HIRSCHMANN
A BELDEN BRAND

User Manual

Configuration
Lite Managed Switch
GECKO 4TX

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You can get the latest version of this manual on the Internet at the Hirschmann product site (www.hirschmann.com).

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Safety instructions

⚠ WARNING

UNCONTROLLED MACHINE ACTIONS
To avoid uncontrolled machine actions caused by data loss, configure all the data transmission devices individually.
Before you start any machine which is controlled via data transmission, be sure to complete the configuration of all data transmission devices.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

About this manual

The documentation for your device consists of the following documents.

Mounting instruction	This document contains safety instructions and information that you need for mounting the device.
Installation user manual	This document contains a device description, safety instructions and further information that you need for installing the device before you start configuring it.
Configuration user manual	This document contains the information that you need for starting up the device. It takes you step by step from the first startup operation through to the basic settings for operation in your environment.
Online help	The online help contains descriptions of the individual parameters that you configure via the graphical user interface.Use the “Help” button to call up the online help in the graphical user interface. The content of the online help corresponds to the information in the “References” chapter of the configuration user manual.

You can find the documentation that is not provided as a printout with your device as a PDF file under “Downloads” at www.hirschmann.com/en/QR/INET-GECKO4TX_en-HB.

The Industrial HiVision Network Management software provides you with additional options for smooth configuration and monitoring:

- ActiveX control for SCADA integration
- Auto-topology discovery
- Browser interface
- Client/server structure
- Event handling
- Event log
- Simultaneous configuration of multiple devices
- Graphical user interface with network layout
- SNMP/OPC gateway

Key

Designations used:

▶	List
☐	Work step
■	Subheading
Link	Cross-reference with link
Note:	A note emphasizes an important fact or draws your attention to a dependency.
`Courier`	ASCII representation in user interface

Introduction

The device has been developed for use in a harsh industrial environment. Accordingly, the installation process has been kept simple. Thanks to the selected default settings, you only have to enter a few settings before starting to operate the device.

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

1 Defining IP parameters

Note: You will find background information on this topic here: “IP Parameter Basics” on page 105.

To access the device via the network during the first installation, you require the IP parameters of the device.

The device gives you the following options for defining IP parameters:

- Defining IP Parameters via DHCP (state on delivery)
  You need a DHCP server for this. The DHCP server assigns the IP parameters to the device using its MAC address or its system name.

- Defining IP Parameters via HiDiscovery
  You choose this method on a previously installed network device or if you have another Ethernet connection between your PC and the device.

- Defining IP Parameters via BOOTP
  You need a BOOTP server for this method. The BOOTP server assigns the IP parameters to the device using its MAC address.

- Defining IP parameters via the graphical user interface
  You choose this method if your device already has an IP address and can be accessed via the network.

1.1 Defining IP Parameters via DHCP (state on delivery)

Note: You will find background information on this topic here: “Basics of the Dynamic Host Configuration Protocol (DHCP)” on page 111.

Prerequisite:

- You need a DHCP server. The DHCP server assigns the configuration data to the device using its MAC address or its system name.

On delivery, the definition of the IP parameters via a DHCP server is activated. The device tries to obtain an IP address from a DHCP server.

If there is no response from the DHCP server, the device sets the IP address to 0.0.0.0 and makes another attempt to obtain a valid IP address.

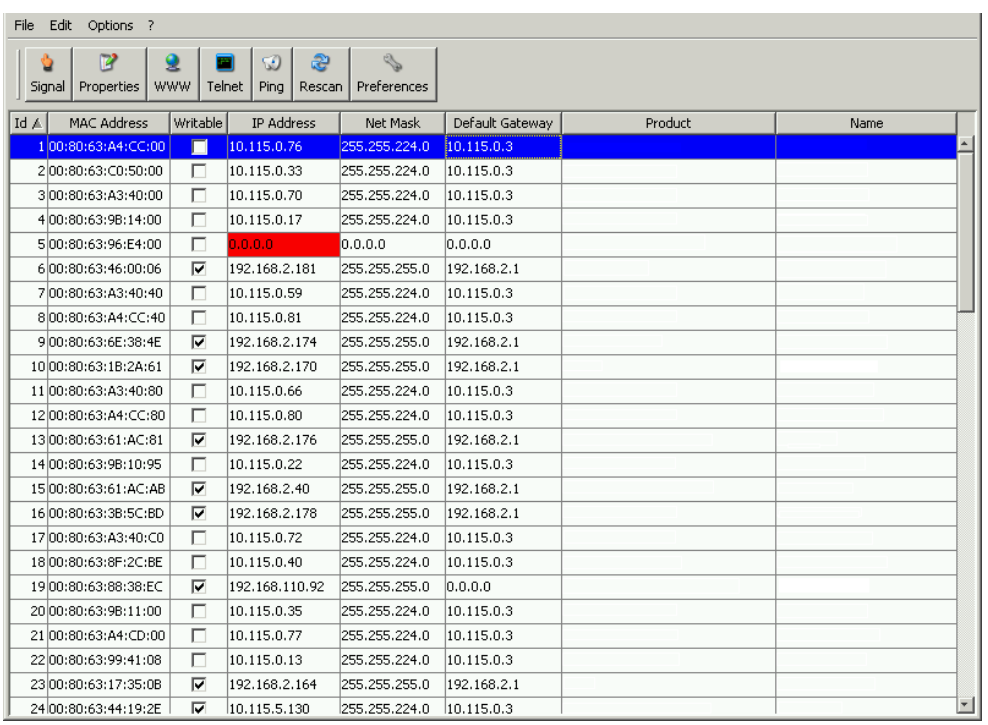
To activate or deactivate the definition of the IP parameters via a DHCP server, you change the source from which the device obtains its IP parameters in the `Basic Settings > Network` dialog, "Management Interface" frame.

1.2 Defining IP Parameters via HiDiscovery

The HiDiscovery protocol enables you to assign IP parameters to the device via the Ethernet.

Install the HiDiscovery software on your PC. You can download the software from the Hirschmann product pages.

☐ Start the HiDiscovery program.



Id	MAC Address	Writable	IP Address	Net Mask	Default Gateway	Product	Name
1	00:80:63:A4:CC:00	☐	10.115.0.76	255.255.224.0	10.115.0.3		
2	00:80:63:C0:50:00	☐	10.115.0.33	255.255.224.0	10.115.0.3		
3	00:80:63:A3:40:00	☐	10.115.0.70	255.255.224.0	10.115.0.3		
4	00:80:63:9B:14:00	☐	10.115.0.17	255.255.224.0	10.115.0.3		
5	00:80:63:96:E4:00	☐	0.0.0.0	0.0.0.0	0.0.0.0		
6	00:80:63:46:00:06	☑	192.168.2.181	255.255.255.0	192.168.2.1		
7	00:80:63:A3:40:40	☐	10.115.0.59	255.255.224.0	10.115.0.3		
8	00:80:63:A4:CC:40	☐	10.115.0.81	255.255.224.0	10.115.0.3		
9	00:80:63:6E:38:4E	☑	192.168.2.174	255.255.255.0	192.168.2.1		
10	00:80:63:1B:2A:61	☑	192.168.2.170	255.255.255.0	192.168.2.1		
11	00:80:63:A3:40:80	☐	10.115.0.66	255.255.224.0	10.115.0.3		
12	00:80:63:A4:CC:80	☐	10.115.0.80	255.255.224.0	10.115.0.3		
13	00:80:63:61:AC:81	☑	192.168.2.176	255.255.255.0	192.168.2.1		
14	00:80:63:9B:10:95	☐	10.115.0.22	255.255.224.0	10.115.0.3		
15	00:80:63:61:AC:AB	☑	192.168.2.40	255.255.255.0	192.168.2.1		
16	00:80:63:3B:5C:BD	☑	192.168.2.178	255.255.255.0	192.168.2.1		
17	00:80:63:A3:40:C0	☐	10.115.0.72	255.255.224.0	10.115.0.3		
18	00:80:63:8F:2C:BE	☐	10.115.0.40	255.255.224.0	10.115.0.3		
19	00:80:63:88:38:EC	☑	192.168.110.92	255.255.255.0	0.0.0.0		
20	00:80:63:9B:11:00	☐	10.115.0.35	255.255.224.0	10.115.0.3		
21	00:80:63:A4:CD:00	☐	10.115.0.77	255.255.224.0	10.115.0.3		
22	00:80:63:99:41:08	☐	10.115.0.13	255.255.224.0	10.115.0.3		
23	00:80:63:17:35:0B	☑	192.168.2.164	255.255.255.0	192.168.2.1		
24	00:80:63:44:19:2E	☑	10.115.5.130	255.255.224.0	10.115.0.3		

Figure 1: HiDiscovery

When HiDiscovery is started, HiDiscovery automatically searches the network for those devices which support the HiDiscovery protocol.

HiDiscovery uses the first network interface found for the PC. If your computer has several network cards, you can select the one you desire in the HiDiscovery toolbar.

HiDiscovery displays a line for every device that reacts to the HiDiscovery protocol.

HiDiscovery enables you to identify the devices displayed.

- ☐ Select a device line.
- ☐ Click the "Signal" symbol in the tool bar to set the LEDs for the selected device flashing. To switch off the flashing, click on the symbol again.
- ☐ By double-clicking a line, you open a window in which you can enter the device name and the IP parameters.

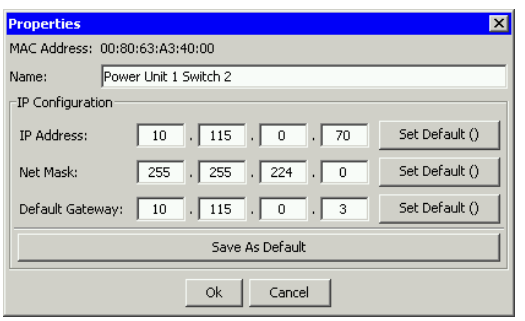


Figure 2: HiDiscovery—IP parameter assignment

Note: For security reasons, switch off the HiDiscovery function for the device in the graphical user interface, after you have assigned the IP parameters to the device.
See “Enabling/disabling HiDiscovery access” on page 38.

Note: So that the entries are available again after a restart, you save the settings in the local non-volatile memory of the device via the "Load/Save" dialog.

1.3 Defining IP parameters via the graphical user interface

Prerequisite:

- Your device already has an IP address and can be accessed via the network.

Procedure:

☐ Open the `Basic Settings > Network` dialog.

☐ In the "IP Parameters" frame, define the IP parameters of the device:

Parameter	Meaning
IP Address	Specifies the IP address under which the device management can be accessed via the network. Possible values: ▶ Valid IPv4 address (default setting: —)
Netmask	Specifies the netmask. The netmask identifies the network prefix and the host address of the device in the IP address. Possible values: ▶ Valid IPv4 netmask (default setting: —)
Gateway address	Specifies the IP address of a router through which the device accesses other devices outside its own network. Possible values: ▶ Valid IPv4 address (default setting: —)

☐ To temporarily save the changes, click "Set".

Note: So that the entries are available again after a restart, you save the settings in the local non-volatile memory of the device via the "Load/Save" dialog.

1.4 Defining IP Parameters via BOOTP

Prerequisite:

- You need a BOOTP server for this method. The BOOTP server assigns the configuration data to the device using its MAC address.

Procedure:

☐ Open the `Basic Settings > Network` dialog.

☐ To activate the assignment of the IP parameters via a BOOTP server, select the `BOOTP` value in the "Management Interface" frame.

With the BOOTP function activated the device sends a boot request message to the BOOTP server. The server answers with a boot reply message. The boot reply message contains the assigned IP address.

If there is no response from the BOOTP server, the device sets the IP address to 0.0.0.0 and makes another attempt to obtain a valid IP address.

2 Starting the graphic user interface

Prerequisite:

▶ The IP parameters of the device are defined and the device can be accessed via the network.
See “Defining IP parameters” on page 13.

Procedure:

☐ Start your Web browser.

☐ Write the IP address of the device in the address field of the Web browser. Use the following format: `https://xxx.xxx.xxx.xxx`

The Web browser sets up the connection to the device and shows the login window.

☐ Select the language for the graphical user interface.

☐ Select the user name and the password:

User name	Password (default setting)	Access role
admin	private	read and write access
user	public	read access only

☐ Click "OK".

The Web browser shows the window with the graphical user interface.

3 Loading/Storing the Configuration

The device gives you the following options for loading or saving the device configuration:

- Resetting the configuration to the delivery state
- Importing a configuration
- Saving the configuration in the device
- Exporting a configuration

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

3.1 Resetting the configuration to the delivery state

When it is restarted, the device loads its configuration data from the local non-volatile memory.
If you reset the settings in the device to the delivery state, the device deletes the configuration in the volatile memory and in the non-volatile memory. The device then reboots and loads the delivery settings.

Prerequisite:
- ▶ You are accessing the device as an “admin” user with read and write access.

Procedure:
- ☐ Select the dialog `Basic Settings > Load/Save`.
- ☐ In the "Load/Save" frame, click the "Reset" button beside “Back to delivery state”.

3.2 Importing a configuration

The device allows you to load settings from a configuration file from your PC or from a TFTP server.

Prerequisite:
- You are accessing the device as an “admin” user with read and write access.
- Import from a TFTP server
  The configuration file is saved in the relevant path of the TFTP server with the file name, e.g. `backup/config.bin`
  See “Exporting a configuration” on page 26.
- Import from your PC:
  The configuration file is saved as a binary file on your PC.

Procedure:
☐ Select the dialog `Basic Settings > Load/Save`.
☐ Select the `Server to device` value for the transfer direction in the "Configuration Transfer"frame.
  - Or enter the path for the configuration file on a TFTP server.
    The URL identifies the path to the configuration file stored on the TFTP server with the file name. The URL has the form tftp://IP address of the TFTP server/path name/file name.
  - Or use Drag & Drop to pull the file to the dotted area in the “Configuration Transfer” frame.
    This option support all common Web browsers except the Internet Explorer.

☐ Click "Transfer".
  After the update is completed successfully, you activate the configuration: Restart the device by clicking “Restart”.

Note: Loading a configuration deactivates the ports while the configuration is being set up. Afterwards, the device sets the port status according to the new configuration.

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

3.3 Saving the configuration in the device

The device allows you to save the current configuration data in the local non-volatile memory of the device.

Prerequisite:

▶ You are accessing the device as an “admin” user with read and write access.

Procedure:

☐ Select the dialog `Basic Settings > Load/Save`.

☐ In the "Load/Save" frame, click the "Save" button beside "Save current configuration".

3.4 Exporting a configuration

The device allows you to save settings in a configuration file on your PC or on a TFTP server.

Prerequisite:
- You are accessing the device as an “admin” user with read and write access.

Procedure:
☐ Select the dialog `Basic Settings > Load/Save`.
☐ Select the `Device to server` value for the transfer direction in the "Configuration Transfer" frame.
- Either click "Download" beside "Save as" in the "Configuration Transfer" frame to save the configuration on your PC.
- Or enter the path to the storage location on a TFTP server.
  The URL identifies the path to the configuration file stored on the TFTP server with the file name. The URL has the form
  tftp://IP address of the TFTP server/path name/file name.
  Click "Transfer".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

4 Checking the status of the software/updating the software

Hirschmann never stops working on improving the performance of its products. So it is possible that you may find a more up to date release of the software on the Hirschmann Internet site (www.hirschmann.com) than the release saved on your device.

4.1 Checking the status of the software

The device allows you to display the status of the software saved on the device.

Procedure:
☐ Select the `Basic settings > Software` dialog.
☐ The "Running Version" frame shows you the release number of the software saved on the device.

4.2 Updating the software

Prerequisite:

- The file with the more recent software version is saved on a TFTP server, on your PC or on a network drive.

Procedure:

☐ Select the `Basic settings > Software` dialog.

You have 2 options for updating the software:

- Enter the path for the configuration file on a TFTP server.
  The URL identifies the path to the software stored on the TFTP server with the file name. The URL has the form
  tftp://IP address of the TFTP server/path name/file name.
- Or use Drag & Drop to pull the file to the dotted area in the “software update” frame.
  This option support the common Web browsers except the Internet Explorer.

☐ Click "Install" to transfer the software to the device.
The “Status” frame shows the progress of the installation.
After a successful installation, the message “Flash 100.00 % completed” appears in the progress bar.

☐ After successfully loading it, you activate the new software:
Restart the device by clicking “Restart”.

5 Configuring the Ports

This device gives you the following options for defining basic settings for the ports:

- Enabling/disabling ports
  For a higher level of access security, disable the ports at which you are not connecting any other network components.

- Selecting the operating mode
  The device allows you to manually select the data transfer rate and a half duplex or full duplex connection, or to have the device define this automatically (autonegotiation).

- Switching link monitoring (alarm messages) on/off
  The device allows you to transfer alarm messages to a network management station.

5.1 Enabling/disabling ports

Every port is enabled in the state on delivery. For a higher level of access security, disable the ports at which you are not connecting any network components.

Procedure:
☐ Select the dialog `Basic Settings > Port > Configuration`.
☐ To enable or disable a port, select the value `Off` or `On` in the "Status" column for the relevant port.

