Falcon R-Class

User Guide

Falcon-RX

Software version 8.0.20

www.fibrolan.com

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Special Notes

The R Class series includes various Falcon-RX models.

Please refer to the Alphabetical Glossary of terms and definitions for clarification of the terminology found in the User Guide.

The features and characteristics described in this User Guide are common to all R class devices.

For a detailed features vs models cross reference table, please refer to the 'Product Selection Guide' on Fibrolan website.

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1 Introduction

1.1 R Class series overview

1.1.1 Falcon-RX

Falcon-RX is a high performance, 5G xHaul Timing Aware O-RAN Switch & PTP Grandmaster. It is a high capacity, low latency transport and high precision synchronization device that enables 5G RAN operation at its optimal throughput, on both telecom and enterprise environments.

The **Falcon-RX** combines the best of breed of the Transport and Timing worlds, in a single powerful package. Both elements are critical for 5G fronthaul deployments, along with support for the latest O-RAN architectures and recommendations.

The **Falcon-RX** is equipped with up to twenty (20) multi-rate 10G SFP+ ports or eight (8) 25G SFP28 ports, based on user configuration. Additionally, one tri-speed Copper management port is included. All ports can operate at full wire speed, with a total forwarding capacity of 200Gbps.

The system offers advanced Quality of Service (QoS) features including classification and mapping based on layer 1 through layer 4 attributes, rate limiting, highly flexible scheduling, queuing and shaping options and MEF defined services.

1.2 Physical Description

1.2.1 Falcon-RX/812/G

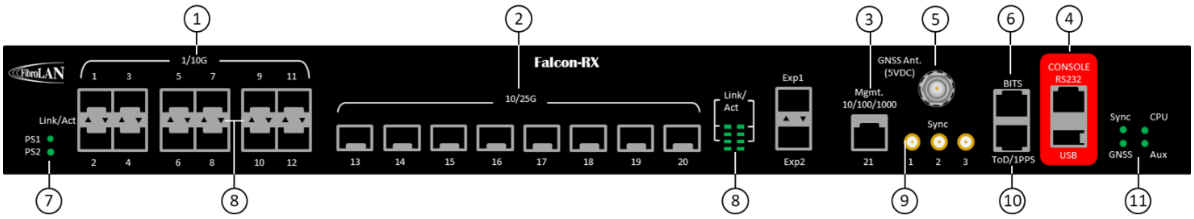

①
②
③
⑤
⑥
④
FibroLAN
1/10G
Falcon-RX
10/25G
Link/Act
PS1
PS2
Link/Act
Exp1
Exp2
GNSS Ant. (5VDC)
Mgmt. 10/100/1000
Sync
BITS
ToD/1PPS
CONSOLE RS232
USB
Sync
CPU
GNSS
Aux
⑦
⑧
⑧
⑨
⑩
⑪

Figure 1-1: Falcon-RX/812/G front panel

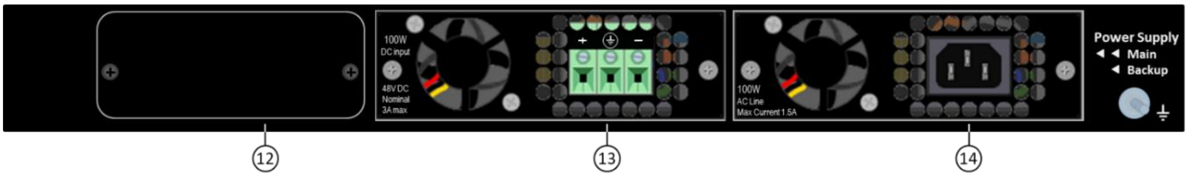

100W DC input
48V DC Nominal 3A max
100W AC Line Max Current 1.5A
Power Supply
Main
Backup
⑫
⑬
⑭

Figure 1-2: Falcon-RX/812/G back panel

Table 1-1: Falcon-RX/812/G Front Panel Description

①	12x 1/10G BaseX	⑧	LEDs indicators Link/Activity (per port)
②	8x 1/10/25G BaseX	⑨	2x Sync SMA input/output – 1PPS/10 MHz
③	1x 10/100/1000 BaseT (management)	⑩	RJ45 input/output ToD/1PPS
④	RJ45 and USB Console	⑪	LEDs indicators Sync/GNSS/CPU/Aux.
⑤	GNSS antenna TNC connector (5VDC)	⑫	Expansion module for Rubidium clock
⑥	1.5 / 2 Mbps BITS input/output	⑬	PSU1 – AC/DC options supported
⑦	LEDs indicators PSU1/PSU2	⑭	PSU2 – AC/DC options supported

1.3 Models List

Table 1-2**: **Falcon-RX models list

Model	Part #	Description
Falcon-RX/812/G/A	7160	Timing Aware xHaul Switch, 12x10G (SFP+), 8x25G (SFP28) ports, Advanced Timing spec w/ GNSS Rx, 1 removable AC power supply (FPS10012/A)
Falcon-RX/812/G/D	7161	Timing Aware xHaul Switch, 12x10G (SFP+), 8x25G (SFP28) ports, Advanced Timing spec w/ GNSS Rx, 1 removable DC power supply (FPS10012/D)

1.4 Typical Applications

1.4.1 5G Fronthaul & Backhaul Convergence

Evolved mobile networks requires high level of synchronization to operate. The required accuracy level increases as the networks further evolve, reaching the point the expected time error of nanoseconds is needed in the 5G Fronthaul. The Falcon-RX ability to provide this level of synchronization, on top of its line rate Ethernet forwarding, makes it the ideal Fronthaul switch. Additionally, the Falcon-RX can also provide backhaul connection to complete gNodeB units towards the 5G Core.

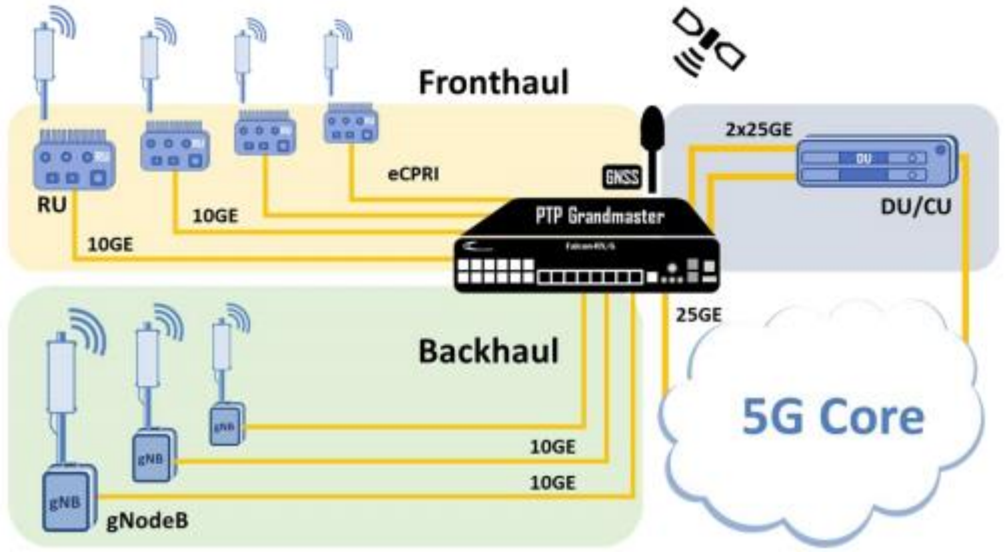

Fronthaul
eCPRI
GNSS
2x25GE
DU
DU/CU
RU
10GE
10GE
PTP Grandmaster
Backhaul
25GE
5G Core
10GE
10GE
gNB
gNB
gNB
gNodeB

