUS PA devices for e.g., bench parametrization. The manual address change is only possible in online mode.

Adress assignment

1. In the project tree, click on the switch to which the PROFIBUS PA device is connected to.
2. Select the "Connect" option. Wait until the connection to the switch is established.
3. Select the "PROFIBUS Address Management" option. The list of PROFIBUS PA devices that are connected emerges.
4. Click on the address field of the PROFIBUS PA device whose address you want to change.
5. Modify the address and press the "Return" and afterwards the "Apply" button. The address update could take a few seconds. The status of the address change can be tracked in the log window.

8.3.7 Use of the switch FDI package in conjunction with CodeWrights iDTM-FDI

Ethernet-APL rail field switches can be configured by inserting an iDTM from CodeWrights beneath the rail field switch's gateway DTM. The iDTM employs the rail field switch FDI package and hence provides therefore the same functionality. With PACTware 6.1 the iDTM is included in the DTM library. Check with other FDT frame vendors for iDTM support.

The procedure for installing the rail field switch FDI package and using it with the iDTM with PactWare is provided below. The approach may alter with other FDI hosts, depending on how the iDTM is integrated into the FDT host.

Installation of a FDI-package

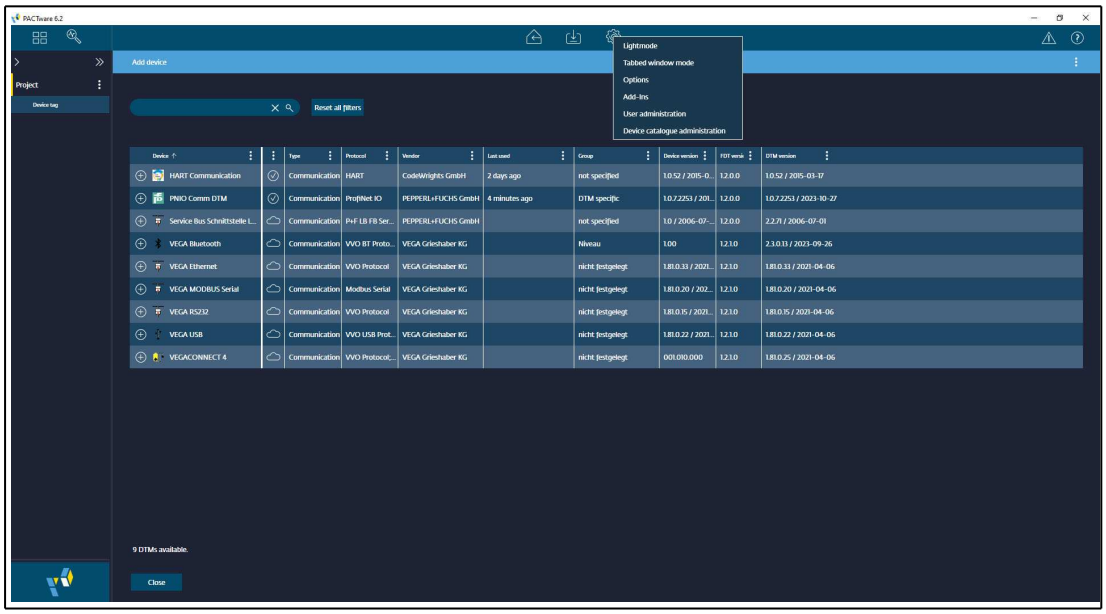


Figure 8.42

1. Navigate to the Settings menu and select the "Device Catalogue Administration" option.

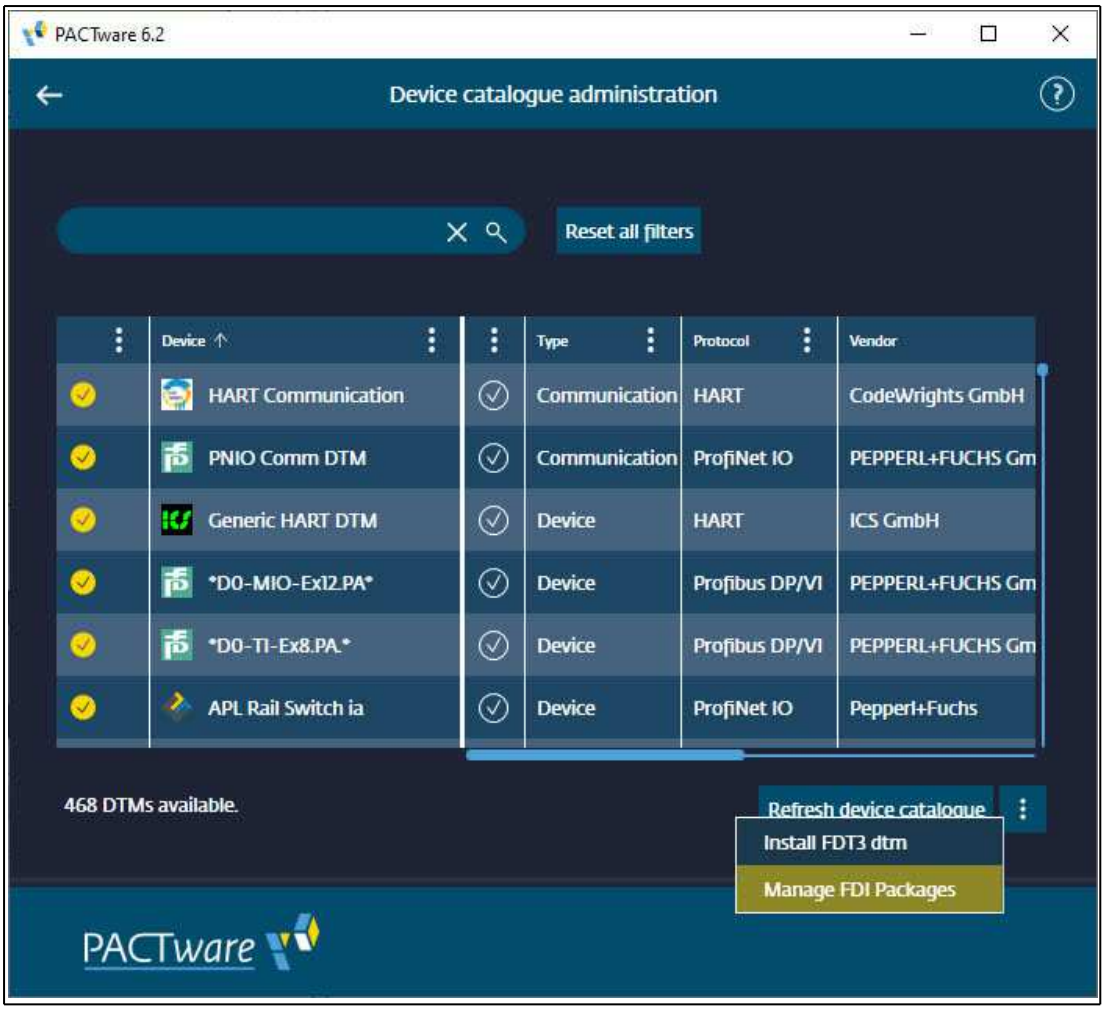


Figure 8.43

2. Select "Manage FDI packages" from the additional option menu (three dots) in the lower right corner of the page.

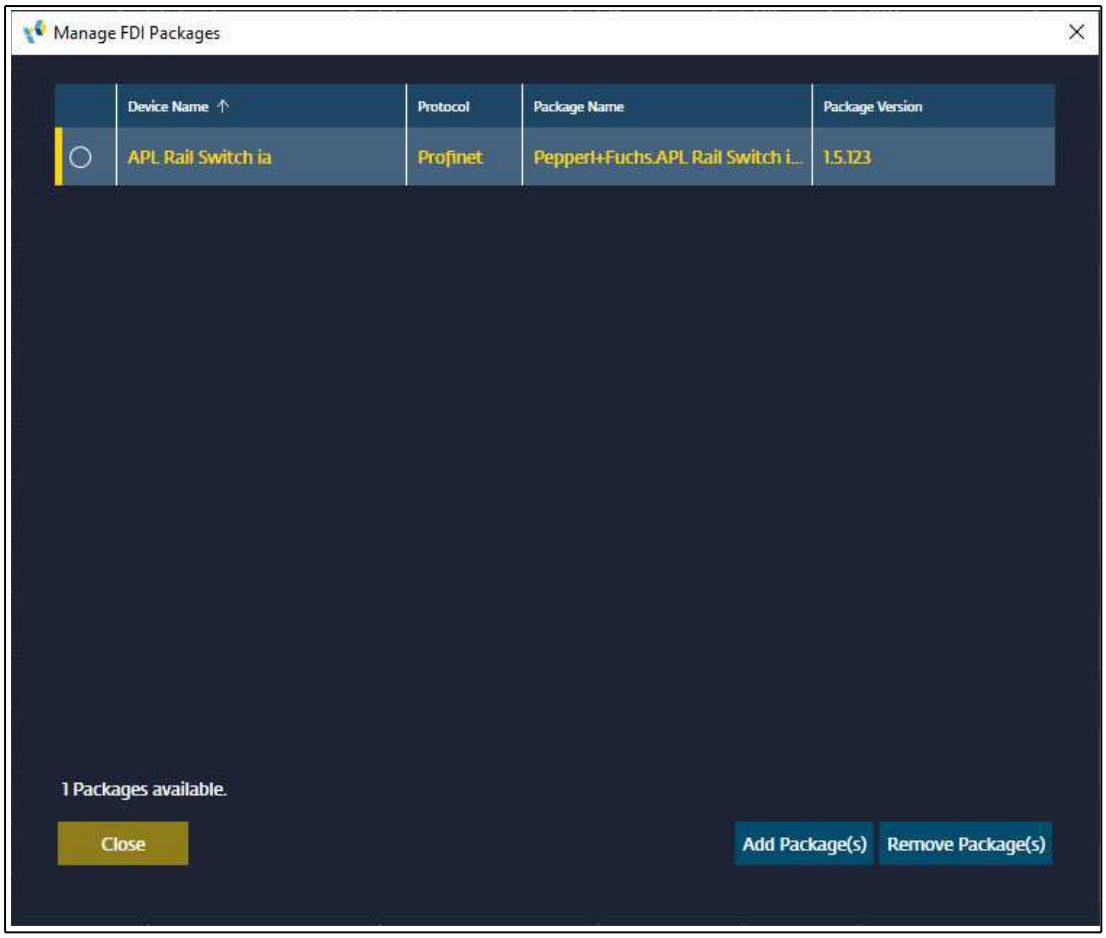


Figure 8.44

3. Select the FDI-package you want to add to the device catalogue and click "Add Packages(s)." The FDI-package will appear in the list of installed FDI-packages after installation.

Adding the FDI-package to an Ethernet-APL switch

1. Open your project and choose "Add device" from the additional option menu (three dots) of the rail field switch with which you wish to utilize the FDI-package.
2. Double-click on the FDI-package you wish to add from the list. To access the FDI-package for rail field switch configuration, double-click on the FDI-package entry in the project tree.

Compatibility

- PANOS v1.2.1 or later
- PactWare 6.1 or later
- ARS IC and IA FDI-package v 1.4 or later
- FieldConnex DTMs package v1.9.0 or later
- iDTM-FDI v 1.7.31 or later

8.4 Field Device Integration (FDI)

For each Ethernet-APL rail field switches series, e.g., ARS*IC and ARS*IA, a generic FDI package is provided. The FDI package allows a basic management of the rail field switches with all FDI-compliant hosts. FDI packages for specific host systems are available to provide full management access to Ethernet-APL rail field switches. A compatibility document of the FDI host and the FDI packages are available on the product web page under www.pepperl-fuchs.com. All tested and approved host systems are listed and limitations due to the host system functionality are described.

For installing and using Ethernet-APL rail field switch with FDI packages, refer to the documentation of the specific FDI host system.