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

5.2 Selecting the operating mode

In the state on delivery, the ports are in the "autonegotiation" operating mode.

With autonegotiation, the device autonomously determines the maximum possible data transfer rate and the duplex mode between the connected ports.

If autonegotiation is switched off at the remote site, the device uses the “parallel detection” method. The device determines the maximum possible data transfer rate and selects the half duplex mode. The remote site must be permanently set to half duplex, as otherwise the result is a duplex mismatch (one side supports full duplex and the other supports half duplex). This causes a very slow connection.

Procedure:

☐ Select the dialog `Basic Settings > Port > Configuration`.

☐ If the device connected to this port requires a fixed setting, select the transfer speed and the duplex mode in the "Manual Configuration" column.

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

5.3 Switching link monitoring (alarm messages) on/off

The device allows you to transfer alarm messages to a network management station. In the `Basic Settings > Port > Configuration` dialog, you specify whether the device sends an SNMP trap when it detects a change in the monitored functions. You specify the monitored functions in the `Diagnostics > Alarms (Traps)` dialog.

Procedure:

☐ Select the dialog `Basic Settings > Port > Configuration`.

☐ To enable or disable the transfer of alarm messages to a network management station, select the value `On` or `Off` in the "Link Monitoring" column for the relevant port.

☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

6 Protection from Unauthorized Access

The device provides you with the following options to help you protect it against unauthorized access.

- Changing passwords
  For a higher level of access security, change the preset passwords for the access to the device.

- Enabling/disabling ports
  For security reasons, disable the ports at which you are not connecting any other network components.

- Enabling/disabling HiDiscovery access
  For security reasons, restrict the HiDiscovery function for the device or disable it after you have assigned the IP parameters to the device.

- Adjusting the SNMP access
  To make unauthorized access to the device more difficult, change the community for read/write access, define a different community for read/write access than for read access, and only use SNMPv1 or SNMPv2 in environments protected from eavesdropping. We recommend using SNMPv3 and deactivating the access via SNMPv1 and SNMPv2 in the device.

6.1 Changing passwords

Note: The passwords for accessing the device via the graphical user interface are the same as the passwords for accessing the device via SNMPv3.

A network management station communicates with the device via the Simple Network Management Protocol (SNMP).
Every SNMP packet contains the IP address of the sending computer and the password with which the sender of the packet wants to access the management information base (MIB) of the device.

The device receives the SNMP packet and compares the IP address of the sending computer and the password with the entries in the MIB of the device . If the password has the appropriate access right, and if the IP address of the sending computer has been entered, the device will allow access.

The preset passwords on delivery:

User name	Password (default setting)	Access role
admin	private	read and write access
user	public	read access only

Prerequisite:

- You are accessing the device as an “admin” user with read and write access.

Please note the following information on secure passwords:

- ☐ Define a new password with which you can access from your computer with write access.
  Treat this community with discretion since everyone who knows the password can access the MIB of the device with the IP address of your computer.
- ☐ Set different passwords for the read password and the read/write password so that a user that only has read access (user name “user”) does not know, or cannot guess, the password for read/write access (user name “admin”).

Procedure:

- ☐ Select the `Security > Password` dialog.
- ☐ Select "Modify read-only password (user)" to enter the read password or "Modify read/write password (admin)" to enter the read/write password. The minimum password length is 8 characters. Upper- and lower-case letters, numbers and special characters are allowed.
- ☐ Enter the password for user “admin” in the "Current Administrator Password" field.
- ☐ Enter the new password in the "New Password" field.
- ☐ Repeat your entry in the "Please retype" field.
- ☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: So that the entries are available again after a restart, you save the settings in the local non-volatile memory of the device via the "Load/Save" dialog.

6.2 Enabling/disabling HiDiscovery access

The HiDiscovery protocol enables you to assign IP parameters to the device via the Ethernet.
You will find more information on this topic here: “Defining IP Parameters via HiDiscovery” on page 15.

Note: For security reasons, restrict the HiDiscovery function for the device or disable it after you have assigned the IP parameters to the device.

Procedure:
☐ Select the `Basic Settings > Network` dialog.
☐ To disable the HiDiscovery function, select the value `Off` for "Operation" in the "HiDiscovery Protocol" frame.
☐ To disable the write access to the device using HiDiscovery, select the value `Off` for "Write Permission" in the "HiDiscovery Protocol" frame.
☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

6.3 Adjusting the SNMP access

The SNMP protocol allows you to monitor and configure the device via the network with a network management system (NMS). When the NMS accesses the device via SNMPv1 or SNMPv2, the NMS authenticates itself with the community. When the NMS accesses the device via SNMPv3, the NMS authenticates itself with a user's login data.

Make the following basic provisions to make undesired access to the device more difficult:

- ☐ Change the community for read/write access. Treat this community confidentially. Everyone who knows the community has the option to change the settings for the device.
  See "Modifying the community for read/write access" on page 40.
- ☐ Specify a different community for read/write access than for read access.
  See "Modifying the community for read/write access" on page 40.
- ☐ Use SNMPv1 or SNMPv2 only in environments protected from eavesdropping. The protocols do not use encryption. The SNMP packets contain the community in clear text. We recommend using SNMPv3 and deactivating the access via SNMPv1 and SNMPv2 in the device.
  See "Deactivating the access via SNMPv1 or SNMPv2 in the device" on page 41.
  See "Activating access via SNMPv3 in the device" on page 41.

6.3.1 Modifying the community for read/write access

In the state on delivery, you access the device via the communities `public` (read access) and `private` (read/write access).

The community is contained in every SNMP packet. When it receives a packet, the device compares this community with the communities specified in the device. If the communities match, the device accepts the SNMP packet and grants access.

Prerequisite:

- You are accessing the device as an “admin” user with read and write access.

Procedure:

☐ Open the `Device Security > SNMP` dialog.
The dialog shows the communities that are set up.

☐ In the row for the `Write` community, click the "Name" field. Enter the community.
- Up to 32 alphanumeric characters are allowed.
- The device differentiates between upper and lower case.
- Specify a different community than for read access.

☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

6.3.2 Deactivating the access via SNMPv1 or SNMPv2 in the device

Prerequisite:
- ▶ You are accessing the device as an “admin” user with read and write access.

Procedure:
- ☐ Open the `Device Security > SNMP` dialog.
- ☐ To deactivate the SNMPv1 protocol, you remove the selection from the "SNMPv1 enabled" checkbox.
- ☐ To deactivate the SNMPv2 protocol, you remove the selection from the "SNMPv2 enabled" checkbox.
- ☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

6.3.3 Activating access via SNMPv3 in the device

Prerequisite:
- ▶ You are accessing the device as an “admin” user with read and write access.

Procedure:
- ☐ Open the `Device Security > SNMP` dialog.
- ☐ To activate the SNMPv3 protocol, select the "SNMPv3 enabled" checkbox.
- ☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

7 Network load control

The device gives you the following options for reducing the network load:

- Direct packet distribution
- Prioritizing the data traffic (Quality of Service)

7.1 Direct packet distribution

The device reduces the network load with direct packet distribution.

The device learns the MAC address of the senders of received data packets at every port. The device stores the combination “port and MAC address” in a MAC address table (forwarding database).

By applying the “store-and-forward” method, the device buffers data received and checks it for validity before forwarding it. The device rejects invalid and defective data packets.

7.1.1 Learning MAC addresses

If the device receives a data packet, it checks whether the MAC address of the sender is already stored in the MAC address table. If the MAC address of the sender is unknown, the device generates a new entry. The device then compares the destination MAC address of the data packet with the entries stored in the MAC address table:

- The device sends packets with a known destination MAC address directly to ports that have already received data packets from this MAC address.
- The device floods data packets with unknown destination addresses, that is, the device forwards these data packets to all ports.

7.1.2 Aging of learned MAC addresses

Addresses that have not been detected by the device for the period of time of 30 seconds (aging time) are deleted from the MAC address table (FDB) by the device. A reboot or resetting of the MAC address table deletes the entries in the MAC address table (FDB).

7.1.3 Creating static address entries

In addition to learning the sender MAC address, the device also provides the option to set MAC addresses manually. These MAC addresses remain configured and survive resetting of the MAC address table as well as rebooting of the device.

Static address entries allow the device to forward data packets directly to selected device ports.

Prerequisite:

▶ You are accessing the device as an “admin” user with read and write access.

Procedure:

☐ Open the `Switching > Filter for MAC addresses` dialog.
☐ To add a user-defined MAC address, click "Create".
☐ In the "Address" field, define the destination MAC address to which the table entry applies.
☐ In the "Possible Ports" field, select the device ports to which the device sends data packets with the specified destination MAC address.
  ☐ Select exactly one device port if you have defined a unicast MAC address in the "Address" field.
  ☐ Select one or more device ports if you have defined a multicast MAC address in the "Address" field.
☐ Click "OK".
☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

7.1.4 Deleting learned address entries

Prerequisite:
- ▶ You are accessing the device as an “admin” user with read and write access.

Procedure:
- ☐ To delete the learned addresses from the MAC address table (FDB), open the `Switching > Filter for MAC Addresses` dialog and click the "Delete" button beside the address entry to be deleted.
- ☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

7.2 Prioritizing the data traffic (Quality of Service)

Note: You will find background information on this topic here: “Basics of prioritizing the data traffic” on page 133.

QoS (Quality of Service) is a procedure defined in IEEE 802.1D. It is used to distribute resources in the network. QoS allows you to prioritize the data of important applications.

Prioritizing prevents data traffic with lower priority from interfering with delay-sensitive data traffic, especially when there is a heavy network load. Delay-sensitive data traffic includes, for example, voice, video, and real-time data.

7.2.1 Setting prioritization

Assigning the port priority

- ☐ Open the `Switching > QoS/Priority > Port Configuration` dialog.
- ☐ In the "Port Priority" column, you define the priority with which the device sends the data packets received on this port without a VLAN tag.
- ☐ In the "Trust Mode" column, you define the criteria the device uses to assign a traffic class to data packets received.
- ☐ To save the changed settings in the temporary memory of the device, click "Set".

Assigning VLAN priority to a traffic class

☐ Open the `Switching > QoS/Priority > 802.1D/p-Mapping` dialog.
☐ To assign a traffic class to a VLAN priority, insert the associated value in the "Traffic Class" column.
☐ To save the changed settings in the temporary memory of the device, click "Set".

Assigning DSCP to a traffic class

☐ Open the `Switching > QoS/Priority > IP DSCP Mapping` dialog.
☐ Enter the desired value in the "Traffic Class" column.
☐ To save the changed settings in the temporary memory of the device, click "Set".

Note: The device stores changed settings in the temporary memory when you click "Set".
You use the `Basic Settings > Load/Save` dialog to save changed settings permanently in the local memory of the device.

8 Diagnostics

The device provides you with the following diagnostic tools:

- Setting alarms (traps)
- Displaying the topology discovery
- System log

8.1 Setting alarms (traps)

The device immediately reports unusual events which occur during normal operation to the management station. This is done by messages called traps that bypass the polling procedure (“polling” means querying the data stations at regular intervals). Traps allow you to react quickly to unusual events.

The device sends traps to those hosts entered in the trap destination table. The device allows you to configure the trap destination table with the management station via SNMP.

List of SNMP traps

The following table shows a list of possible traps sent by the device.

Name of the trap	Meaning
authenticationFailure	is sent if a station attempts to access an agent without permission.
coldStart	is sent during the boot phase when a cold start is performed (after the successful initialization of the network management).
linkDown	is sent if the link to a port is interrupted.
linkUp	is sent when the connection to a port is intact.
lldpRemTablesChange	is sent if an entry in the topology table is changed.
newRoot	is sent if the sending agent becomes a new root of the spanning tree.
topologyChange	is sent if the port status changes from “blocking” to “forwarding”, or from “forwarding” to “blocking”.

Table 1: Possible traps

Prerequisite:

▶ You are accessing the device as an “admin” user with read and write access.

Procedure:

☐ Open the dialog.

This dialog allows you to specify which events trigger a trap, and where the device sends these messages.

☐ In the "Destination Addresses" frame you enter the name of the trap community that the device uses to identify itself as the source of the trap.

☐ Enter the IP address of the management stations to which the device sends the traps.

The device generates traps for changes that have been selected in the frame. Create at least one SNMP manager that receives traps.

8.2 Displaying the topology discovery

Note: You will find background information on this topic here: “Basics of the Topology Discovery” on page 131.

Procedure:
☐ Open the `Diagnostics > LLDP` dialog.

The “Topology Discovery” frame displays the collected LLDP information for the neighboring devices. This information enables the network management station to map the structure of your network.

Parameter	Meaning
Port	Displays the number of the device port.
Neighbor Identifier	Displays the chassis ID of the neighboring device. This can be the basis MAC address of the neighboring device, for example.
Neighbor IP Address	Displays the IP address with which the management functions of the neighboring device can be reached.
Neighbor Port Description	Displays a description for the device port of the neighboring device.
Neighbor System Name	Displays the device name of the neighboring device.
Neighbor System Description	Displays a description for the neighboring device.

If you use a port to connect several devices, for example via a hub, the table contains a line for each connected device.

The FDB address table contains MAC addresses of devices that the topology table hides for the sake of clarity.

8.3 System log

The system log file is an HTML file in which the device writes every important device-internal event. In service situations, this report provides the necessary information to the technician.

The table in the `Diagnostics > System Log` dialog lists the logged events.
☐ To archive the content of the log as an HTML file, click the “Save” button.

9 Configuring the Rapid Spanning Tree Protocol redundancy procedure

Note: You will find background information on this topic here: “Basics of the Spanning Tree Protocol” on page 113.

The device supports the Rapid Spanning Tree Protocol (RSTP) defined in standard IEEE 802.1D-2004. This protocol is a further development of the Spanning Tree Protocol (STP) and is compatible with it.

The Rapid Spanning Tree Protocol enables fast switching to a newly calculated topology without interrupting existing connections.
RSTP configures the network topology completely independently. The device with the lowest bridge priority automatically becomes the root bridge. However, to define a specific network structure regardless, you specify a device as the root bridge. In general, a device in the backbone takes on this role.

Procedure:

☐ Set up the network to meet your requirements, initially without redundant lines.

☐ Switch Spanning Tree on on all devices in the network.
In the state on delivery, Spanning Tree is switched on on the device.
  ☐ Open the `Redundancy > Spanning Tree > Global` dialog.
  ☐ In the "Operation" frame, select the value `On`.

☐ Click "Set" to save the changes.

☐ You now connect the redundant lines.

☐ Define the settings for the device that takes over the role of the root bridge.

☐ In the "Priority"field you enter a numerically lower value.
The bridge with the numerically lowest bridge ID has the highest priority and becomes the root bridge of the network.

☐ Click "Set" to save the changes.

☐ If applicable, change the values in the "Forward Delay [s]" and "Max Age" fields.

☐ Click "Set" to save the changes.

Note: The parameters "Forward Delay [s]" and "Max Age" have the following relationship:
"Forward Delay [s]" ≥ ("Max Age"/2) + 1
If you enter values in the fields that contradict this relationship, the device replaces these values with the last valid values or with the default value.

Note: If possible, do not change the value in the “Hello Time” field.

☐ Check the following values in the other devices:
  – Bridge ID (bridge priority and MAC address) of the corresponding device and the root bridge.
  – Number of the device port that leads to the root bridge.
  – Path cost from the root port of the device to the root bridge.

10 References

This chapter contains descriptions of the individual parameters that you configure via the graphical user interface.

Note: The content of the online help corresponds to the information in the “References” chapter of this configuration user manual.
Use the “Help” button to call up the online help in the graphical user interface.

10.1 Basic Settings

With this menu you can configure the basic settings of the device.

10.1.1 Basic Settings > System

This dialog displays the device properties.

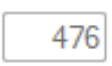
System data

Parameter	Meaning
Name	Specifies the device name. Possible values: ▶ Alphanumeric ASCII character string with 0 to 255 characters
Location	Specifies the location of the device. Possible values: ▶ Alphanumeric ASCII character string with 0 to 255 characters
Contact	Specifies the contact person for this device. Possible values: ▶ Alphanumeric ASCII character string with 0 to 255 characters
Device Type	Displays the product name of the device.
Uptime	Displays the time that has elapsed since this device was last restarted. Possible values: ▶ Time in the format `day(s), hh:mm:ss`

Time

Parameter	Meaning
System Time (UTC)	Displays the current date and time with reference to Universal Time Coordinated (UTC).
System Time	Displays the current date and time with reference to the local time: "System Time" = "System Time (UTC)" + "Local Offset [min]"
Local Offset [min]	Defines the difference between the local time and “System Time (UTC)” in minutes: “Local Offset [min]” = “System Time” − “System Time (UTC)” Possible values: ▶ `-780..840` (default setting: `60`)
Set Time from PC	The device uses the time on the PC as the system time.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.1.2 Basic Settings > Network

This dialog allows you to specify the IP and HiDiscovery settings required for the access to the device management through the network.