Figure 1-3: Falcon-RX typical xHaul application

1.4.2 IIoT Campus deployment

Modern industrial campuses and factories are being designed to accommodate high level of automation and mobility in production, which dictates specific requirement for synchronization. In such environment where, man and machine coexist and work together side by side all actions must be coordinated and mutually aware. Synchronized packet networks and time sensitive networking (TSN) are a key element in building these enrolments.

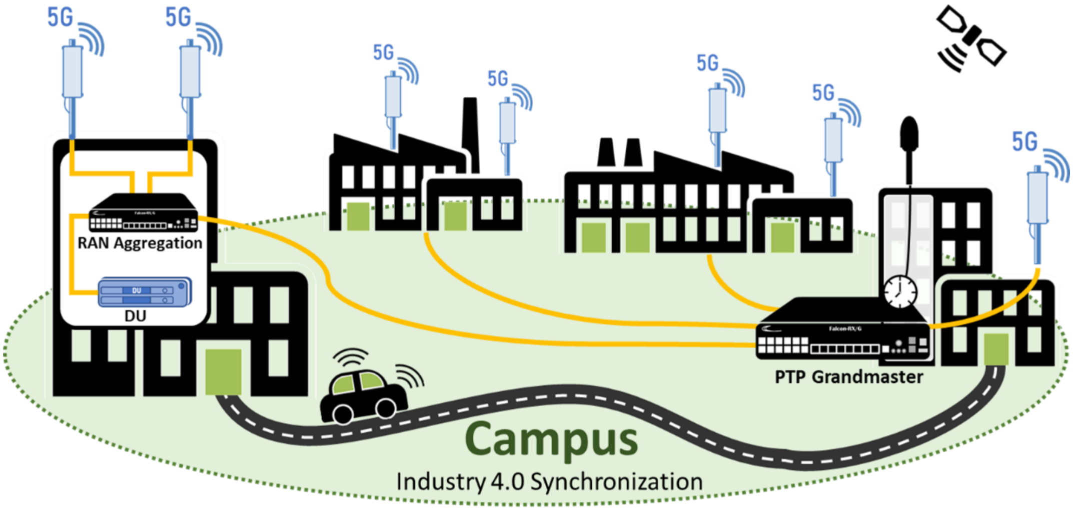

5G
5G
5G
5G
5G
5G
5G
RAN Aggregation
DU
DU
PTP Grandmaster
Campus
Industry 4.0 Synchronization

Figure 1-4: Falcon-RX in IIoT campus deployment.

2 System Description

2.1 Block Diagram

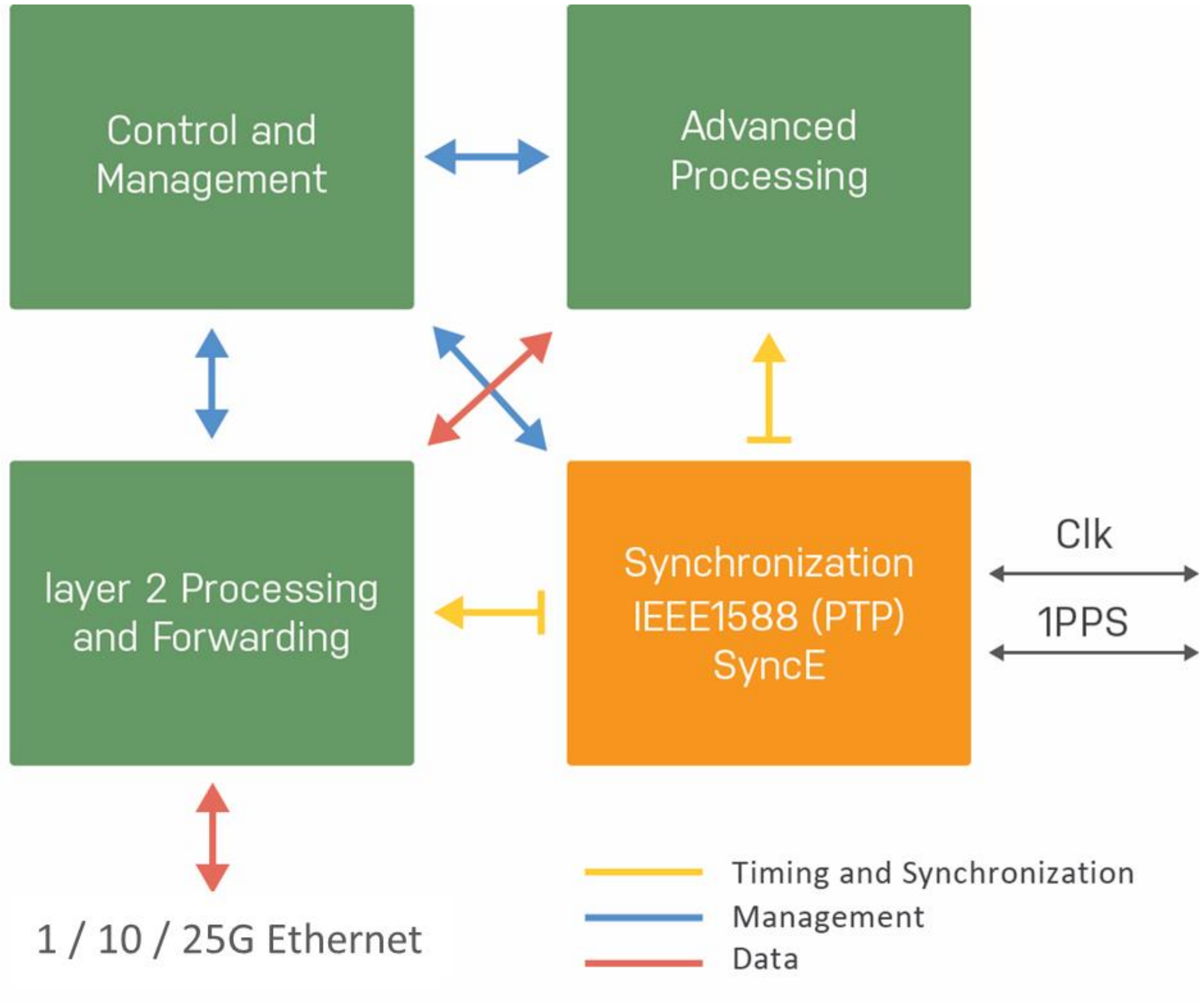

Control and Management
Advanced Processing
layer 2 Processing and Forwarding
Synchronization IEEE1588 (PTP) SyncE
Clk
1PPS
1 / 10 / 25G Ethernet
Timing and Synchronization
Management
Data