In order to use the FDI package, you need:

- compatible FDI host system
- FDI PROFINET communication package

The FDI package allows to configure the Ethernet-APL rail field switches with a subset of the functionality provided by the web server. Not included web server functionalities in the FDI package are firmware update, network information, and configuration, e.g., access to MAC address tables. To configure the additional functionality, the FDI package offers a user interface plug-in (UIP). This interface allows to launch the device web server in the FDI application.

The FDI package can also be used with a FDT host by using the iDTM-FDI from CodeWrights. See chapter 8.3.7.

8.4.1 FDI Device Data

The structural and graphical representation of the Ethernet-APL rail field switch data depend from the FDI host system. The FDI package defines main menus and sub menus in which the configuration data independent of the host system is structured.

The following tables describe the main menus with its sub menus including references to the web server chapters providing more detailed information. All online sub menus provide access to the device web server by pressing the button "Open device interface."

OFFLINE Configuration

The OFFLINE menu is used to create or visualize stored databases of rail field switches for commissioning or configuration. The OFFLINE database can be downloaded to the rail field switches.

Device Settings Menu

Sub menu	Description	Reference chapter
MRP	Provides access to configuration of the device for use in a Media Redundant Ring (MRP) network	See chapter 8.1.4.2 Configuration / Network / MRP
System time	Provides access to configuration of the device system time with a SNTP server	See chapter 8.1.4.3 Configuration / Device / System time
HTTP/HTTPS server	Enable / disable the HTTP/HTTPS server (Hypertext Transfer Protocol/Hypertext Transfer Protocol Secure) of the device	See chapter 8.1.4.3 Configuration / Device / HTTP server Configuration / Device / HTTPS server
SNMP server	Enable / disable and configure the SNMP server of the device.	See chapter 8.1.4.3 Configuration / Device / SNMP server

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Sub menu	Description	Reference chapter
PFDCP server	Enable / disable the Pepperl+Fuchs Discovery Protocol (PFDCP)	See chapter 8.1.4.3 Configuration / Device / PFDCP server
Diagnosis	Provides information about all currently acknowledged and disabled alerts for the device and each port	See chapter 8.1.4.1 Configuration / Diagnosis

Table 8.7

Diagnostic Menu

Sub menu	Description	Reference chapter
Overview	Provides access to diagnostic information for the device and all ports	See chapter 8.1.3.1 Diagnostics / Overview
Ports	Provides diagnostic information for all ports P1 ... P4 and S1 ... Sn	See chapter 8.1.3.3 Diagnostics / Network / Port summary
Connected devices	Provides information about connected devices to ports P1 ... P4 and S1 ... Sn	See chapter 8.1.3.3 Diagnostics / Network / Connected devices
Physical layer	Provides physical layer information of all spur ports with a connected device. Depending on the type of connected field device, physical layer diagnostic information for the Ethernet-APL (10 Mbit/s) or PROFIBUS PA is available.	See chapter 8.1.3.8 Diagnostics / Physical layer
Statistics	Provides information about communication statistics for Ethernet-APL and PROFIBUS PA	See chapter 8.1.3.3 Diagnostics / Network / Statistics
Network load	Provides information about the load condition of ports Ethernet devices are connected to	See chapter 8.1.3.3 Diagnostics / Network / Network load

Table 8.8

Operate / Maintenance Menu

Sub menu	Description	Reference chapter
Device	Provides access to device specific information	See chapter 8.1.3.4 Diagnostics / Device

Table 8.9

Process Variables Menu

The menu process variables is not in use for the device.

8.4.2 ABB FIM integration

FDI integration into ABB Field Information Manager (FIM) is possible in two ways:

- Using the standard FDI package file with the extension *.fdix.
- Using a FIM specific FDI integration file (FIMlet) with the extension *.fimlet.

The FIMlet based integration allows to manage PROFIBUS PA devices connected to the spurs of the Ethernet-APL rail field switch with manufacturer-specific or profile-specific FDI packages. See chapter 8.4.1

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- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

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