Management interface

Parameter	Meaning
IP address assignment	Specifies the source from which the device receives its IP parameters after starting: Possible values: ▶ `BOOTP` The device receives its IP parameters from a BOOTP or DHCP server. The server evaluates the MAC address of the device, then assigns the IP parameters. ▶ `DHCP` (state on delivery) The device receives its IP parameters from a DHCP server. The server evaluates the MAC address, the DHCP name, or other parameters of the device, then assigns the IP parameters. ▶ `Local` The device uses the IP parameters from the internal memory. You define the settings for this in the "IP Parameter" frame. **Note:** If there is no response from the BOOTP or DHCP server, the device sets the IP address to 0.0.0.0 and makes another attempt to obtain a valid IP address.
MAC Address	Displays the MAC address of the device. The device management can be accessed via the network using the MAC address.

IP Parameters

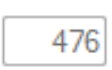
Parameter	Meaning
IP Address	Specifies the IP address under which the device management can be accessed through the network. Possible values: ▶ Valid IPv4 address (default setting: —)
Netmask	Specifies the netmask. The netmask identifies the network prefix and the host address of the device in the IP address. Possible values: ▶ Valid IPv4 netmask (default setting: —)
Gateway address	Specifies the IP address of a router through which the device accesses other devices outside its own network. Possible values: ▶ Valid IPv4 address (default setting: —)

HiDiscovery protocol

On a PC the HiDiscovery software shows you the Hirschmann devices that can be accessed in the network on which the HiDiscovery function is activated. You can access these devices even if they have invalid IP parameters or none at all. The HiDiscovery software allows you to change the IP parameters in the device.

Parameter	Meaning
Function	Activated/deactivates the HiDiscovery function in the device. Possible values: ▶ `On` (default setting) HiDiscovery is activated. You can access the device with the HiDiscovery software from your PC. ▶ `Off` HiDiscovery is deactivated.
Write Permission	Activates/deactivates the write access to the device using HiDiscovery. Possible values: ▶ `On` (default setting) The HiDiscovery software is given write access to the device. With this setting you can change the IP parameters in the device. ▶ `Off` The HiDiscovery software is only given read access to the device. With this setting you can view the IP parameters in the device. Recommendation: Change the setting to `Off` exclusively after putting the device into operation.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.1.3 Basic Settings > Software

This dialog allows you to update the device software and display information about the device software.

Version

Parameter	Meaning
Bootcode	Displays the version number and creation date of the boot code.
Running Version	Displays the version number and creation date of the device software that the device loaded during the last restart and is currently running.

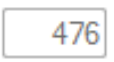
Software update

Parameter	Meaning
File	Specifies the path and the file name of the file with which you update the device software. The device allows you to update the device software via a TFTP download. ☐ Enter the URL for the file in the following format: `tftp://<IP address>/<path>/<file name>`
Upload	The device allows you to use Drag & Drop to store the file with which you are updating the device software. This option support the common Web browsers except the Internet Explorer. ☐ Use Drag & Drop to pull the file to the dotted area.
Install	Updates the device software The device installs the file specified in the "File" field, or stored using Drag & Drop, in the local non-volatile memory, replacing the previously saved device software. Upon restart, the device loads the installed device software.

Status

Parameter	Meaning
URL	Shows the URL for the file with which you are updating the device software.
Progress	Shows the progress of the device software update.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Restart	Restarts the device.
Help	Opens the online help.

10.1.4 Basic settings > Load/Save

This dialog allows you to permanently store the configuration profile. When you click "Set" in a dialog while the device is operating, the device saves the changes temporarily solely.

You have the option of exporting configuration profiles to or copying them to the device.

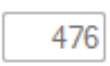
Load/Save

Parameter	Meaning
Save	Transfers the settings from the volatile memory (RAM) into the configuration profile in the non-volatile memory (NVM).
Reset	Resets the settings in the device to the default values. ▶ The device deletes the saved configuration profiles from the volatile memory (RAM) and from the non-volatile memory (NVM).

Configuration Transfer

Parameter	Meaning
Transfer Direction	Defines the transfer direction in which the configuration profile is transferred. Possible values: ▶ `Device to server` Select this value if you are transferring the configuration profile from the device. ▶ `Server to device` Select this value if you are transferring the configuration profile to the device.
Server IP address	Defines the IP address of the server from or to which the configuration profile is transferred. Enter the URL for the file in the following format: `tftp://<IP address>/<path>/<file name>`
Transfer	Transfers the configuration profile in the selected transfer direction
Download	Exports the current configuration profile as a file in binary format.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Help	Opens the online help.

10.1.5 Basic Settings > Port > Configuration

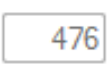
This dialog allows you to specify settings for the individual device ports. The dialog also displays the operating mode and connection status for every device port.

Configuration

Parameter	Meaning
Port	Displays the number of the device port.
State	Activates/deactivates the device port. Possible values: ▶ `On` (default setting) The device port is activated. ▶ `Off` The device port is deactivated. The device port does not send or receive any data.
Link/current operating mode	Displays the operating mode which the device port currently uses. Possible values: ▶ `–` No cable connected, no link. ▶ `10 Mbit/s HDX` Half duplex connection ▶ `10 Mbit/s FDX` Full duplex connection ▶ `100 Mbit/s HDX` Half duplex connection ▶ `100 Mbit/s FDX` Full duplex connection

Parameter	Meaning
Manual configuration	Specifies the operating mode of the device port. Possible values: ▶ `Autoneg` (default setting) The device port negotiates the operating mode independently using autonegotiation and detects the devices connected to the TP port automatically (Auto Cable Crossing). This setting has priority over the manual setting of the device port. Elapse several seconds until the device port has set the operating mode. ▶ `10 Mbit/s HDX` Half duplex connection ▶ `10 Mbit/s FDX` Full duplex connection ▶ `100 Mbit/s HDX` Half duplex connection ▶ `100 Mbit/s FDX` (default setting on TP ports) Full duplex connection
Link monitoring	Activates/deactivates the reporting of link errors. Possible values: ▶ `On` The link monitoring is activated. ▶ `Off` The link monitoring is deactivated.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.1.6 Basic Settings > Port > Statistics

This frame displays the following overview per device port:

- Number of data packets/bytes sent from the device
  - "Transmitted Packets"
  - "Sent Unicast Packets"
  - "Sent Non Unicast Packets"

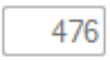
- Number of data packets/bytes received on the device
  - "Received Packets"
  - "Received Bytes"

- Number of errors detected by the device
  - "Detected collisions"
  - "Detected CRC errors"
  - "Received fragments"

- Number of data packets per size category received on and sent from the device
  - "Packets 64 byte"
  - "Packets 65 to 127 byte"
  - "Packets 128 to 255 byte"
  - "Packets 256 to 511 byte"
  - "Packets 512 to 1023 byte"
  - "Packets 1024 to 1518 byte"

To reset the counter for the port statistics in the table to `0`, click the "Reset port counters" button in the `Basic Settings > Port > Statistics` dialog.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Reset the port counter	Resets the port statistic entries in the table to 0.
Help	Opens the online help.

10.2 Device Security

This menu allows you to specify the settings for the access to the device.

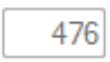
10.2.1 Device Security > Password

The device allows users to access its management functions when they log in with valid login data.

Selecting a password (HTTPS/SNMPv3)

Parameter	Meaning
Select Password	Displays the password to be changed. Possible values: ▶ `Modify read-only Password (user)` Changes the password for read access ▶ `Modify read\write Password (admin)` Changes the password for read and write access
Current Administrator Password	Here you enter the administrator password.
New Password	Here you enter the new password. The minimum password length is 8 characters.
Please retype	Here you enter the new password again.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.2.2 Device Security > HTTPS

This dialog allows you to specify settings for the HTTPS server of the device and to restart the server.

The HTTP server provides the graphical user interface (GUI) via an encrypted HTTP connection. The graphical user interface communicates with the device based on SNMP via the encrypted HTTP connection and enables access to the management functions.

A digital certificate is required for the encryption of the HTTP connection. The device allows you to create this certificate yourself or to load an existing certificate onto the device.

Configuration

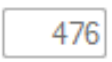
Parameter	Meaning
Web Interface Session Timeout [s]	Specifies the timeout in seconds. After the device has been inactive for this time it ends the session for the user logged on.
TCP Port	Specifies the number of the TCP port on which the server receives requests from clients. Possible values: ▶ `1..65535` (default setting: `443`) The server restarts automatically after the port is changed. In the process, the device terminates open connections to the server.

Certificate

Parameter	Meaning
Status	Displays whether the digital certificate is present on the device. Possible values: ▶ `Certificate present` The certificate is present. ▶ `No certificate present` The certificate has been removed. ▶ `Certificate will be created ...` The certificate is being created on the device. ▶ `Certificate created` The certificate has been created on the device.
Create	Creates a digital certificate on the device. To get the server to use this certificate, click the "Create" button and restart the server using the "Restart Web server" button . Alternatively, you have the option of copying your own certificate to the device.
Delete	Deletes the digital certificate. To permanently remove the certificate from the device, save the changes. In the process, the device switches off the HTTPS server.
File	Specifies the path and file name of the certificate. X.509 certificates (PEM) are permitted. The device gives you the following options for copying the certificate to the device: ▶ Import from the PC If the certificate is on your PC or on a network drive, select the file to be imported and use Drag & Drop to pull it into the dotted area. This option support the common Web browsers except the Internet Explorer. ▶ Import from a TFTP server If the certificate is on a TFTP server, enter the URL for the file in the following form: `tftp://<IP address>/<Path>/<File name>`.
Upload	If the certificate is on your PC or on a network drive, select the file to be imported and use Drag & Drop to pull it into the dotted area.
Import	Copies the certificate to the device. To get the server to use this certificate, click the "Set" button and restart the server.
Restart Web server	Restarts the HTTPS service of the device.

Note: In the Web browser, a warning appears when you are loading the graphical user interface if you are using a certificate that has not been verified by a certifying organization. To load the graphical user interface, add an exception rule for the certificate in the Web browser.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.2.3 Device Security > SNMP

This dialog allows you to specify settings for the SNMP agent of the device and to enable/disable access to the device with different SNMP versions.

The SNMP agent activates access to the management functions of the device with SNMP-based applications, for example with the graphical user interface.

Configuration

Parameter	Meaning
SNMPv1 enabled	Activates/deactivates the access to the device with SNMP version 1. Possible values: ▶ `marked` (default setting) Access activated. ▶ `unmarked` Access deactivated. You define the community name in the `SNMPv1/v2 Community` frame.
SNMPv2 enabled	Activates/deactivates the access to the device with SNMP version 2. Possible values: ▶ `marked` (default setting) Access activated. ▶ `unmarked` Access deactivated. You define the community name in the `SNMPv1/v2 Community` frame.

Parameter	Meaning
SNMPv3 enabled	Activates/deactivates the access to the device with SNMP version 3. Possible values: ▶ `marked` (default setting) Access activated. ▶ `unmarked` Access deactivated. his function uses, for example, the Industrial HiVision software to make changes to the settings.
Port Number	Specifies the number of the UDP port on which the SNMP agent receives requests from clients. Possible values: ▶ `1..65535` (default setting: `161`) To enable the SNMP agent to use the new port after a change, you proceed as follows: ☐ Click the "Set" button. ☐ In the `Basic Settings > Load/Save` dialog, click the "Save" button beside "Save current configuration". ☐ Restart the device.

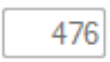
SNMPv1/v2 Community

This frame displays the authorization for SNMPv1/v2 applications to the device:

- `Read`
  For requests with the community name entered, the application receives read authorization for the device.
- `Write`
  For requests with the community name entered, the application receives read and write authorization for the device.

Parameter	Meaning
Read	Specifies the community name for the adjacent authorization. Possible values: ▶ Alphanumeric ASCII character string with 0 to 32 characters `public` (default setting for read authorization)
Write	Specifies the community name for the adjacent authorization. Possible values: ▶ Alphanumeric ASCII character string with 0 to 32 characters `private` (default setting for read and write authorization)

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.3 Switching

With this menu you can configure the settings for the switching.

10.3.1 Switching > Filter for MAC Addresses

This dialog allows you to display and edit address filters for the address table (forwarding database). Address filters specify the way the data packets are forwarded in the device based on the destination MAC address.

Each row in the table represents one filter. The device automatically sets up the filters. The device allows you to set up additional filters manually.

The device transmits the data packets as follows:

- If the table contains an entry for the destination address of a data packet, the device transmits the data packet from the receiving port to the port specified in the table entry.
- If there is no table entry for the destination address, the device transmits the data packet from the receiving port to all the other ports.

Table

Parameter	Meaning
Address	Displays the destination MAC address to which the table entry applies.
Status	Displays how the device has set up the address filter. Possible values: ▶ `learned` Address filter set up automatically by the device based on received data packets. ▶ `static` Address filter set up manually. The address filter stays set up permanently.
Port	Displays the device port to which the table entry is assigned.
Remove	Deletes the adjacent destination address from the MAC address table.

To remove all learned MAC addresses from the address table (forwarding database), click the "Reset MAC Address Table" button.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
476	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Reset MAC Address Table	Removes the MAC addresses from the forwarding table that have the value `learned` in the "Status" field.
Create	Opens the "Create Entry" dialog to add a new entry to the table. ▶ In the "Address" field, you specify the destination MAC address. ▶ In the "Possible Ports" field, you specify the device port. – Select one port if the destination MAC address is a unicast address. – Select one or more ports if the destination MAC address is a multicast address. – Select no port to create a discard filter. The device discards data packets with the destination MAC address specified in the table entry.
Help	Opens the online help.

10.3.2 QoS/Priority

Communication networks transmit a number of applications at the same time that have different requirements as regards availability, bandwidth and latency periods.

QoS (Quality of Service) is a procedure defined in IEEE 802.1D. It is used to distribute resources in the network. You therefore have the possibility of providing a minimum bandwidth for important applications. The prerequisite for this is that the end devices and the devices in the network support prioritized data transmission. Data packets with high priority are given preference when transmitted by devices in the network. You transfer data packets with lower priority when there are no data packets with a higher priority to be transmitted.

The device provides the following setting options:

- You specify how the device evaluates QoS/prioritization information for inbound data packets.
- For outbound packets, you specify which QoS/prioritization information the device writes in the data packet (e.g. priority for management packets, port priority).

10.3.3 Switching > QoS/Priority > Port Configuration

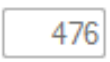
In this dialog, you specify the QoS/priority settings for each device port for received data packets.

Table

Parameter	Meaning
Port	Displays the number of the device port.
Port Priority	Specifies the VLAN priority of the data packets that the port receives. The device applies this setting to data packets depending on the value in the "Trust Mode" column: – Trust Mode =`untrusted` The device transmits the data packet with the VLAN priority specified here. – Trust Mode = `trustDot1p` If the data packet does not contain any VLAN or priority tag, the device transmits the data packet with the VLAN priority specified here. – Trust Mode = `trustIpDscp` If the data packet is not an IP packet, the device transmits the data packet with the priority specified here. Possible values: ▶ `0..7` (default setting: `0`) In the `Switching > QoS/Priority > 802.1D/p Mapping` dialog, you assign a traffic class to every VLAN priority. Depending on the VLAN priority, the device assigns the data packet to a specific traffic class and thus to a specific priority queue of the port.

Parameter	Meaning
Trust mode	Specifies how the device handles received data packets that contain a QoS/priority information. Possible values: ▶ `untrusted` The device transmits the data packet with the VLAN priority specified in the "Port Priority" field. The device ignores the QoS/priority information contained in the data packet. ▶ `trustDot1p` (default setting) – If the data packet contains a VLAN tag, the device transmits the data packet based on the contained QoS/priority information. In the `Switching > QoS/Priority > 802.1D/p Mapping` dialog, you assign a traffic class to every VLAN priority. Depending on the VLAN priority, the device assigns the data packet to a specific traffic class and thus to a specific priority queue of the port. – If the data packet does not contain a VLAN tag, the device transmits the data packet with the VLAN priority specified in the "Port Priority" field. ▶ `trustIpDscp` – If the data packet is an IP data packet, the device transmits the data packet based on the contained IP DSCP value. In the `Switching > QoS/Priority > IP DSCP Mapping` dialog you assign a traffic class to every IP DSCP value. Depending on the IP DSCP value, the device assigns the data packet to a specific traffic class and thus to a specific priority queue of the port. – If the data packet is not an IP data packet, the device transmits the data packet with the VLAN priority specified in the "Port Priority" field.
Untrusted traffic class	Displays the traffic class. The device assigns data packets to this traffic class if in the "Trust Mode" field the value `untrusted` is specified. Possible values: ▶ `0..3` In the `Switching > QoS/Priority > 802.1D/p Mapping` dialog, you assign a traffic class to every VLAN priority. Depending on the VLAN priority, the device assigns the data packet to a specific traffic class and thus to a specific priority queue of the port.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.3.4 Switching > QoS/Priority > 802.1D/p Mapping

The device transmits data packets with a VLAN tag according to the contained QoS/priority information with a higher or lower priority.

In this dialog, you assign a traffic class to every VLAN priority. You assign the traffic classes to the priority queues of the ports.