Figure 2-1: R Class functional block diagram

2.2 R Class series key features

- LTE/5G xHaul Transport and Timing RAN switch
- Integrated PTP Grandmaster
- Compatible with O-RAN architectures
- High capacity, low latency
- Extensive Sync and Timing with SyncE and PTP (PTRC/GM, BC, TC)
- Sub nanosecond timestamping, Class C/D performance
- Time Sensitive Networking support
- Based on 4th generation Falcon architecture
- Advanced QoS and service level traffic management
- Advanced OAM and management capabilities
- Multiple protection mechanisms for link, path, and ring service resilience

2.3 Management

The R Class Falcon can be remotely managed via a variety of mechanisms/ platforms at virtually no integration efforts:

IP Based (in-band): SNMP (v1/v2/v3), Telnet, SSH, Web (HTTP, HTTPS).

Console (RJ-45): RS-232 (115,200Bd), CLI (Cisco like).

OAM/IEEE802.3ah: when connected to third party edge switch that supports the standard.

2.3.1 Management integration

Integration with 3rd party network management systems can be achieved via SNMP protocol, in addition to the following standards: NTPV4, SYSLOG, RADIUS, TACACS, DHCP, LACP, LLDP.

2.3.2 OAM & Diagnostics:

- IEEE802.3ah link OAM
- IEEE802.1ag CFM
- ITU-T Y.1731 PM (HW based measurements)
- Copper TDR
- SFP diagnostics (SFF-8472)
- Traffic mirroring

2.4 R Class Falcon port features

R Class ports can be configured to support special data-plain functions. extended traffic handling capabilities, more functionality and processing power. These capabilities are Software and Firmware based and therefore field upgradeable and configurable.

The following special features are supported by the R Class series models ports:

- Synchronous Ethernet
- IEEE1588-2008 - PTP.
- MEF 20: specifies MEF User to Network Interface (UNI) Type 2.

- MEF 22.1: Mobile Backhaul Phase 2
- Per port / queue policing
- Per port / queue shaping
- Per Port Counters: The R Class models support frame and byte counters per port.
- Link OAM (IEEE802.3ah) and Service OAM (based on IEEE 802.1ag, ITU-T Y.1731)
- ITU Y.1731 data-plane support– several functions of this standard require HW based support. These functions are:
    - Loss measurement
    - Delay measurement
    - Delay variation measurement
- Linear Ethernet Protection Switching (G.8031)
- Ethernet Ring Protection Switching (G.8032v2)
- Power Link ports support the implementation of the following:

Note: The above feature list represents the current status. It is expected that further features will be added in future System Software releases

3 Getting Started

3.1 Quick Setup Outline

To set up the R Class models carry out the following steps:

1. Mount the device at its location (rack or desktop).
2. Install the SFP transceivers.
3. Connect the unit to a console and a power source (Figure 3-1).
4. Verify that the Power (PS1, PS2 or both) LEDs are green lit.
5. Connect required cables to ports: twisted pair (RJ45 Ethernet) and fiber (Ethernet SFPs).
6. Verify that the ports Link and Speed LEDs are lit per connected interfaces.
7. Configure the selected device via the console to assign management IP address or use default IP address (192.168.1.90)
8. Establish management access via SSH, Telnet or Web GUI (4.1.2).
9. For a general configuration procedure please refer to the Getting Started Quick Guide located at www.Fibrolan.com (Resources > Documents > Quick Guides).

Note: Remote management requires basic IP configuration.

3.2 Console Connection and Configuration

Note: Applicable to R Class series devices.

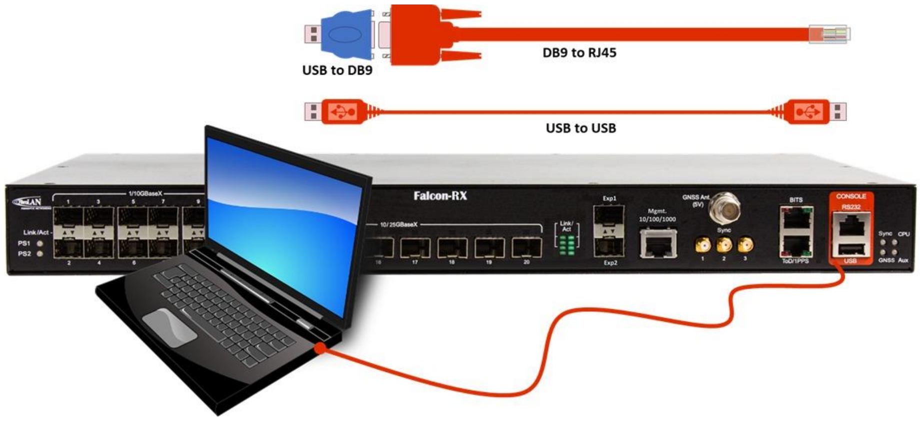


Figure 3-1: Falcon console connection

To enable basic console connection for initial setup, carry out the following steps:

1. Use an RJ-45-to-DB-9 console cable and insert the RJ-45 connector into the console port on the front panel. Alternately connect USB-to-USB from PC directly to USB port on Falcon front panel. Configure the baud rate and character format of the PC or terminal to match these console port default characteristics:
   115200 baud, 8 data bits, 1 stop bit, No parity, None (flow control).
2. Connect the device to a power source and wait until it boots up.
3. The system prompts you to log in.
   Default username: **moose**   Default password: **1234**.

Note: if you experiment difficulty in the connection, contact Fibrolan support (International: support@Fibrolan.com; North America: Us-info@Fibrolan.com)

3.2.1 Initial IP address settings

This first configuration is done via the console; it enables the switch to connect to the IP network. Once the unit IP address is set via console, the system can be accessed through Web, Telnet, SSH or any other management options.

Initial IP setup can be implemented by manually setting the IP address Parameters or by an automatic DHCP setup (if a DHCP server is present).