Table

Parameter	Meaning
VLAN Priority	Displays the VLAN priority.
Traffic class	Specifies the traffic class assigned to the VLAN priority. Possible values: ▶ `0..3` `0` assigned to the priority queue with the lowest priority. `3` assigned to the priority queue with the highest priority. **Note:** Network management protocols and redundancy mechanisms use the highest traffic class. Therefore, select another traffic class for application data.

Default assignment of the VLAN priority to traffic classes

VLAN priority	Traffic Class	Content description according to IEEE 802.1D
0	2	Best Effort Normal data without prioritizing.
1	0	Background Non-time critical data and background services.
2	1	Standard Normal data.
3	3	Excellent Effort Important data.
4	4	Controlled load Delay-critical data with a high priority.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
476	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.3.5 QoS/Priority > IP DSCP Mapping

The device transmits IP data packets according to the DSCP value contained in the data packet with a higher or lower priority.

In this dialog, you assign a traffic class to every DSCP value. You assign the traffic classes to the priority queues of the ports.

Table

Parameter	Meaning
DSCP Value	Displays the DSCP value.
Traffic Class	Specifies the traffic class which is assigned to the DSCP value. Possible values: ▶ `0..3` `0` assigned to the priority queue with the lowest priority. `3` assigned to the priority queue with the highest priority.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

Default assignment of the DSCP values to traffic classes

DSCP Value	Traffic Class
0-7	1
8-23	0
24-31	1
32-47	2
48-63	3

10.3.6 Switching > L2 Redundancy > Spanning Tree > Global

This dialog allows you to configure and monitor the settings for redundancy procedure.

The device supports the Rapid Spanning Tree Protocol (RSTP) defined in standard IEEE 802.1D-2004. This protocol is a further development of the Spanning Tree Protocol (STP) and is compatible with it.

The Spanning Tree Protocol (STP) is a protocol that deactivates redundant paths of a network in order to avoid loops. If a network component fails on the path, the device calculates the new topology and reactivates these paths.

The Rapid Spanning Tree Protocol enables fast switching to a newly calculated topology without interrupting existing connections.

Spanning tree

Parameter	Meaning
Function	Enables/disables the Spanning Tree function in the device. Possible values: ▶ `On` (Default setting) ▶ `Off` The device behaves transparently. The device floods received Spanning Tree data packets like multicast data packets to the device ports.

Protocol Configuration / Information

"Bridge"

Parameter	Meaning
Bridge ID	Displays the bridge ID of the device. The device with the numerically lowest bridge ID takes over the role of the root bridge in the network. Possible values: ▶ `<Bridge priority> / <MAC address>`
Priority	Specifies the bridge priority of the device. Possible values: ▶ `0..61440` in steps of 4096 (default setting: `32,768`) Assign the lowest numeric priority in the network to the device to make it the root bridge.
Hello Time [s]	Specifies the time in seconds between the sending of two configuration messages (Hello data packets). Possible values: ▶ `2` If the device takes over the role of the root bridge, the other devices in the network use the value specified here. Otherwise, the device uses the value specified by the root bridge, see the "Root" column.
Forward Delay [s]	Specifies the delay time for the status change in seconds. Possible values: ▶ `4..30` (default setting: `15`) If the device takes over the role of the root bridge, the other devices in the network use the value specified here. Otherwise, the device uses the value specified by the root bridge, see the "Root" column. In the RSTP protocol, the bridges negotiate a status change without a specified delay. The STP protocol uses the parameter to delay the status change between the statuses `disabled`, `discarding`, `learning`, `forwarding`.

Parameter	Meaning
The parameters "Forward Delay" and "Max Age" have the following relationship: `Forward Delay` ≥ (`Max Age`/2) + 1 If you enter values in the fields that contradict this relationship, the device replaces these values with the last valid values or with the default value.	
Max Age	Specifies the maximum permissible branch length, for example the number of devices to the root bridge. Possible values: ▶ `6..40` (default setting: `20`) If the device takes over the role of the root bridge, the other devices in the network use the value specified here. Otherwise, the device uses the value specified by the root bridge, see the "Root" column. The STP protocol uses the parameter to specify the validity of STP-BPDUs in seconds.

"Root"

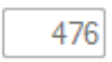
Parameter	Meaning
Bridge ID	Displays the bridge ID of the current root bridge. Possible values: ▶ `<Bridge priority> / <MAC address>` The bridge ID is made up of the bridge priority and the MAC address.
Priority	Displays the bridge priority of the current root bridge. Possible values: ▶ `0..61440` in steps of 4096
Hello Time [s]	Displays the time in seconds specified by the root bridge between the sending of two configuration messages (Hello data packets). Possible values: ▶ `1..2` The device uses this specified value - see the "Bridge" column.

Parameter	Meaning
Forward Delay [s]	Displays the delay time in seconds set up by the root bridge for status changes. Possible values: ▶ `4..30` The device uses this specified value, see the "Bridge" column. In the RSTP protocol, the bridges negotiate a status change without a specified delay. The STP protocol uses the parameter to delay the status change between the statuses `disabled`, `discarding`, `learning`, `forwarding`.
Max Age	Displays the maximum permissible branch length set up by the root bridge, for example the number of devices to the root bridge. Possible values: ▶ `6..40` (default setting: `20`) The STP protocol uses the parameter to specify the validity of STP-BPDUs in seconds.

"Topology"

Parameter	Meaning
Bridge is Root	Displays whether the device currently has the role of the root bridge. Possible values: ▶ `unmarked` Another device currently has the role of the root bridge. ▶ `marked` The device currently has the role of the root bridge.
Root Port	Displays the number of the device port from which the current path leads to the root bridge. If the device takes over the role of the root bridge, the field displays the value `0`.
Topology Change Count	Displays how often the device has put a device port into the `forwarding` status via Spanning Tree since it was started.
Time Since Topology Change	Displays the time since the last topology change. Possible values: ▶ <days, hours:minutes:seconds>
Root Path Cost	Specifies the path cost for the path that leads from the root port of the device to the root bridge of the layer 2 network. Possible values: ▶ `0..200000000` If the value `0` is specified, the device takes over the role of the root bridge.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.3.7 Switching > L2 Redundancy > Spanning Tree > Port

With this dialog you can switch the Spanning Tree function on/off on the device ports, specify edge ports, and specify the settings for various protection functions.

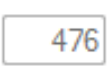
Table

Parameter	Meaning
Port	Displays the number of the device port.
Stp	Activates/deactivates the Spanning Tree function on the device port. Possible values: ▶ `On` (default setting) ▶ `Off` If the Spanning Tree is active in the device and inactive on the device port, the port does not send STP-BPDUs and drops any STP-BPDUs received.

Parameter	Meaning
Port priority	Specifies the priority of the device port. Possible values: ▶ `16..240` in steps of 16 (default setting: `128`) This value represents the first 4 bits of the port ID.
Root Path Cost	Specifies the path cost for the path that leads from the root port of the device to the root bridge of the layer 2 network. Possible values: ▶ `0..200000000` If the value `0` is specified, the device takes over the role of the root bridge.
Port Status	Displays the transmission status of the device port. Possible values: ▶ `discarding` The device port is blocked and forwards STP-BPDUs exclusively. ▶ `learning` The device port is blocked, but it learns the MAC addresses of received data packets. ▶ `forwarding` The device port forwards data packets. ▶ `disabled` The Spanning Tree function is inactive on the device port. The device port forwards STP-BPDUs. ▶ `disconnected` No cable is connected.
Oper Edge Port	Displays whether a terminal device or an STP bridge is connected to the device port. Possible values: ▶ `enable` An end device is connected to the device port. The device port does not receive any STP-BPDUs. ▶ `disable` An STP bridge is connected to the device port. The device port receives STP-BPDUs.

Parameter	Meaning
Admin Edge Port	Specifies whether an end device is connected to the device port. Possible values: ▶ `unmarked` (default setting) An STP bridge is connected to the device port. After the connection is set up, the device port changes to the `learning` status before changing to the `forwarding` status, if applicable. ▶ `marked` An end device is connected to the device port. – After the connection is set up, the device port changes to the `forwarding` status without changing to the `learning` status beforehand. – If the device port receives an STP-BPDU, the device deactivates the port if the BPDU Guard function is inactive in the `Switching > L2-Redundancy > Spanning Tree > Global` dialog.
Auto Edge Port	Activates/deactivates the automatic detection of whether you connect an end device to the port. This setting is effective if you unmark the checkbox in the "Admin Edge Port" field. Possible values: ▶ `marked` (default setting) After the installation of the connection, and after 1.5 × "Hello Time [s]", the device sets the port to the `forwarding` status (default setting 1.5 × 2 s) if the port has not received any STP-BPDUs during this time. ▶ `unmarked` After the installation of the connection, and after "Max Age", the device sets the port to the `forwarding` status (default setting 20 s).

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.4 Diagnostics

The dialogs in this menu show information on statuses and events that the device has logged. In service cases, this information helps our support to diagnose the situation.

10.4.1 Diagnosis >Alarms (Traps)

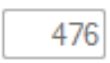
Alarms (Traps)

Parameter	Meaning
Function	Specifies whether the device sends an SNMP trap when it detects a change in the monitored functions. Possible values: ▶ `On` The device sends an SNMP trap. ▶ `Off` (default setting) The device does not send an SNMP trap. The prerequisite for sending SNMP traps is that you enable the link monitoring in the dialog and specify at least 1 SNMP manager (destination address).
Link Up/Down	At one port of the device, the link to a device connected there has been established/interrupted.
Authentication	The device has rejected an unauthorized access attempt, see “Device Security > SNMP” on page 74 dialog
Spanning tree	The topology of the Rapid Spanning Tree has changed.
LLDP	Is sent if an entry in the topology discovery table is changed

Destination Addresses

Parameter	Meaning
IP Address	Specifies the IP address of the SNMP manager. Possible values: ▶ `Valid IPv4 address`
Trap Community	Specifies the name of the trap community that the device uses to identify itself as the source of the trap. Possible values: ▶ `public` (default setting) ▶ Alphanumeric ASCII character string with 0 to 64 characters

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.4.2 Diagnosis > LLDP

The device allows you to gather information about neighboring devices. For this, the device uses the Link Layer Discovery Protocol (LLDP). This information enables the network management station to map the structure of your network.

Devices in networks send messages in the form of packets that are also known by the name “LLDPDU” (LLDP data unit). The data sent and received via LLDPDUs is useful for many reasons. For example, it enables the device to recognize which devices within the network are neighbors and via which ports they are connected with each other.

This dialog allows you to visualize the network and determine the connected devices and their function characteristics.

LLDP

Parameter	Meaning
Function	If the function is switched on, the topology discovery with LLDP is activated on the device. ▶ `On` (default setting) ▶ `Off`

Topology discovery

This dialog displays the collected LLDP information for the neighboring devices. This information enables the network management station to map the structure of your network.

When devices both with and without an active topology discovery function are connected to a device port, the topology table hides the devices without active topology discovery.

When only devices without active topology discovery are connected to a device port, the table will contain one line for this port to represent all devices. This line contains the number of connected devices.

The FDB address table contains MAC addresses of devices that the topology table hides for the sake of clarity.

If you use a port to connect several devices, for example via a hub, the table contains a line for each connected device.

Parameter	Meaning
Port	Displays the number of the device port.
Neighbor Identifier	Displays the chassis ID of the neighboring device. This can be the basis MAC address of the neighboring device, for example.
Neighbor IP Address	Displays the IP address with which the management functions of the neighboring device can be reached.
Neighbor Port Description	Displays a description for the device port of the neighboring device.
Neighbor System Name	Displays the device name of the neighboring device.
Neighbor System Description	Displays a description for the neighboring device.

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
476	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Write	Transfers the changes to the volatile memory of the device. To save the changes in the non-volatile local memory, proceed as follows: ☐ Open the `Basic Settings > Load/Save` dialog. ☐ Click "Save" in the "Load/Save" frame beside "Save current configuration".
Help	Opens the online help.

10.4.3 Diagnosis > System Log

System Information

This dialog displays the current operating condition of individual components in the device.

The dialog allows you to save the page in HTML format on your PC.

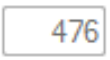
System Log

The device logs important device-internal events in a log file (system log).

This dialog displays the log file (system log). The dialog allows you to save the log file in HTML format on your PC.

The log file is kept until a restart is performed on the device. After the restart the device creates the file again.
To delete the logged events from the log file, click "Delete Log File".

Buttons

	Ends the session and terminates the connection to the device.
	Restarts the device.
	Displays the time in seconds after which the device automatically ends the session when the user is inactive.
Load	Reloads the display of the page in your Web browser.
Save	Opens the "Save" dialog. The dialog allows you to save the log file in HTML format on your PC.
Delete Log File	Removes the logged events from the log file.
Help	Opens the online help.

A Appendix

A.1 Technical Data

Switching	
Size of MAC address table (incl. static filters)	1,024
Max. number of statically configured MAC address filters	100
MTU (max. length of over-long packets)	1,522 bytes
Latency, depends on the port data rate 100 Mbit/s	 min.7 µs max. 9 µs
Max. number of static address entries	100
Max. number of dynamic unicast entries	910
Number of priority queues	4 queues
Port priorities that can be set	0 ... 7

A.2 Underlying technical standards

ANSI/TIA-1057	Link Layer Discovery Protocol for Media Endpoint Devices, April 2006
IEEE 802.1AB	Topology Discovery (LLDP)
IEEE 802.1D-1998, IEEE 802.1 D-2004	Media access control (MAC) bridges (includes IEEE 802.1p Priority and Dynamic Multicast Filtering, GARP, GMRP)
IEEE 802.1Q-1998	Virtual Bridged Local Area Networks (VLAN Tagging, Port-Based VLANs, GVRP)
IEEE 802.1 Q-2005	Spanning Tree (STP), Rapid Spanning Tree (RSTP), Multiple Spanning Tree (MSTP)
IEEE 802.3-2002	Ethernet
IEEE 802.3x	Flow control

A.3 List of RFCs

RFC 768	UDP
RFC 783	TFTP
RFC 791	IP
RFC 792	ICMP
RFC 793	TCP
RFC 826	ARP
RFC 951	BOOTP
RFC 1157	SNMPv1
RFC 1155	SMIv1
RFC 1212	Concise MIB Definitions
RFC 1213	MIB2
RFC 1493	Dot1d
RFC 1542	BOOTP Extensions
RFC 1643	Ethernet-like MIB
RFC 1757	RMON
RFC 1867	Form-based File Upload in HTML
RFC 1901	Community-based SNMP v2
RFC 1905	Protocol Operations for SNMP v2
RFC 1906	Transport Mappings for SNMP v2
RFC 1907	Management Information Base for SNMP v2
RFC 1908	Coexistence between SNMP v1 and SNMP v2
RFC 1945	HTTP/1.0
RFC 2068	HTTP/1.1
RFC 2131	DHCP
RFC 2132	DHCP Options
RFC 2233	The Interfaces Group MIB using SMI v2
RFC 2246	The TLS Protocol, Version 1.0
RFC 2271	SNMP Framework MIB
RFC 2346	AES Ciphersuites for Transport Layer Security
RFC 2365	Administratively Scoped Boundaries
RFC 2474	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
RFC 2475	An Architecture for Differentiated Service
RFC 2570	Introduction to SNMP v3
RFC 2571	Architecture for Describing SNMP Management Frameworks
RFC 2572	Message Processing and Dispatching for SNMP
RFC 2573	SNMP v3 Applications
RFC 2574	User Based Security Model for SNMP v3
RFC 2575	View Based Access Control Model for SNMP

RFC 2576	Coexistence between SNMP v1, v2 & v3
RFC 2578	SMIv2
RFC 2579	Textual Conventions for SMI v2
RFC 2580	Conformance Statements for SMI v2
RFC 2674	Dot1p/Q
RFC 2818	HTTP over TLS
RFC 2851	Internet Addresses MIB
RFC 4188	(Definitions of Managed Objects for Bridges)

A.4 Literature references

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  ISBN 3-7785-2262-0

- „TCP/IP Illustrated“, Vol. 1
  W.R. Stevens
  Addison Wesley 1994
  ISBN 0-201-63346-9

- Hirschmann“Installation” user manual

- Hirschmann Mounting instruction

A.5 IP Parameter Basics

A.5.1 IP Address (Version 4)

The IP addresses consist of 4 bytes. Write these 4 bytes in decimal notation, separated by a decimal point.

RFC 1340, written in 1992, defines 5 IP address classes.

Class	Network address	Host address	Address range
A	1 byte	3 Bytes	0.0.0.0 to 127.255.255.255
B	2 Bytes	2 Bytes	128.0.0.0 to 191.255.255.255
C	3 Bytes	1 byte	192.0.0.0 to 223.255.255.255
D			224.0.0.0 to 239.255.255.255
E			240.0.0.0 to 255.255.255.255

Table 2: IP address classes

The first byte of an IP address is the network address. The worldwide leading regulatory board for assigning network addresses is the IANA (Internet Assigned Numbers Authority). If you require an IP address block, contact your Internet Service Provider (ISP). Your ISP contacts their local higher-level organization to reserve an IP address block:

- APNIC (Asia Pacific Network Information Center) - Asia/Pacific Region
- ARIN (American Registry for Internet Numbers) - Americas and Sub-Sahara Africa
- LACNIC (Regional Latin-American and Caribbean IP Address Registry) – Latin America and some Caribbean Islands
- RIPE NCC (Réseaux IP Européens) - Europe and Surrounding Regions

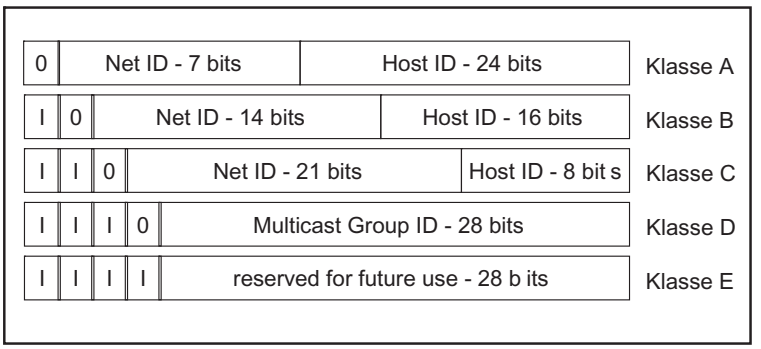


Figure 3: Bit representation of the IP address

The IP addresses belong to class A when their first bit is a zero, for example, the first octet is less than 128.
The IP address belongs to class B if the first bit is a one and the second bit is a zero: for example, the first octet is between 128 and 191.
The IP address belongs to class C when the first 2 bits are a one, for example, the first octet is higher than 191.

Assigning the host address (host ID) is the responsibility of the network operator. The network operator alone is responsible for the uniqueness of the assigned IP addresses.Host address

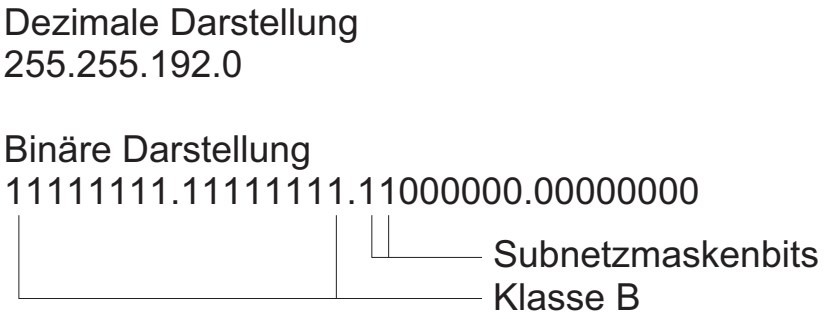
A.5.2 Netmask

Routers and gateways subdivide large networks into subnetworks. The netmask assigns the IP addresses of the individual devices to a particular subnetwork.

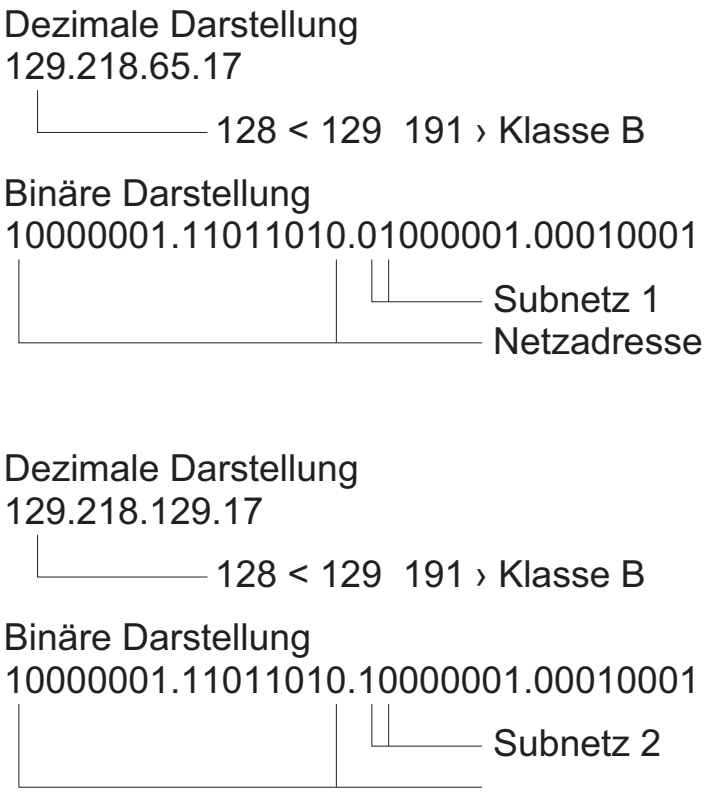
You perform subnetwork division using the netmask in much the same way as the division of the network addresses (net id) into classes A to C.

Set the bits of the host address (host id) that represent the mask to one. Set the remaining host address bits to zero (see the following examples).

Example of a subnet mask:



Example of IP addresses with subnetwork assignment when applying the subnet mask:



Example of how the network mask is used

In a large network it is possible that gateways and routers separate the management agent from its management station. How does addressing work in such a case?

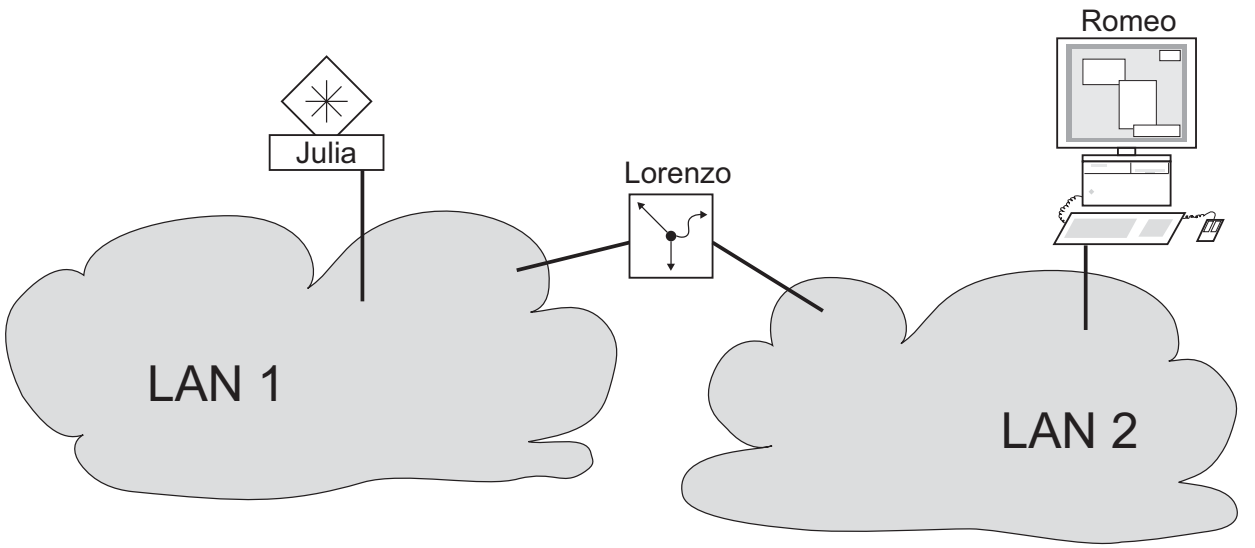


Figure 4: Management agent that is separated from its management station by a router

The management station “Romeo” wants to send data to the management agent “Juliet”. Romeo knows Juliet's IP address and also knows that the router “Lorenzo” knows the way to Juliet.

Romeo therefore puts his message in an envelope and writes Juliet's IP address as the destination address. For the source address he writes his own IP address on the envelope.

Romeo then places this envelope in a second one with Lorenzo's MAC address as the destination and his own MAC address as the source. This process is comparable to going from layer 3 to layer 2 of the ISO/OSI base reference model.

Finally, Romeo puts the entire data packet into the mailbox. This is comparable to going from layer 2 to layer 1, i.e. to sending the data packet over the Ethernet.

Lorenzo receives the letter and removes the outer envelope. From the inner envelope he recognizes that the letter is meant for Juliet. He places the inner envelope in a new outer envelope and searches his address list (the ARP table) for Juliet's MAC address. He writes her MAC address on the outer envelope as the destination address and his own MAC address as the source address. He then places the entire data packet in the mail box.

Juliet receives the letter and removes the outer envelope. She finds the inner envelope with Romeo's IP address. Opening the inner envelope and reading its contents corresponds to transferring the message to the higher protocol layers of the ISO/OSI layer model.

Juliet would now like to send a reply to Romeo. She places her reply in an envelope with Romeo's IP address as destination and her own IP address as source. But where is she to send the answer? For she did not receive Romeo's MAC address.
It was lost when Lorenzo replaced the outer envelope.

In the MIB, Juliet finds Lorenzo listed under the variable hmNetGatewayIPAddr as a means of communicating with Romeo. She therefore puts the envelope with the IP addresses in yet another envelope with Lorenzo's MAC destination address.

The letter now travels back to Romeo via Lorenzo, the same way the first letter traveled from Romeo to Juliet.

A.5.3 Classless Inter-Domain Routing

Class C with a maximum of 254 addresses was too small, and class B with a maximum of 65,534 addresses was too large for most users. This resulted in an ineffective usage of the available class B addresses.
Class D contains reserved multicast addresses. Class E is for experimental purposes. A non-participating gateway ignores experimental datagrams with these destination addresses.

Since 1993, RFC 1519 has been using Classless Inter-Domain Routing (CIDR) to solve this problem. CIDR overcomes these class boundaries and supports classless IP address ranges.

With CIDR, you enter the number of bits that designate the IP address range. You represent the IP address range in binary form and count the mask bits that designate the netmask. The mask bits equal the number of bits used for the subnet in a given IP address range. Example:

IP-Adresse dezimal	Netzmaske dezimal	IP-Adresse binär
149.218.112.1	255.255.255.128	10010101 11011010 01110000 00000001
149.218.112.127		10010101 11011010 01110000 01111111

25 Maskenbits

CIDR-Schreibweise: 149.218.112.0/25

Maskenbits

The term “supernetting” refers to combining a number of class C address ranges. Supernetting enables you to subdivide class B address ranges to a fine degree.

A.6 Basics of the Dynamic Host Configuration Protocol (DHCP)

The DHCP (Dynamic Host Configuration Protocol) is a further development of BOOTP, which it has replaced. DHCP additionally allows the configuration of a DHCP client via a name instead of via the MAC address.
For DHCP, this name is known as the “client identifier” in accordance with RFC 2131.
The device uses the name entered under sysName in the system group of the MIB II as the client identifier. You can enter this system name in the `Basic Settings > System` dialog, in the "Device Name" field.

The device sends its system name to the DHCP server. The DHCP server then uses the system name to allocate an IP address as an alternative to the MAC address.

In addition to the IP address, the DHCP server sends

- the netmask
- the default gateway (if available)
- the TFTP URL of the configuration file (if available).

The device applies the configuration data to the appropriate parameters. When the DHCP server assigns the IP address, the device permanently saves the configuration data in the non-volatile memory.

Option	Meaning
1	Subnet Mask
2	Time Offset
3	router
4	Time Server
12	Host Name
42	NTP Server

Table 3: DHCP options which the device requests

Option	Meaning
61	Client Identifier
66	TFTP Server Name
67	Bootfile Name

Table 3: DHCP options which the device requests

The advantage of using DHCP instead of BOOTP is that the DHCP server can restrict the validity of the configuration parameters (“Lease”) to a specific time period (known as dynamic address allocation). Before this period (“Lease Duration”) elapses, the DHCP client can attempt to renew this lease. Alternatively, the client can negotiate a new lease. The DHCP server then allocates a random free address.
To avoid this, DHCP servers provide the explicit configuration option of assigning a specific client the same IP address based on a unique hardware ID (known as static address allocation).

A.7 Basics of the Spanning Tree Protocol

Note: The Spanning Tree Protocol is a protocol for MAC bridges. For this reason, the following description uses the term bridge for GECKO.

Local networks are getting bigger and bigger. This applies to both the geographical expansion and the number of network subscribers. Therefore, it is advantageous to use multiple bridges, for example:

- to reduce the network load in sub-areas,
- to set up redundant connections and
- to overcome distance limitations.

However, using multiple bridges with multiple redundant connections between the subnetworks can lead to loops and the loss of communication through the network. In order to avoid this, you have the option of using Spanning Tree. Spanning Tree enables loop-free switching through the systematic deactivation of redundant connections. Redundancy ensures the systematic reactivation of individual connections as needed.

RSTP is a further development of the Spanning Tree Protocol (STP) and is compatible with it. If a connection or a bridge fails, the STP required a maximum of 30 seconds to reconfigure. This is no longer acceptable in time-sensitive applications. RSTP achieves average reconfiguration times of less than a second. When you use RSTP in a ring topology with 10 to 20 devices, you can even achieve reconfiguration times in the order of milliseconds.

Note: RSTP reduces a layer 2 network topology with redundant paths into a tree structure (Spanning Tree) that does not contain any more redundant paths. One of these takes over the role of the root bridge here. You can specify the maximum number of devices permitted in an active branch from the root bridge to the tip of the branch using the variable `Max Age` for the current root bridge. The preset value for `Max Age` is 20, which can be increased up to 40.

If the device working as the root fails and another device takes over its function, the `Max Age` setting of the new root bridge determines the maximum number of devices allowed in a branch.

Note: The RSTP standard dictates that all the devices within a network work with the (Rapid) Spanning Tree Algorithm. If STP and RSTP are used at the same time, the advantages of faster reconfiguration with RSTP are lost in the network segments that are operated in combination.
A device that only supports RSTP works together with MSTP devices by not assigning an MST region to itself, but rather the CST (Common Spanning Tree).

A.7.1 Basics

Because RSTP is a further development of the STP, all the following descriptions of the STP also apply to the RSTP.

The tasks of the STP

The Spanning Tree algorithm reduces network topologies that are set up using bridges, and that have ring structures with redundant connections, to a tree structure. In doing this, STP divides up the ring structures on the basis of specified rules by deactivating redundant paths. If a path is interrupted because a network component fails, the STP reactivates the path previously deactivated. This enables redundant connections to increase the communication availability.
In forming the tree structure, the STP determines a bridge that represents the basis of the STP tree structure. This bridge is known as the root bridge.

Features of the STP algorithm:

- automatic reconfiguration of the tree structure in the case of a bridge failure or the interruption of a data path
- stabilization of the tree structure up to the maximum network extension
- stabilization of the topology within a foreseeable time
- topology can be predetermined and reproduced by the administrator
- transparency for the terminal devices
- low network load relative to the available transmission capacity due to the tree structure created

The bridge parameters

Every bridge and its connections are clearly described by the following parameters in the context of Spanning Tree:

- Bridge identifier
- Root path costs of the bridge ports
- Port identifier

Bridge Identifier

The bridge identifier consists of 8 bytes. The 2 highest-value bytes are the priority. The default setting for the priority number is 32,768 (8000H), but the Management Administrator can change this when configuring the network. The 6 lowest-value bytes of the bridge identifier are the MAC address of the bridge. The MAC address enables every bridge to have a unique bridge identifier.
The bridge with the smallest number for the bridge identifier has the highest priority.

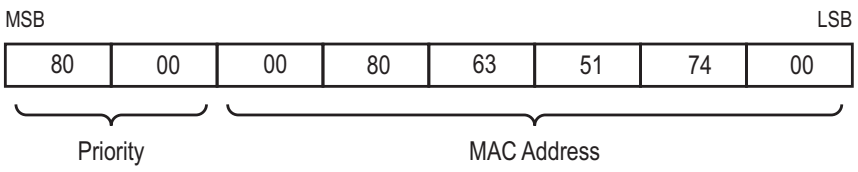


Figure 5: Bridge identifier, example (values in hexadecimal notation)

Root Path Costs

To every path that connects 2 bridges, the bridges assign costs for the transmission (path costs). The bridge determines this value based on the data rate (see table 4). It assigns the higher path costs to paths with lower data rates.

Alternatively, the Administrator can specify the path costs. Like the bridge, the Administrator assigns the higher path costs to paths with lower data rates. However, since the Administrator can choose this value freely, he has a tool with which he can give a certain path an advantage among redundant paths.

The root path costs are the sum of all the individual path costs for the paths along which a data packet travels between the connected port of a bridge and the root bridge.

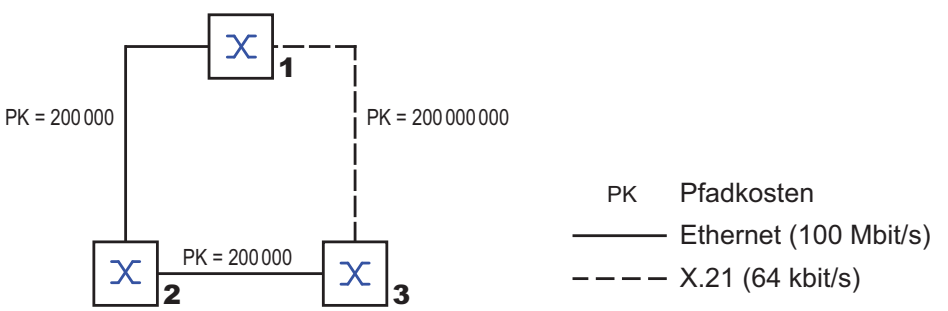


Figure 6: Path costs

Data rate	Recommended value	Recommended range	Possible range
≤100 Kbit/s	[a]	20,000,000-200,000,000	1-200,000,000
1 Mbit/s	20,000,000[a]	2,000,000-200,000,000	1-200,000,000
10 Mbit/s	2,000,000[a]	200,000-20,000,000	1-200,000,000
100 Mbit/s	200,000[a]	20,000-2,000,000	1-200,000,000
1 Gbit/s	20,000	2,000-200,000	1-200,000,000
10 Gbit/s	2,000	200-20,000	1-200,000,000
100 Gbit/s	200	20-2,000	1-200,000,000
1 TBit/s	20	2-200	1-200,000,000
10 TBit/s	2	1-20	1-200,000,000

Table 4: Recommended path costs for RSTP based on the data rate.

a. Bridges that conform with IEEE 802.1D 1998 and only support 16-bit values for the path costs should use the value 65,535 (FFFFH) for path costs when they are used in conjunction with bridges that support 32-bit values for the path costs.