To assign a new IP address to the device enter the following CLI commands:

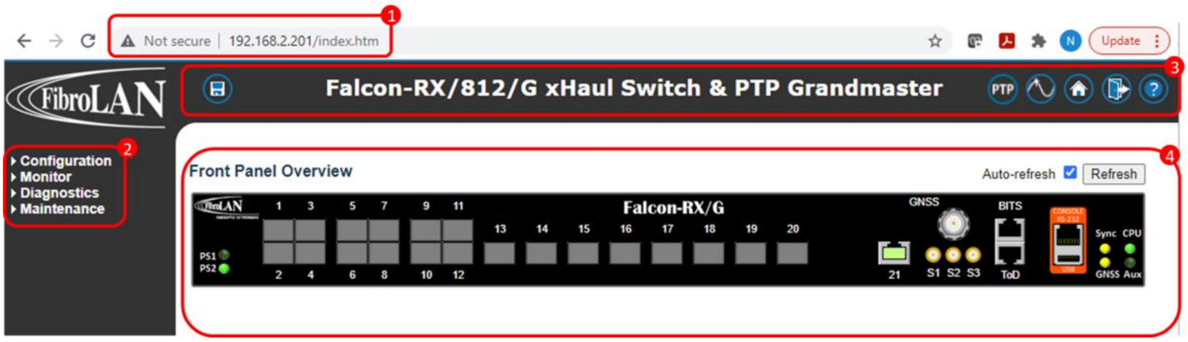
```
➢ configure terminal
➢ interface vlan 1
➢ ip address 192.168.1.90 255.255.255.0
```

The Falcon R class will initially boot-up with this default IP address: 192.168.1.90/24.

3.3 Web GUI

The Web management is accessed by setting the required IP address in the URL Browser. When accessing the devices via the Web interface, its initial Port State Overview window is displayed. as shown below.

Web GUI: Monitor > Ports > State


Not secure | 192.168.2.201/index.htm
1
Update
FibroLAN
Falcon-RX/812/G xHaul Switch & PTP Grandmaster
PTP
3
Configuration
Monitor
Diagnostics
Maintenance
2
Front Panel Overview
Auto-refresh ☑
Refresh
4
Falcon-RX/G
PS1
PS2
1 3 5 7 9 11
2 4 6 8 10 12
13 14 15 16 17 18 19 20
21
GNSS
S1 S2 S3
BITS
ToD
CONSOLE
USB
Sync CPU
GNSS Aux

① IP address of device in explorer URL line.

② Four functionality management menus: Configuration, Monitor, Diagnostics and Maintenance

Configuration: For setting all system parameters relevant to proper operation of the device.

Monitor: Displays a variety of statuses from the device and other device info that enable system administrator to following up and check if the device is working properly.

Diagnostics: Includes tools to diagnose and troubleshoot networking issues

Maintenance: For restarting your device, returning to factory defaults and upgrading your device.

③ Main bar: consists of the following buttons:

? **Show help**: online help specific to the displayed dynamic configuration screen.

Logout: User can end access to device web site.

Home: Access to device front panel.

SyncCenter: Control center of system synchronization interfaces and timing signal and their distribution.

PTP **PTP:** Manage PTP clock instances

Save running **config**: After

④ Dynamic configuration section: Displays detailed data for the selected from one of the functionality menus.

- **Auto-refresh**: Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds
- **Refresh**: Click to refresh the page.

4 Functional Description

4.1 Overview

This section provides introduction to the **R Class series** functionality and instructions for configuration and monitoring.

The configuration and monitoring functionalities can be accessed via various management interfaces. Sections 4 demonstrates the configuration various functions and setting mainly using the Web interface. However, any configuration can be implemented using other management interfaces (CLI, Telnet, and SNMP).

4.2 Frame Processing Overview

This section provides a general description of the Frame Forwarding Process at the R Class series from the input port toward the output port, as illustrated below.

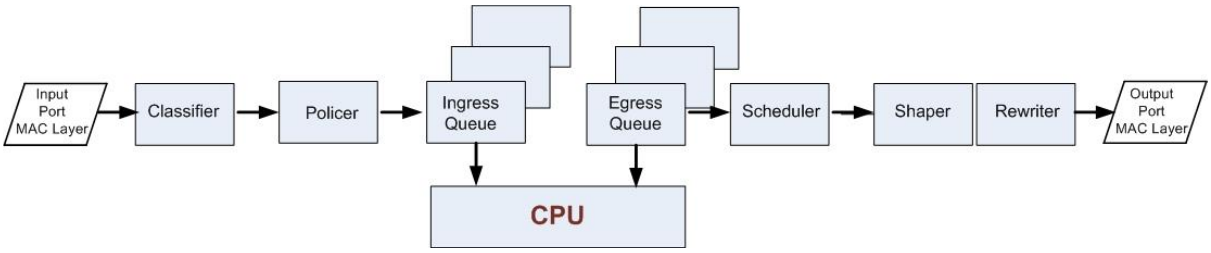


Figure 4-1: Frame Forwarding Diagram

Input frame flow

Frames received on the input port (MAC layer) are handed to the classifiers in order to classify frames into different flows (e.g., management frames, specific service/user frames, etc.). Following the classification, the frames are passed to the Policer. If the Policer is not selected the frames pass untouched. From the Policer the frames enter the Ingress Queue. Some prioritization algorithms are used to handle traffic and to avoid buffer overrun and Frame loss.

Output frame flow

The frames, which pass from the Ingress Queue, are transferred to the Egress Queue (8 parallel queues). The topmost queue handles management frames injected by the CPU, which have super priority over the other four queues. The remaining queues transfer data frames. At this stage, a scheduling process is taking place in order to decide which frame will be sent out of the port (out of the 8 candidate queues). For scheduling either a Strict-Priority or a Weighted Fair Queuing algorithm is being used. The output of the queue is passed to the Shaper. If the Shaper is not selected the frame passes untouched. The frames are then passed to the Rewriter. The Rewriter examines the frame header information and adjusts it if required. From there on the frame is sent to the output port (MAC layer).

Packet forwarding

Packet forwarding decisions are based on the following criteria:

- ACL:(Access Control List) The ACL can drop a frame or redirect it to a specific port
- MAC address and VLAN: The standard Ethernet switch forwarding – a frame is forwarded by searching the learn-table and sending it to the port where the MAC-address + VLAN was learnt. If the address is not found, or the frame is a broadcast frame it will be sent to all the other member ports of the VLAN.

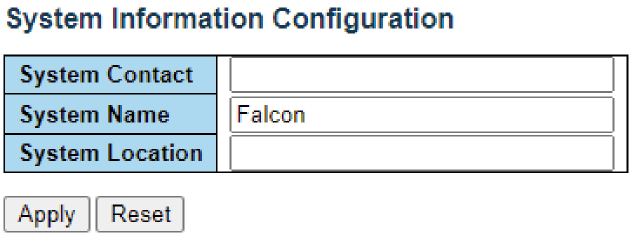
4.3 System Information

The switch system information is provided here.