Port Identifier

The port identifier consists of 2 bytes. One part, the lower-value byte, contains the physical port number. This provides a unique identifier for the port of this bridge. The second, higher-value part is the port priority, which is specified by the Administrator (default value: 128). It also applies here that the port with the smallest number for the port identifier has the highest priority.

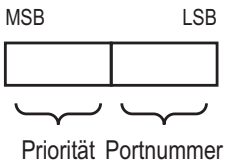


Figure 7: Port identifier

Diameter

The “Max Age” and “Diameter” values largely determine the maximum expansion of a Spanning Tree network.

The number of connections between the devices in the network that are furthest removed from each other is known as the network diameter.

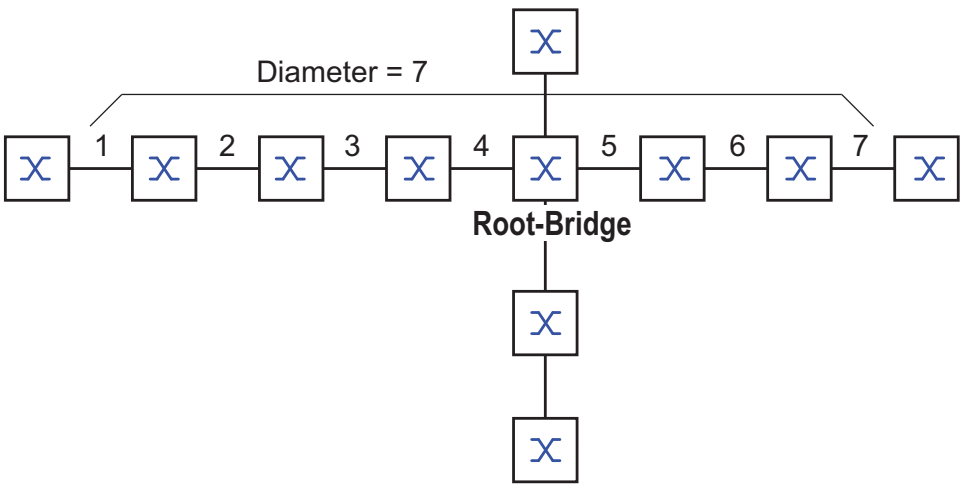


Figure 8: Definition of diameter

The network diameter that can be achieved in the network is MaxAge−1. In the state on delivery, MaxAge is 20 and the maximum diameter that can be achieved is 19. If you set the maximum value of 40 for MaxAge, the maximum diameter that can be achieved is 39.

MaxAge

The “Max Age” and “Diameter” values largely determine the maximum expansion of a Spanning Tree network.

Every STP-BPDU contains a “MessageAge” counter. When a bridge is passed through, the counter increases by 1.
Before forwarding an STP-BPDU, the bridge compares the “MessageAge” counter with the “MaxAge” value defined in the device:

- ☐ If MessageAge < MaxAge, the bridge forwards the STP-BPDU to the next bridge.
- ☐ If MessageAge = MaxAge, the bridge discards the STP-BPDU.

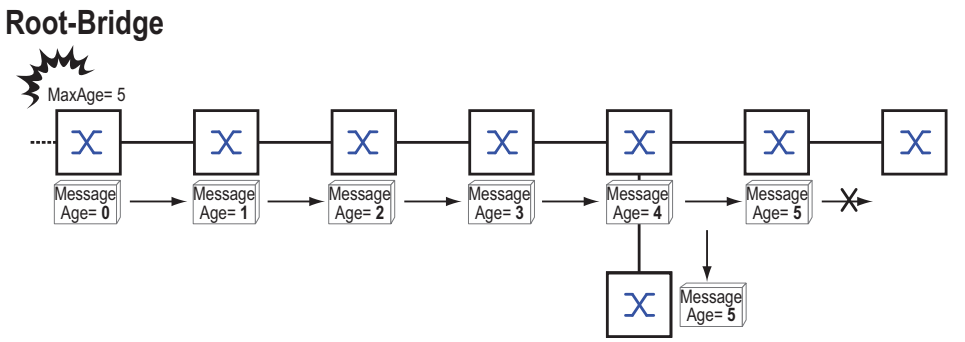


Figure 9: Transmission of an STP-BPDU depending on MaxAge

A.7.2 Rules for creating the tree structure

Bridge information

To calculate the tree structure, the bridges require more detailed information about the other bridges located in the network.
To obtain this information, each bridge sends a BPDU (Bridge Protocol Data Unit) to the other bridges.

The contents of a BPDU include

- bridge identifier,
- root path costs and
- port identifier.

(see IEEE 802.1D).

Setting up the tree structure

- The bridge with the smallest number for the bridge identifier is also known as the root bridge. It is the root of the tree structure.
- The structure of the tree depends on the root path costs. Spanning Tree selects the structure so that the path costs between each individual bridge and the root bridge are kept to a minimum.
- If there are multiple paths with the same root path costs, the bridge furthest away from the root decides which port it blocks. For this purpose, it uses the bridge identifiers of the bridges closer to the root. The bridge blocks the port that leads to the bridge with the numerically higher ID (a numerically higher ID is logically worse). If 2 bridges have the same priority, the bridge with the numerically higher MAC address has the numerically higher ID, and is logically the worse one.
- If multiple paths with the same root path costs lead from one bridge to the same bridge, the bridge further removed from the root uses the port identifier of the other bridge as the last criterion (see figure 7). In the process, the bridge blocks the port that leads to the port with the worse ID. If 2 ports have the same priority, the ID with the higher port number is the worse one.

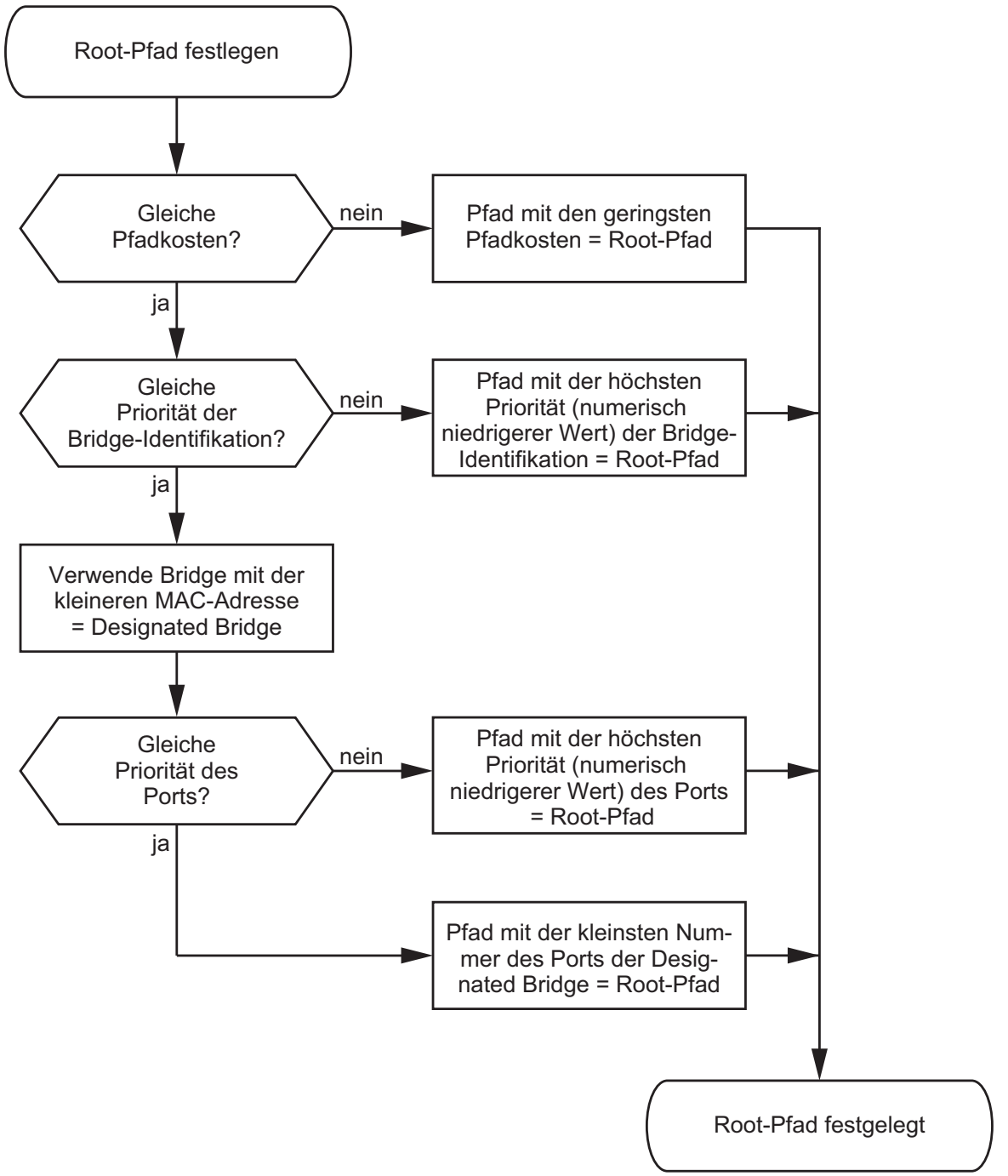


Figure 10: Flow chart for determining the root path

A.7.3 Examples

Example of determining the root path

You can use the network plan (see figure 11) to follow the flow chart (see figure 10) for determining the root path. The administrator has specified a priority in the bridge identifier for each bridge. The bridge with the smallest numerical value for the bridge identifier takes on the role of the root bridge, in this case, bridge 1. In the example all the sub-paths have the same path costs. The protocol blocks the path between bridge 2 and bridge 3, as a connection from bridge 3 via bridge 2 to the root bridge would result in higher path costs.

The path from bridge 6 to the root bridge is interesting:

- The path via bridge 5 and bridge 3 creates the same root path costs as the path via bridge 4 and bridge 2.
- STP selects the path using the bridge that has the lowest MAC address in the bridge identifier (bridge 4 in the illustration).
- There are also 2 paths between bridge 6 and bridge 4. The port identifier is decisive here (port 1 < port 3).

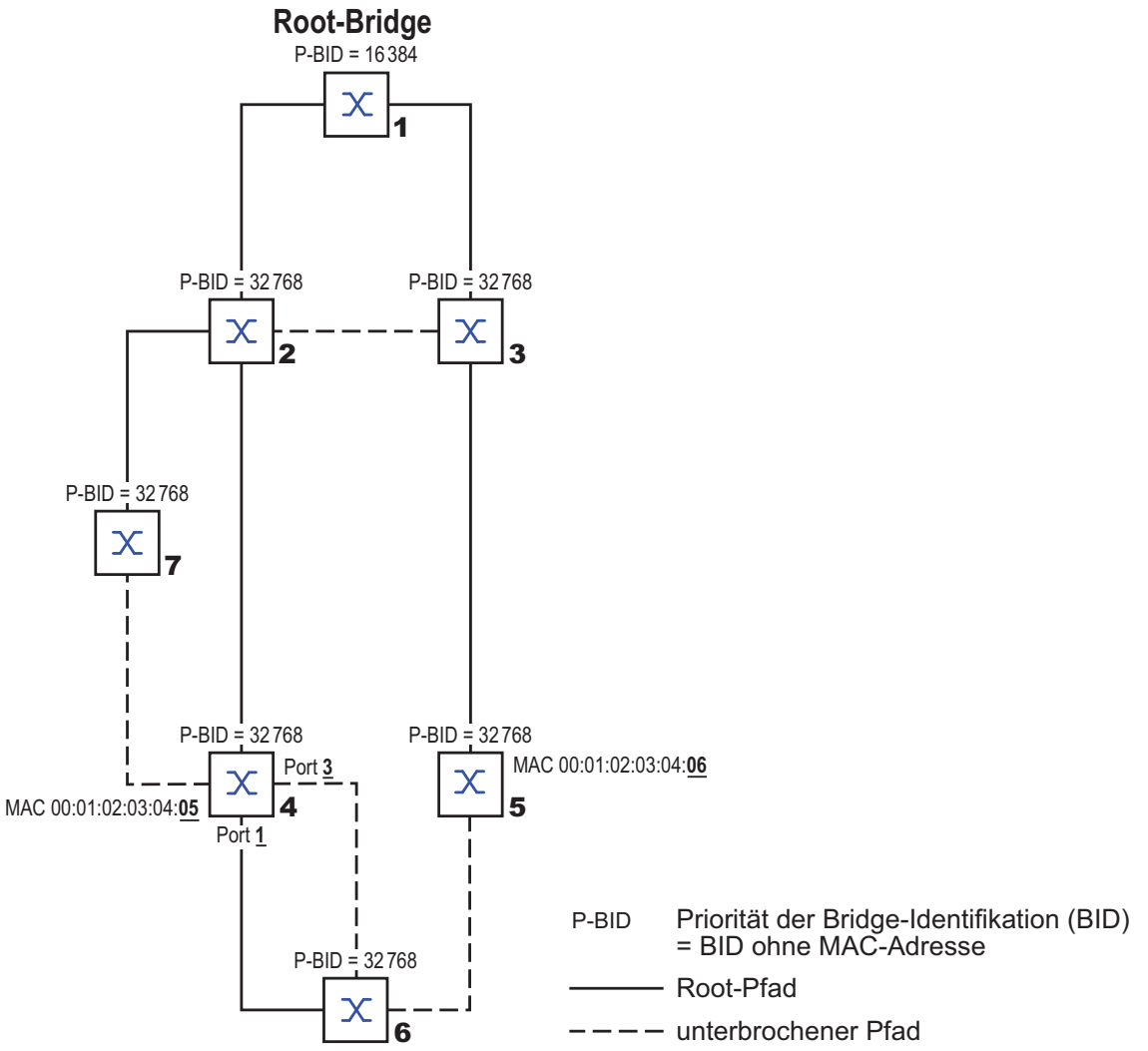


Figure 11: Example of determining the root path

Note: Because the Administrator does not change the default values for the priorities of the bridges in the bridge identifier, apart from the value for the root bridge, the MAC address in the bridge identifier alone determines which bridge becomes the new root bridge if the current root bridge goes down.

Example of manipulating the root path

You can use the network plan (see figure 12) to follow the flow chart (see figure 10) for determining the root path. The Administrator has performed the following:

– Left the default value of 32,768 (8000H) for every bridge apart from bridge 1 and bridge 5 and
– assigned to bridge 1 the value 16,384 (4000H), thus making it the root bridge.
– Assigned to bridge 5 the value 28,672 (7000H).

The protocol blocks the path between bridge 2 and bridge 3, as a connection from bridge 3 via bridge 2 to the root bridge would mean higher path costs.

The path from bridge 6 to the root bridge is interesting:

▶ The bridges select the path via bridge 5 because the value 28,672 for the priority in the bridge identifier is smaller than value 32,768.

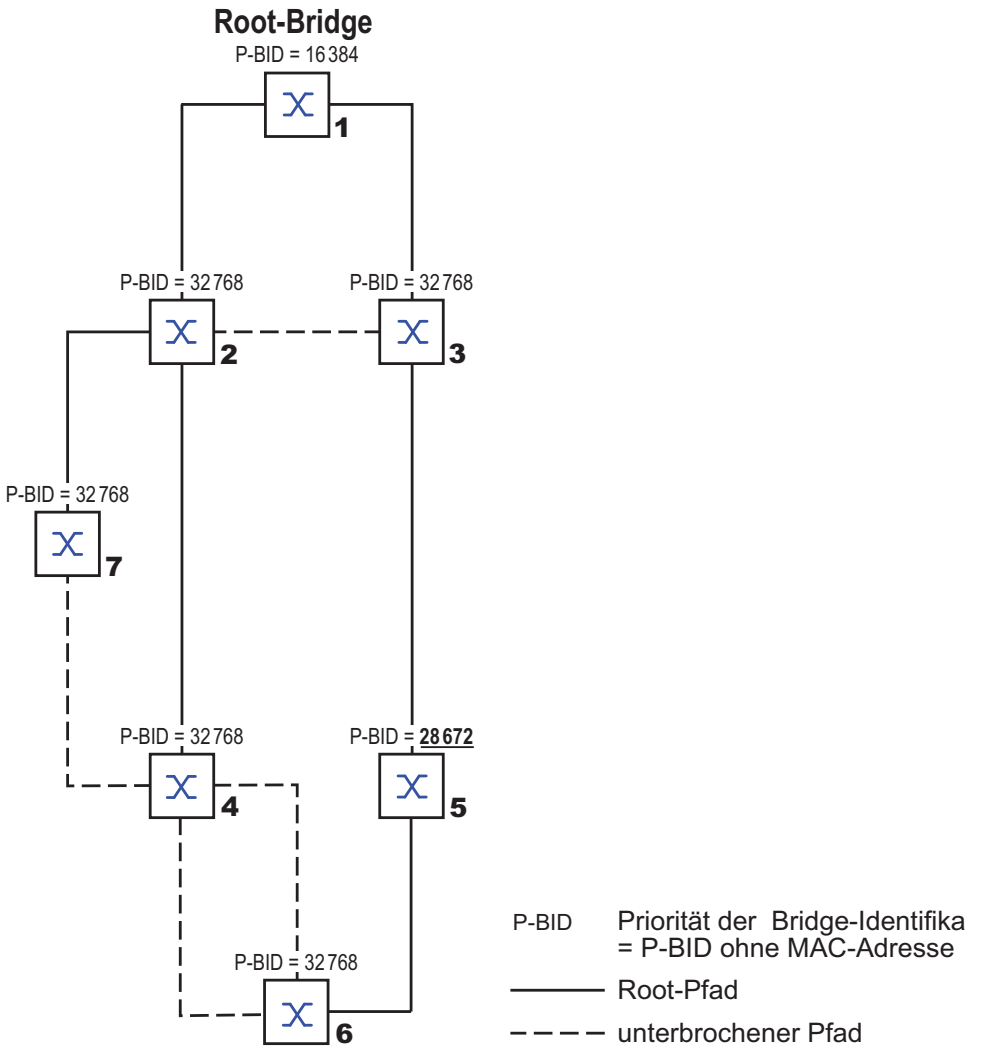


Figure 12: Example of manipulating the root path

Example of manipulating the tree structure

The Management Administrator of the network soon discovers that this configuration with bridge 1 as the root bridge (see on page 121 “Example of determining the root path”) is unfavorable. On the paths from bridge 1 to bridge 2 and bridge 1 to bridge 3, the control packets which the root bridge sends to all other bridges add up.

If the Management Administrator configures bridge 2 as the root bridge, the burden of the control packets on the subnetworks is distributed much more evenly. The result is the configuration shown here (see figure 13). The path costs for most of the bridges to the root bridge have decreased.

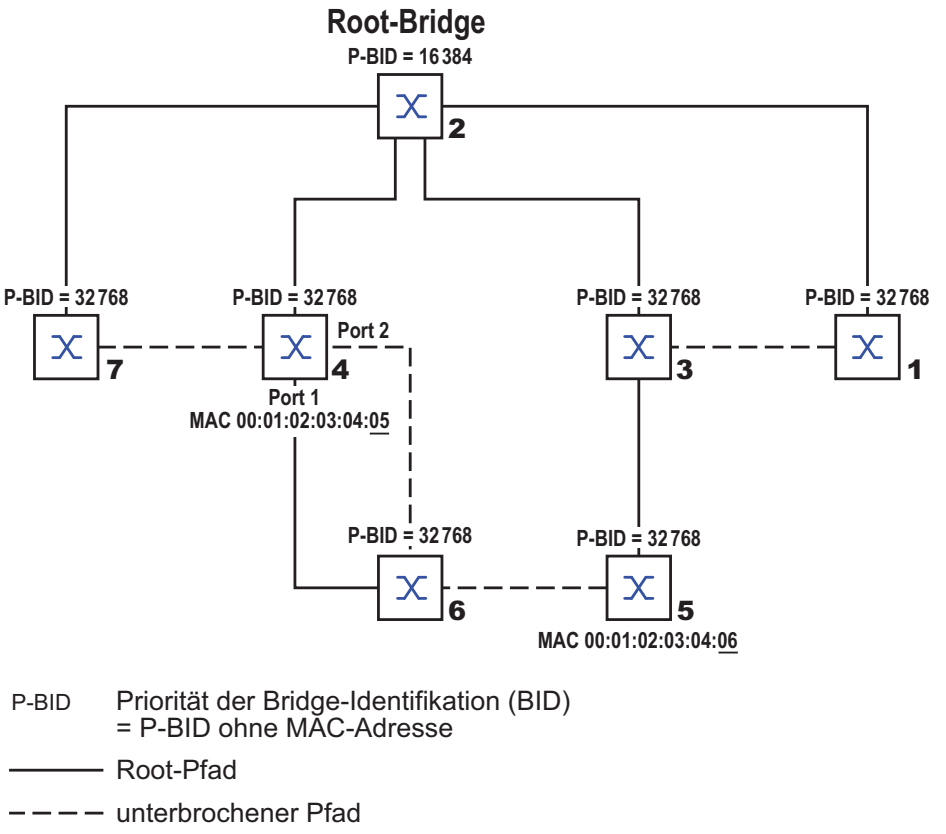


Figure 13: Example of manipulating the tree structure

A.7.4 The Rapid Spanning Tree Protocol

The RSTP takes over the calculation of the tree structure by the STP unchanged. RSTP merely changes parameters, and adds new parameters and mechanisms that speed up the reconfiguration if a connection or a bridge fails.
The ports play a significant role in this context.

Port roles

RSTP assigns each bridge port one of the following roles (see figure 14):

- Root Port:
  This is the port at which a bridge receives data packets with the lowest path costs from the root bridge.
  If there are multiple ports with equally low path costs, the bridge ID of the bridge that leads to the root (designated bridge) decides which of its ports is given the role of the root port by the bridge further removed from the root.
  If a bridge has multiple ports with equally low path costs to the same bridge, the bridge uses the port ID of the bridge leading to the root (designated bridge) to decide which port it selects locally as the root port (see figure 10).
  The root bridge itself does not have a root port.
- Designated Port:
  The bridge in a network segment that has the lowest root path costs is the designated bridge.Designated Bridge).
  If multiple bridges have the same root path costs, the bridge with the lowest numerical bridge identifier takes over the role of the designated bridge. The designated port on this bridge is the port that connects a network segment leading away from the root bridge. If a bridge with more than one port is connected with a network segment (e.g. via a hub), it gives the role of designated port to its port with the better port identifier.
- Edge Port: [1]:
  Every network segment in which there are no additional RSTP bridges is connected with exactly one designated port. This designated port is then also an edge port if it has not received any BPDUs (Spanning Tree Bridge Protocol Data Units).

1. An edge port is an end device port at the “edge” of a switched network.

- Alternate Port:
  This is a blocked port that takes over the task of the root port if the connection to the root bridge fails. The alternate port guarantees the connection of the bridge to the root bridge.
- Backup Port:
  This is a blocked port that serves as a backup in case the connection to the designated port of this network segment (without RSTP bridges, e.g. a hub) fails.
- Disabled Port (Disabled Port):
  This is the port that does not play any role within the Spanning Tree protocol, i.e. it is disabled or does not have any connection

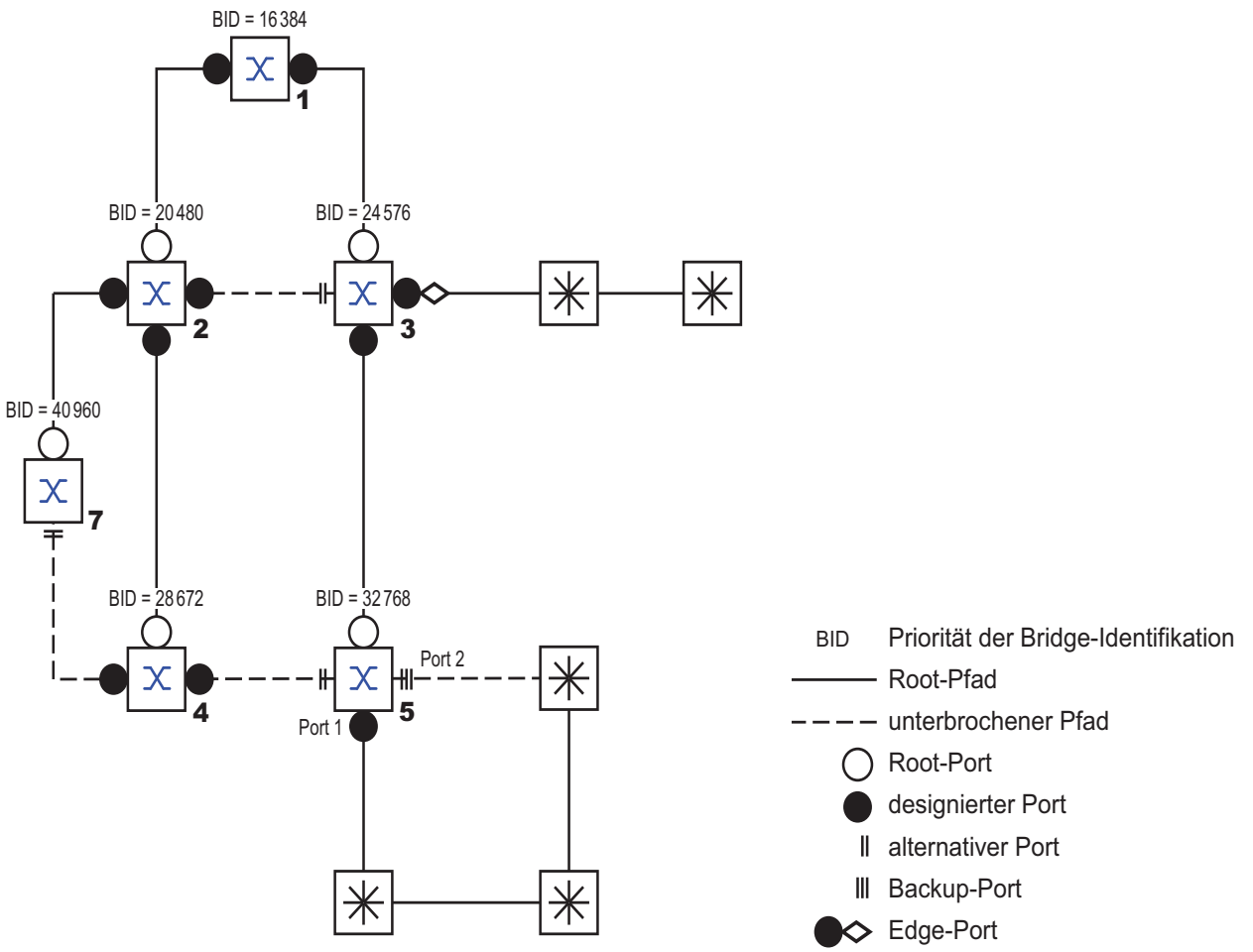


Figure 14: Port role assignment

Port states

Depending on the tree structure and the state of the selected connection paths, the RSTP assigns the ports their states.

STP port state	Administrative bridge port state	MAC Operational	RSTP Port state	Active topology (port role)
DISABLED	Disabled	FALSE	Discarding[a]	Excluded (disabled)
DISABLED	Enabled	FALSE	Discarding[a]	Excluded (disabled)
BLOCKING	Enabled	TRUE	Discarding[b]	Excluded (alternate, backup)
LISTENING	Enabled	TRUE	Discarding[b]	Included (root, designated)
LEARNING	Enabled	TRUE	Learning	Included (root, designated)
FORWARDING	Enabled	TRUE	Forwarding	Included (root, designated)

Table 5: Relationship between port state values for STP and RSTP

a. The dot1d-MIB displays “Disabled”
b. The dot1d-MIB displays “Blocked”

Meaning of the RSTP port states:

- Disabled: Port does not belong to the active topology
- Discarding: No address learning in FDB, no data traffic except for STP-BPDUs
- Learning: Address learning active (FDB), no data traffic apart from STP-BPDUs
- Forwarding: Address learning active (FDB), sending and receiving of all frame types (not only STP-BPDUs)

Spanning Tree Priority Vector

To assign roles to the ports, the RSTP bridges exchange configuration information with each other. This information is known as the Spanning Tree Priority Vector. It is part of the RST BPDUs and contains the following information:

- Bridge identifier of the root bridge
- Root path costs of the sending bridge
- Bridge identifier of the sending bridge
- Port identifier of the port through which the message was sent
- Port identifier of the port through which the message was received

Based on this information, the bridges participating in RSTP are able to determine port roles themselves and define the port status of their local ports.

Fast reconfiguration

Why can RSTP react faster than STP to an interruption of the root path?

- Introduction of edge ports:
  During a reconfiguration, RSTP switches an edge port into the transmission mode after three seconds (default setting) and then waits for the “Hello Time” to elapse, to be sure that no bridge sending BPDUs is connected.
  When the user ensures that a terminal device is connected at this port and will remain connected, there are no waiting times at this port in the case of a reconfiguration.
- Introduction of alternate ports:
  As the port roles are already distributed in normal operation, a bridge can switch from the root port to an alternate port after the connection to the root bridge is lost.
- Communication with neighboring bridges (point-to-point connections):
  Decentralized, direct communication between neighboring bridges enables a reaction to status changes without waiting periods in the spanning tree topology.
- Address table:
  With STP, the age of the entries in the FDB determines the updating of the communication. RSTP immediately deletes the entries in those ports that are affected by a reconfiguration.
- Reaction to events:
  Without having to adhere to any time specifications, RSTP immediately reacts to events such as connection interruptions, connection reinstatements, etc.

Note: The downside of this fast reconfiguration is the possibility that data packages could be duplicated and/or arrive at the receiver in the wrong order during the reconfiguration phase of the RSTP topology. If this is unacceptable for your application, use the slower Spanning Tree Protocol or select one of the other, faster redundancy procedures described in this manual.

STP compatibility mode

The STP compatibility mode allows you to operate RSTP devices in networks with old installations. If an RSTP device detects an older STP device, it switches on the STP compatibility mode at the relevant port.

A.8 Basics of the Topology Discovery

IEEE 802.1AB describes the Link Layer Discovery Protocol (LLDP). LLDP enables the user to have automatic topology discovery for his LAN.

Devices with active LLDP:

- send their connection and management information to the neighboring devices in the shared LAN. The devices are evaluated when the LLDP function is activated in the receiving device.
- receive connection and management information from neighboring devices in the shared LAN if these devices have also activated LLDP.
- create a database with management information and object definitions on neighboring devices that have also activated LLDP.

A central element of the connection information is the exact, unique ID of the connection point: MAC (service access point): This is made up of a device ID unique within the network and a port ID unique for this device.
Content of the connection and management information:

- Chassis ID (its MAC address)
- Port ID (its port MAC address)
- Description of the port
- System name
- System description
- Supported system functions
- Currently active system functions
- Interface ID of the management address
- VLAN ID of the port
- Status of the autonegotiation at the port
- Setting for medium/half and full duplex and for the port speed.
- Information about the VLANs installed on the device (VLAN ID and VLAN name, regardless of whether the port is a VLAN member).

A network management station can call up this information from devices with LLDP activated. This information enables the network management station to map the topology of the network.

802.1d devices normally block the special multicast LLDP IEEE MAC address used for information exchange. For this reason, non-LLDP devices discard LLDP packets. When a non-LLDP-capable device is positioned between 2 LLDP-capable devices, the non-LLDP-capable device prohibits information exchange between the 2 LLDP-capable devices.

The Management Information Base (MIB) for an LLDP-capable device holds the LLDP information in the LLDP MIB.

A.9 Basics of prioritizing the data traffic

A.9.1 Description of prioritization

For data traffic prioritization, traffic classes are predefined in the device. The device prioritizes higher traffic classes over lower traffic classes.

To provide for optimal data flow for delay-sensitive data, you assign higher traffic classes to this data. You assign lower traffic classes to data that is less sensitive to delay.

Assigning traffic classes to the data

The device automatically assigns traffic classes to inbound data (traffic classification). The device takes the following classification criteria into account:

- Methods according to which the device carries out assignment of received data packets to traffic classes:
  - `trustDot1p`:The device uses the priority of the data packet contained in the VLAN tag.
  - `trustIpDscp`:The device uses the QoS information contained in the IP header (ToS/DiffServ).
  - `untrusted`:The device ignores possible priority information within the data packets and uses the priority of the receiving port directly.
- The priority assigned to the receiving port.

Both classification criteria are configurable.

Prioritizing traffic classes

For the prioritization of traffic classes, the device uses the method "Strict":

When the data of a higher traffic class is no longer being sent, or the relevant data is still in the queue, the device sends data of the corresponding traffic class. If all traffic classes are prioritized according to the “strict” method, when there is a high network load the device may permanently block the data of lower traffic classes.