The display is similar in all falcon series

4.3.1 System Information Configuration

Web GUI: Configuration > System > Information



System Information Configuration

System Contact	
System Name	Falcon
System Location	

Figure 4-2: System Information Configuration

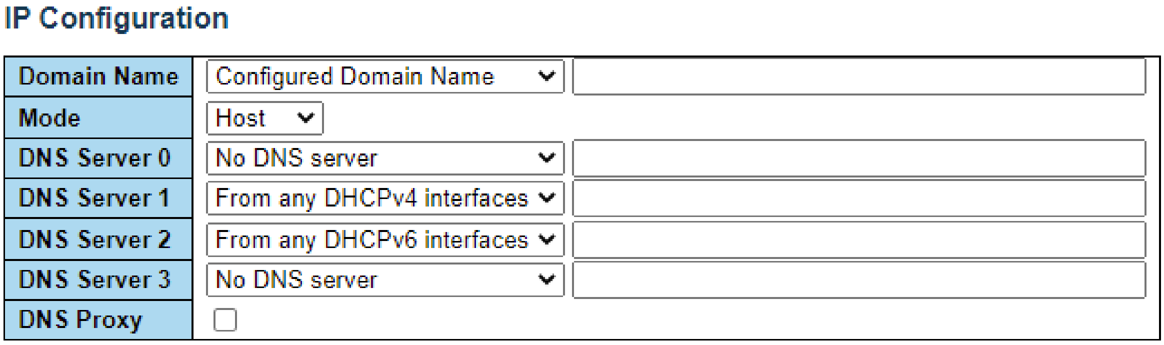
Table 4-1: System Information Configuration Parameters

System Contact	The textual identification of the contact person for this managed node, together with information on how to contact this person. The allowed string length is 0 to 255, and the allowed content is the ASCII characters from 32 to 126.
System Name	An administratively assigned name for this managed node. By convention, this is the node's fully qualified domain name. A domain name is a text string drawn from the alphabet (A-Za-z), digits (0-9), minus sign (-). No space characters are permitted as part of a name. The first character must be an alpha character. And the first or last character must not be a minus sign. The allowed string length is 0 to 255.
System Location	The physical location of this node (e.g., telephone closet, 3rd floor). The allowed string length is 0 to 255, and the allowed content is the ASCII characters from 32 to 126.

4.3.2 IP Configuration

Configure IP basic settings, control IP interfaces and IP routes. The maximum number of interfaces supported is 32 and the maximum number of routes is 32.

Web GUI: Configuration > System > IP



IP Configuration

Domain Name	Configured Domain Name	
Mode	Host	
DNS Server 0	No DNS server	
DNS Server 1	From any DHCPv4 interfaces	
DNS Server 2	From any DHCPv6 interfaces	
DNS Server 3	No DNS server	
DNS Proxy	☐	

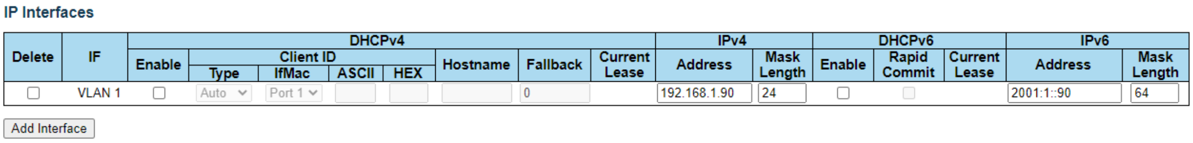
Figure 4-3: IP Configuration

Table 4-2: IP Configuration Parameters

IP Configuration- Basic Settings	
Mode	**Configure** whether the IP stack should act as a **Host** or a **Router**. In **Host** mode, IP traffic between interfaces will not be routed. In **Router** mode traffic is routed between all interfaces.
DNS Server	Controls the DNS name resolution done by the switch. There are four servers available for configuration, and the index of the server presents the preference (less index has higher priority) in doing DNS name resolution. System selects the active DNS server from configuration in turn, if the preferred server does not respond in five attempts. The following modes are supported: • **No DNS server**: No DNS server will be used. • **Configured IPv4:** Explicitly provide the valid IPv4 unicast address of the DNS Server in dotted decimal notation. Make sure the configured DNS server could be reachable (e.g., via PING) for activating DNS service • **Configured IPv6:** Explicitly provide the valid IPv6 unicast (except link local) address of the DNS Server. Make sure the configured DNS server could be reachable (e.g., via PING6) for activating DNS service. • **From any DHCPv4 interfaces:** The first DNS server offered from a DHCPv4 lease to a DHCPv4-enabled interface will be used. • **From this DHCPv4 interface:** Specify from which DHCPv4-enabled interface a provided DNS server should be preferred. • **From any DHCPv6 interfaces:** The first DNS server offered from a DHCPv6 lease to a DHCPv6-enabled interface will be used. • **From this DHCPv6 interface:** Specify from which DHCPv6-enabled interface a provided DNS server should be preferred.
DNS Proxy	When DNS proxy is enabled, system will relay DNS requests to the currently configured DNS server, and reply as a DNS resolver to the client devices on the network. Only IPv4 DNS proxy is currently supported.

4.3.3 IP Interfaces

Web GUI: Configuration > System > IP



IP Interfaces

Delete	IF	DHCPv4								IPv4		DHCPv6			IPv6	
		Enable	Client ID				Hostname	Fallback	Current Lease	Address	Mask Length	Enable	Rapid Commit	Current Lease	Address	Mask Length
			Type	IfMac	ASCII	HEX										
☐	VLAN 1	☐	Auto	Port 1				0		192.168.1.90	24	☐	☐		2001:1::90	64