A.9.2 Handling of received priority information

Applications label data packets with the following prioritization information:

- VLAN priority based on IEEE 802.1Q/ 802.1D (Layer 2)
- Type-of-Service (ToS) or DiffServ (DSCP) for VLAN Management IP packets (Layer 3)

The device offers the following options for evaluating this priority information:

- `trustDot1p`
  The device assigns VLAN-tagged data packets to the different traffic classes according to their VLAN priorities. The corresponding assignment is configurable. The device assigns the priority of the receiving port to data packets that it receives without a VLAN tag.
- `trustIpDscp`
  The device assigns the IP packets to the different traffic classes according to the DSCP value in the IP header, even if the packet was also VLAN-tagged. The corresponding assignment is configurable. The device prioritizes non-IP packets according to the priority of the receiving port.
- `untrusted`
  The device ignores the priority information in the data packets and assigns the priority of the receiving port to the packets.

A.9.3 VLAN tagging

For the VLAN and prioritizing functions, the IEEE 802.1Q standard provides for integrating a VLAN tag into the MAC data frame. The VLAN tag consists of 4 bytes and is located between the source address field (“Source Address Field”) and the type field (“Length / Type Field”).

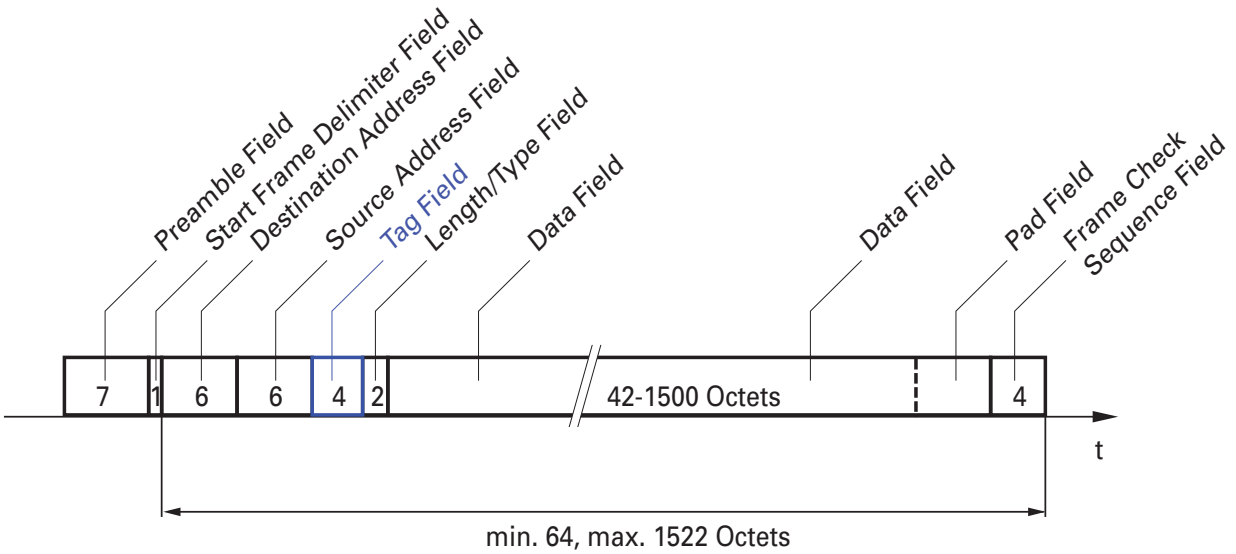


Figure 15: Ethernet data packet with tag

For data packets with VLAN tags, the device evaluates the priority information.

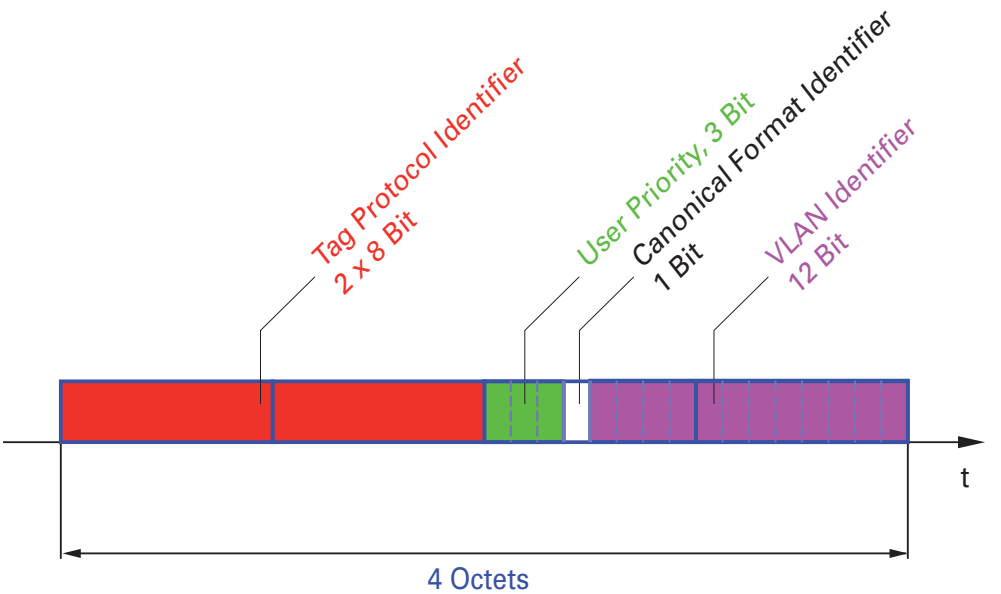


Figure 16: Structure of the VLAN tagging

Data packets with VLAN tags containing priority information but no VLAN information (VLAN ID = 0) are known as Priority Tagged Frames.

Note: Network protocols and redundancy mechanisms use the highest traffic class 7. Therefore, you select lower traffic classes for application data.

When using VLAN prioritizing, consider the following special features:

- End-to-end prioritization requires universal transmission of VLAN tags in the entire network. The prerequisite is that each participating network component must be VLAN-capable.
- Routers are not able to send and receive packets with VLAN tags via port-based router interfaces.

A.9.4 Handling of traffic classes

Description of Strict Priority

With the Strict Priority setting, the device first transmits the data packets that have a higher traffic class (higher priority) before transmitting a data packet with the next highest traffic class. The device transmits a data packet with the lowest traffic class (lowest priority) only when there are no other data packets remaining in the queue. In unfortunate cases, the device never sends packets with a low priority if there is a high volume of high-priority traffic waiting to be sent on this port.
In delay-sensitive applications, such as VoIP or video, Strict Priority allows high priority data to be sent immediately.

A.10 Basics of flow control

If a large number of data packets are received in the sending queue of a port at the same time, this can cause the port memory to overflow. This happens, for example, when the device receives data on a Gigabit port and forwards it to a port with a lower bandwidth. The device discards surplus data packets.

The flow control mechanism described in standard IEEE 802.3 ensures that no data packets are lost due to a port memory overflowing. Shortly before a port memory is completely full, the device signals to the connected devices that it is not accepting any more data packets from them.

- In full duplex mode, the device sends a pause data packet.
- In half duplex mode, the device simulates a collision.

The following figure shows how flow control works. Workstations 1, 2 and 3 want to simultaneously transmit a large amount of data to Workstation 4. The combined bandwidth of Workstations 1, 2, and 3 is greater than the bandwidth of Workstation 4. As a result, the receiving queue of port 4 overflows. The left funnel symbolizes this status.

If the flow control function at ports 1, 2 and 3 of the device is turned on, the device reacts before the funnel overflows. The funnel on the right side represents ports 1, 2 and 3, which send a message to the transmitting devices in order to control the transmission speed. As a result of this, the receiving port is no longer overloaded and is able to process the incoming traffic.

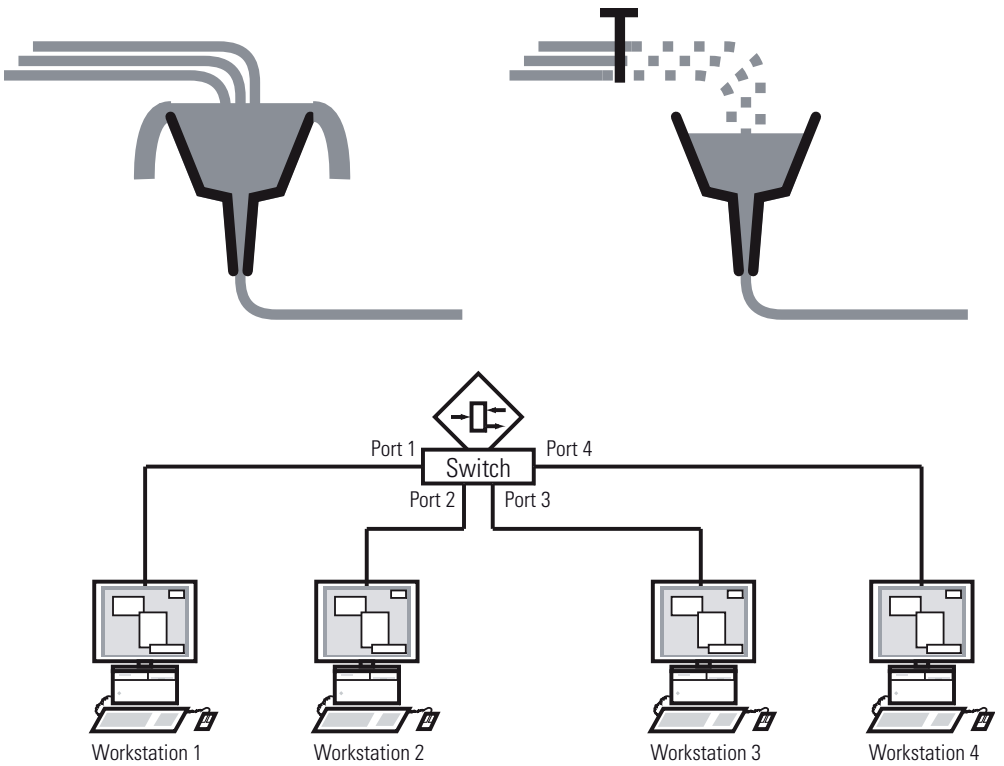


Figure 17: Example of flow control

A.10.1 Half duplex or full duplex link

Flow control with a half duplex link

In the example, there is a half duplex link between Workstation 2 and the device.

Before the send queue of port 2 overflows, the device sends data back to Workstation 2, which detects a collision and interrupts the sending process.

Flow control with a full duplex link

In the example, there is a full duplex link between Workstation 2 and the device.

Before the send queue of port 2 overflows, the device sends a request to Workstation 2 to take a small break in the sending transmission.

A.11 Basics of the Management Information Base MIB

The Management Information Base (MIB) is designed as an abstract tree structure.
The branching points are the object classes. The “leaves” of the MIB are known as generic object classes.
If this is required for unique identification, the generic object classes are instantiated, i.e. the abstract structure is mapped onto reality, for example by specifying the port or the source address.
Values (integers, time ticks, counters or octet strings) are assigned to these instances; these values can be read and, in some cases, modified. The object description or object ID (OID) identifies the object class. The subidentifier (SID) is used to instantiate them.

Example:
The generic object class
`hm2PSState (OID = 1.3.6.1.4.1.248.11.11.1.1.1.1.2)`
is the description of the abstract information “power supply status”. However, it is not possible to read any value from this, as the system does not know which power supply is meant.
Specifying the subidentifier (2) maps this abstract information onto reality (instantiates it), thus identifying it as the operating status of power supply 2. A value is assigned to this instance and can be read. Therefore, the instance “`get 1.3.6.1.4.1.248.11.11.1.1.1.1.2.1`” supplies “1” as a response, meaning that the power supply is ready for operation.

Definition of the syntax terms used:	
Integer	A whole number in the range -2^{31} - 2^{31}-1
IP address	xxx.xxx.xxx.xxx (xxx = integer in the range 0-255)
MAC address	12-digit hexadecimal number in accordance with ISO/IEC 8802-3
Object identifier	x.x.x.x… (e.g. 1.3.6.1.4.1.248...)
Octet string	ASCII character string
PSID	Power supply identifier (number of the power supply unit)

Definition of the syntax terms used:	
TimeTicks	Stopwatch Elapsed time (in seconds) = numerical value/100 Numerical value = integer in the range $0\text{-}2^{32}\text{-}1$
Timeout	Time value in hundredths of a second Time value = integer in the range $0\text{-}2^{32}\text{-}1$
Type field	4-digit hexadecimal number in accordance with ISO/IEC 8802-3
Counter	Integer ($0\text{-}2^{32\text{-}1}$) whose value is incremented by 1 when specific events occur.

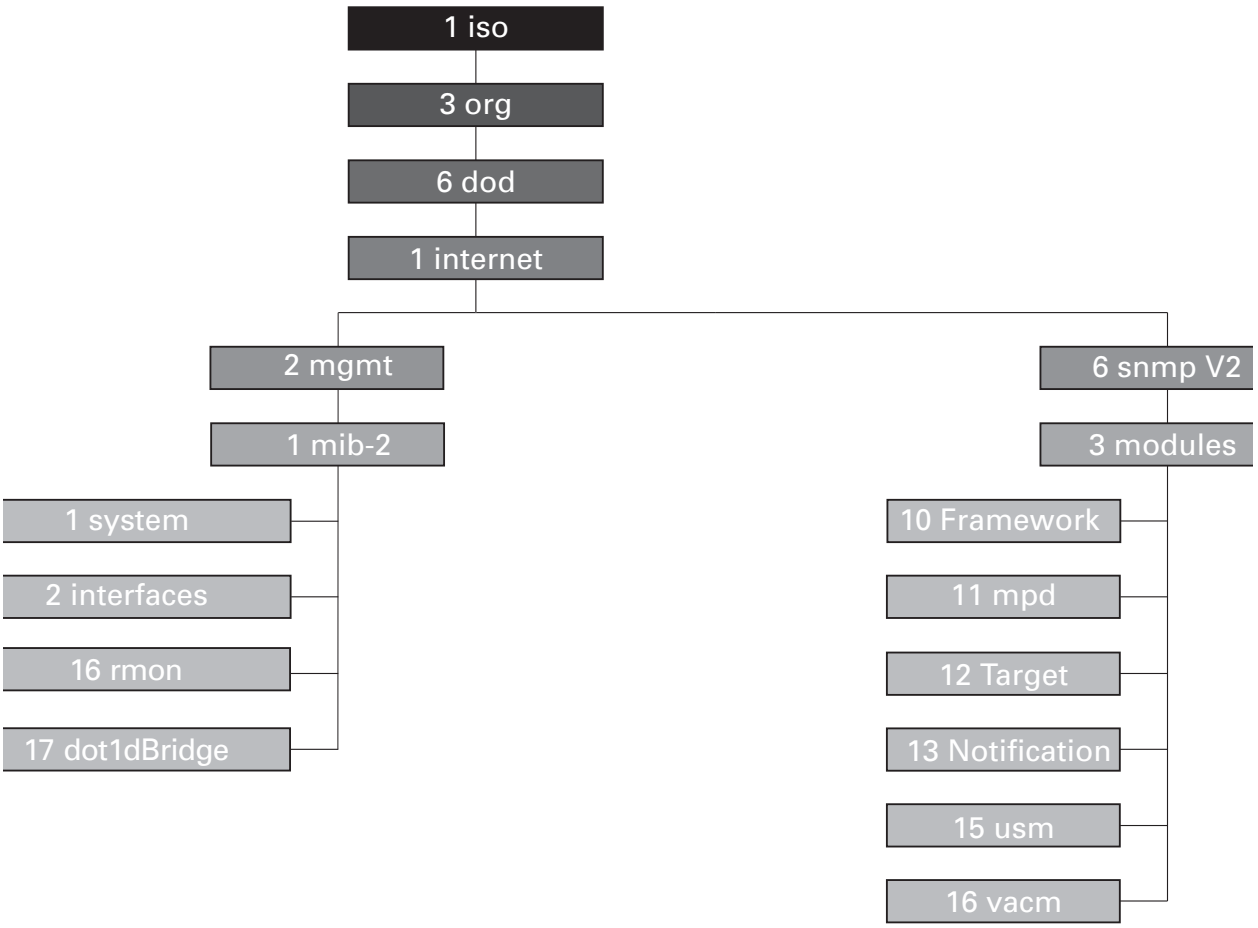


Figure 18: Tree structure of Hirschmann MIB GECKO 4TX

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A.12.2 ICS DHCP

A.12.3 curl

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A.12.13 openssl

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A.13 Abbreviations

ACA	AutoConfiguration Adapter
ACL	Access Control List
BOOTP	Bootstrap Protocol
CLI	Command Line Interface
DHCP	Dynamic Host Configuration Protocol
FDB	Forwarding Database
GUI	Graphic user interface
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
LED	Light Emitting Diode
LLDP	Link Layer Discovery Protocol
F/O	Optical Fiber
MAC	Media Access Control
MIB	Management Information Base
MRP	Media Redundancy Protocol
MSTP	Multiple Spanning Tree Protocol
NMS	Network Management System
NTP	Network Time Protocol
PC	Personal Computer
PTP	Precision Time Protocol
QoS	Quality of Service
RFC	Request For Comment
RM	Redundancy Manager
RSTP	Rapid Spanning Tree Protocol
SCP	Secure Copy
SFP	Small Form-factor Pluggable
SFTP	SSH File Transfer Protocol
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
TP	Twisted Pair
UDP	User Datagram Protocol
URL	Uniform Resource Locator
UTC	Coordinated Universal Time
VLAN	Virtual Local Area Network

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