Figure 4-4: IPv4 / IPv6 Configuration

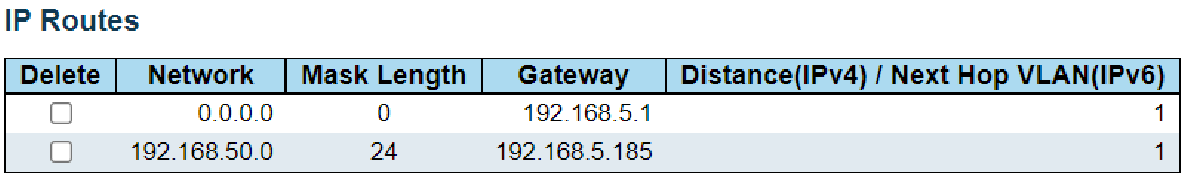
Table 4-3: IP Interfaces Parameters

Delete	Select this option to delete an existing IP interface
VLAN	The VLAN associated with the IP interface. Only ports in this VLAN will be able to access the IP interface. This field is only available for input when creating a new interface.
IPv4 DHCP Enabled	Enable the DHCPv4 client by checking this box. If this option is enabled, the system will configure the IPv4 address and mask of the interface using the DHCPv4 protocol. The DHCPv4 client will announce the configured System Name as hostname to provide DNS lookup
IPv4 DHCP Client Identifier Type	This specified which of the three types below, i.e., IfMac, ASCII or HEX, shall be used for the Client Identifier. See RFC-2132 section 9.14.
IPv4 DHCP Client Identifier IfMac	The interface name of DHCP client identifier. When DHCPv4 client is enabled and the client identifier type is 'ifMac', the configured interface's hardware MAC address will be used in the DHCP option 61 field.
IPv4 DHCP Client Identifier ASCII	The ASCII string of DHCP client identifier. When DHCPv4 client is enabled and the client identifier type is 'ascii', the ASCII string will be used in the DHCP option 61 field.
IPv4 DHCP Client Identifier HEX	The hexadecimal string of DHCP client identifier. When DHCPv4 client is enabled and the client identifier type 'hex', the hexadecimal value will be used in the DHCP option 61 field.
IPv4 DHCP Hostname	The hostname of DHCP client. If DHCPv4 client is enabled, the configured hostname will be used in the DHCP option 12 field. When this value is empty string, the field use the configured system name plus the latest three bytes of system MAC addresses as the hostname.
IPv4 DHCP Fallback Timeout	The number of seconds for trying to obtain a DHCP lease. After this period expires, a configured IPv4 address will be used as IPv4 interface address. A value of zero disables the fallback mechanism, such that DHCP will keep retrying until a valid lease is obtained. Legal values are 0 to 4294967295 seconds.
IPv4 DHCP Current Lease	For DHCP interfaces with an active lease, this column shows the current interface address, as provided by the DHCP server.

IPv4 Address	The IPv4 address of the interface in dotted decimal notation. If `DHCP` is enabled, this field configures the fallback address. The field may be left blank if IPv4 operation on the interface is not desired - or no DHCP fallback address is desired.
IPv4 Mask	The IPv4 network mask, in number of bits (*prefix length*). Valid values are between 0 and 30 bits for a IPv4 address. If **DHCP** is enabled, this field configures the fallback address network mask. The field may be left blank if IPv4 operation on the interface is not desired - or no DHCP fallback address is desired.
DHCPv6 Enable	Enable the DHCPv6 client by checking this box. If this option is enabled, the system will configure the IPv6 address of the interface using the DHCPv6 protocol.
DHCPv6 Rapid Commit	Enable the DHCPv6 Rapid-Commit option by checking this box. If this option is enabled, the DHCPv6 client terminates the waiting process as soon as a Reply message with a Rapid Commit option is received. This option is only manageable when DHCPv6 client is enabled.
DHCPv6 Current Lease	For DHCPv6 interface with an active lease, this column shows the interface address provided by the DHCPv6 server.
IPv6 Address	The IPv6 address of the interface. A IPv6 address is in 128-bit records represented as eight fields of up to four hexadecimal digits with a colon separating each field (:). For example, 2001:1::90. The symbol '**::**' is a special syntax that can be used as a shorthand way of representing multiple 16-bit groups of contiguous zeros; but it can appear only once. System accepts the valid IPv6 unicast address only, except IPv4-Compatible address and IPv4-Mapped address. The field may be left blank if IPv6 operation on the interface is not desired.
IPv6 Mask	The IPv6 network mask, in number of bits (*prefix length*). Valid values are between 1 and 128 bits for a IPv6 address. The field may be left blank if IPv6 operation on the interface is not desired.
Resolving IPv6 DAD	The link-local address is formed from an interface identifier based on the hardware address which is supposed to be uniquely assigned. Once the DAD (Duplicate Address Detection) detects the address duplication, the operation on the interface SHOULD be disabled. At this moment, manual intervention is required to resolve the address duplication. For example, check whether the loop occurs in the VLAN or there is indeed other device occupying the same hardware address as the device in the VLAN. After making sure the specific link-local address is unique on the IPv6 link in use, delete and then add the specific IPv6 interface to restart the IPv6 operations on this interface.
Buttons	**Add Interface**: Click to add a new IP interface. A maximum of 8 interfaces is supported.

4.3.4 IP Routes

Web GUI: Configuration > System > IP



IP Routes

Delete	Network	Mask Length	Gateway	Distance(IPv4) / Next Hop VLAN(IPv6)
☐	0.0.0.0	0	192.168.5.1	1
☐	192.168.50.0	24	192.168.5.185	1

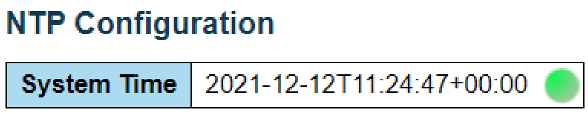
Figure 4-5: IP Routes

Table 4-4: IP Routes Parameters

Delete	Select this option to delete an existing IP route.
Network	The destination IP network or host address of this route. Valid format is dotted decimal notation or a valid IPv6 notation. A default route can use the value 0.0.0.0or IPv6:: notation.
Mask Length	The destination IP network or host mask, in number of bits (prefix length). It defines how much of a network address that must match, in order to qualify for this route. Valid values are between 0 and 32 bits respectively 128 for IPv6 routes. Only a default route will have a mask length of **0** (as it will match anything).
Gateway	The IP address of the IP gateway. Valid format is dotted decimal notation for a valid IPv6 notation. Gateway and Network must be of the same type.
Distance (Only for IPv4)	The distance value of route entry is used to provide the priority information of the routing protocols to routers. When there are two or more different routing protocols are involved and have the same destination, the distance value can be used to select the best path.
Next Hop VLAN (Only for IPv6)	The VLAN ID (VID) of the specific IPv6 interface associated with the gateway. The given VID ranges from 1 to 4095 and will be effective only when the corresponding IPv6 interface is valid. If the IPv6 gateway address is link-local, it must specify the next hop VLAN for the gateway. If the IPv6 gateway address is not link-local, system ignores the next hop VLAN for the gateway.
Buttons	**Add Route** Click to add a new IP route. A maximum of 32 routes is supported.

4.3.5 NTP Configuration

NTP is an acronym for **N**etwork **T**ime **P**rotocol, a network protocol for synchronizing the clocks of computer systems. NTP uses UDP (datagrams) as transport layer. The Falcon-RX supports both client and server functions of the protocol.



NTP Configuration

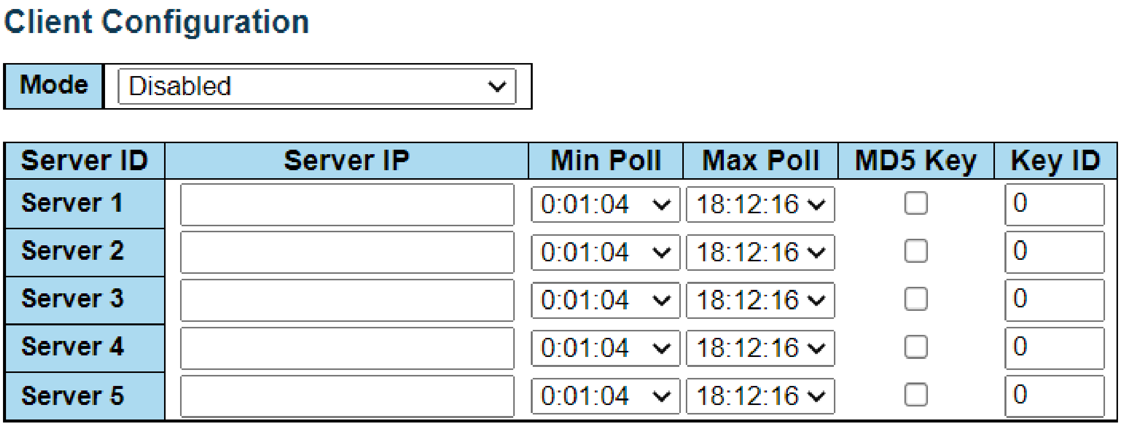
System Time	2021-12-12T11:24:47+00:00 ●

Figure 4-6: System Time Display

4.3.5.1 NTP Client Configuration

The NTP client configuration allows the switch to set the IP address of up to 5 different NTP servers as a time source. Additionally, server polling interval and encryption options can be configured. Maximum and minimum polling values in seconds are between 8-131072(approximately 36.4 hours).

Web GUI: Configuration > Timing > NTP



Client Configuration

Mode	Disabled

Server ID	Server IP	Min Poll	Max Poll	MD5 Key	Key ID
Server 1		0:01:04	18:12:16	☐	0
Server 2		0:01:04	18:12:16	☐	0
Server 3		0:01:04	18:12:16	☐	0
Server 4		0:01:04	18:12:16	☐	0
Server 5		0:01:04	18:12:16	☐	0

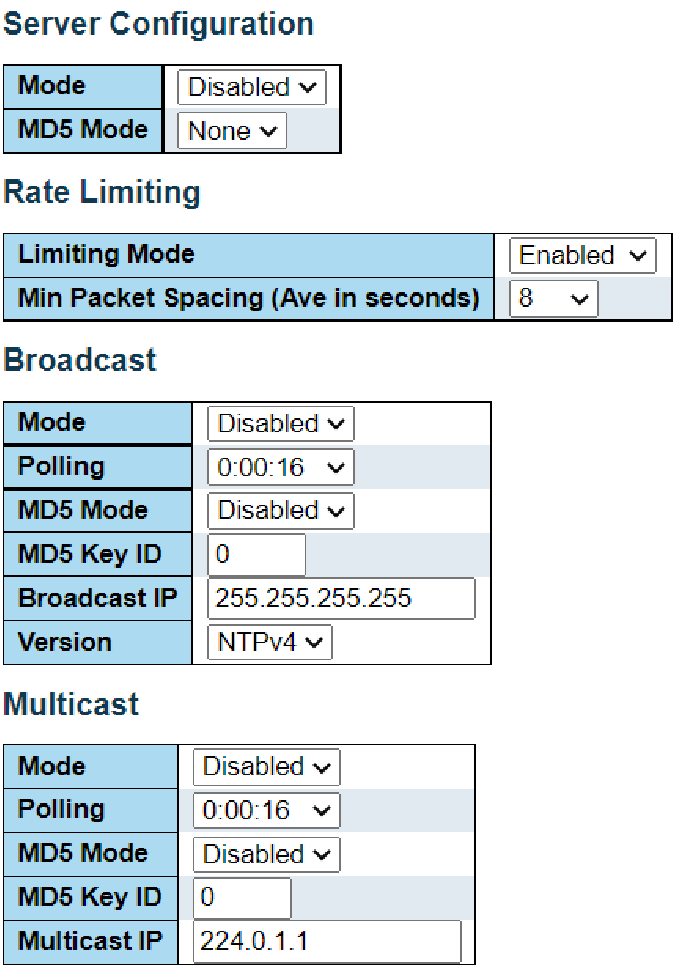
Figure 4-7: NTP Client Configuration

Table 4-5: NTP Client Configuration Parameters

Client Configuration	
Mode	Indicates the NTP Client operation mode. Possible modes are: **Enabled**: Enable NTP mode operation. **Disabled**: Disable NTP mode operation.
Server ID	Up to 5 different servers can be configured
Server IP	Provide the IPv4 or Ipv6 address of a NTP server..
Min Poll	Value in seconds. Available selected options are 2^3, 2^4, 2^5 … 2^{17}
Max Poll	Value in seconds. Available selected options are 2^3, 2^4, 2^5 … 2^{17}
MD5 Key	Enable per server MD5 encryption for NTP session authentication
Key ID	Set per server MD5 encryption key value for NTP session

4.3.5.2 NTP Server Configuration

Falcon-RX NTP server function allows it to propagate the SyncCenter time via NTP to other clients in the network. The server supports three operational modes: Unicast, Broadcast and Multicast. Allowed polling rate and encryption can be set for each mode separately.



Server Configuration

Mode	Disabled
MD5 Mode	None

Rate Limiting

Limiting Mode	Enabled
Min Packet Spacing (Ave in seconds)	8

Broadcast

Mode	Disabled
Polling	0:00:16
MD5 Mode	Disabled
MD5 Key ID	0
Broadcast IP	255.255.255.255
Version	NTPv4

Multicast

Mode	Disabled
Polling	0:00:16
MD5 Mode	Disabled
MD5 Key ID	0
Multicast IP	224.0.1.1

Figure 4-8: NTP Server Configuration

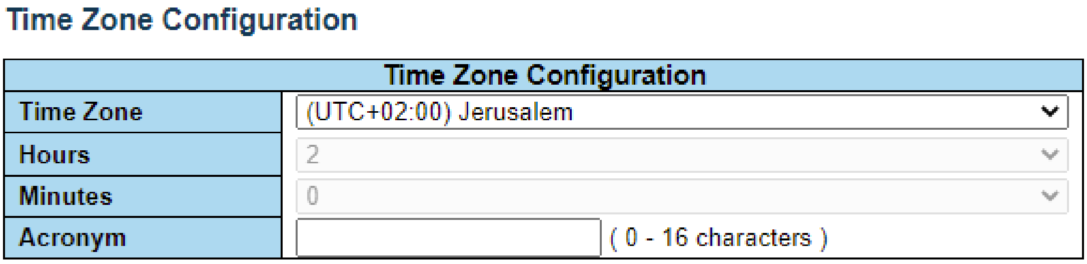
Table 4-6: NTP Server Configuration Parameters

Client Configuration	
Mode	Indicates the NTP Client operation mode. Possible modes are: **Enabled**: Enable NTP mode operation. **Disabled**: Disable NTP mode operation.
Server ID	Up to 5 different servers can be configured
Server IP	Provide the IPv4 or Ipv6 address of a NTP server..
Min Poll	Value in seconds. Available selected options are 2^3, 2^4, 2^5 … 2^{17}
Max Poll	Value in seconds. Available selected options are 2^3, 2^4, 2^5 … 2^{17}
MD5 Key	Enable per server MD5 encryption for NTP session authentication
Key ID	Set per server MD5 encryption key value for NTP session

4.3.6 Time Zone

This section allows us to configure the Time Zone. Time Zone Configuration Daylight Saving Time Configuration. Start Time /End Time/Offset settings.

Web GUI: Configuration > System > Time



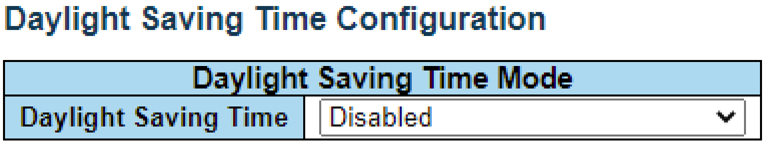
Time Zone Configuration

Time Zone Configuration	
Time Zone	(UTC+02:00) Jerusalem
Hours	2
Minutes	0
Acronym	(0 - 16 characters)

Figure 4-9: Time Zone Configuration

Table 4-7: Time Zone Configuration Parameters

Time Zone Configuration	
Time Zone	Lists various Time Zones worldwide. Select appropriate Time Zone from the drop down and click Save to set.
Hours / Minutes	Local time versus GMT (Greenwich Mean Time).
Acronym	User can set the acronym of the time zone. This is a User configurable acronym to identify the time zone. (Range: Up to 16 characters)



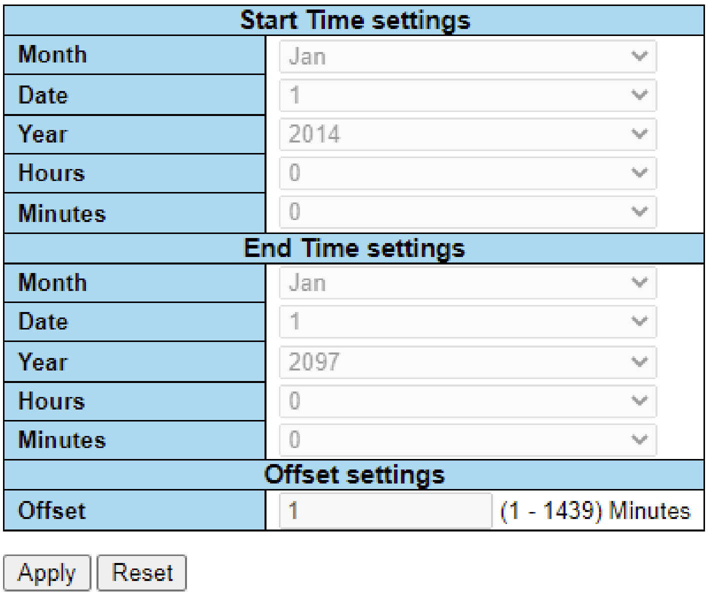
Daylight Saving Time Configuration

Daylight Saving Time Mode	
Daylight Saving Time	Disabled

Figure 4-10: Daylight Saving Time Configuration

Table 4-8: Daylight Saving Time Configuration Parameters

Daylight Saving Time Mode	
This section is used to setup Daylight Saving Time Configuration	
Daylight Saving Time	Clear event occurred indication to set the clock forward or backward according to the configurations set below for a defined Daylight-Saving Time duration. Select '**Disable**' to disable the Daylight-Saving Time configuration. (Default) Select '**Recurring**' and configure the Daylight-Saving Time duration to repeat the configuration every year. Select **'Non-Recurring'** and configure the Daylight-Saving Time duration for single time configuration.



Start Time settings	
Month	Jan
Date	1
Year	2014
Hours	0
Minutes	0
End Time settings	
Month	Jan
Date	1
Year	2097
Hours	0
Minutes	0
Offset settings	
Offset	1 (1 - 1439) Minutes

Figure 4-11: Time Settings displays

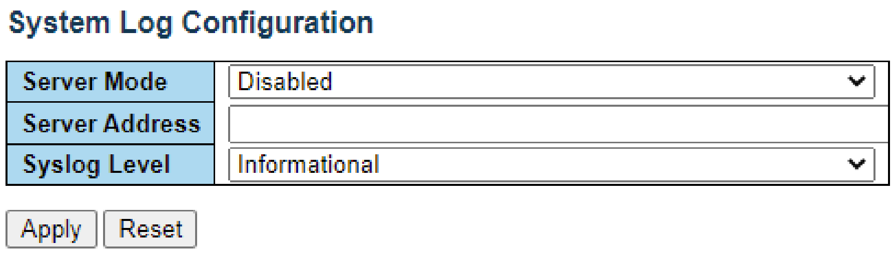
Table 4-9: Time Settings Parameters

Recurring Configurations	
Start time settings	**Week** - Select the starting week number. **Day** - Select the starting day. **Month** - Select the starting month. **Hours** - Select the starting hour. **Minutes** - Select the starting minute.
End time settings	• **Week** - Select the ending week number. • **Day** - Select the ending day. • **Month** - Select the ending month. • **Hours** - Select the ending hour. • **Minutes** - Select the ending minute.
Offset settings	**Offset**: Enter the number of minutes to add during Daylight Saving Time. (Range: 1 to 1440)
Non-Recurring Configurations	
Start time settings	• **Month** - Select the starting month. • **Date** - Select the starting date. • **Year** - Select the starting year. • **Hours** - Select the starting hour. • **Minutes** - Select the starting minute.
End time settings	• **Month** - Select the ending month. • **Date** - Select the ending date. • **Year** - Select the ending year. • **Hours** - Select the ending hour. • **Minutes** - Select the ending minute.
Offset settings	**Offset**: Enter the number of minutes to add during Daylight Saving Time. (Range: 1 to 1439)

4.3.7 System Log Configuration

Configure System Log on this section.

Web GUI: Configuration > System > Log



System Log Configuration

Server Mode	Disabled
Server Address	
Syslog Level	Informational

Figure 4-12: System Log Configuration displays

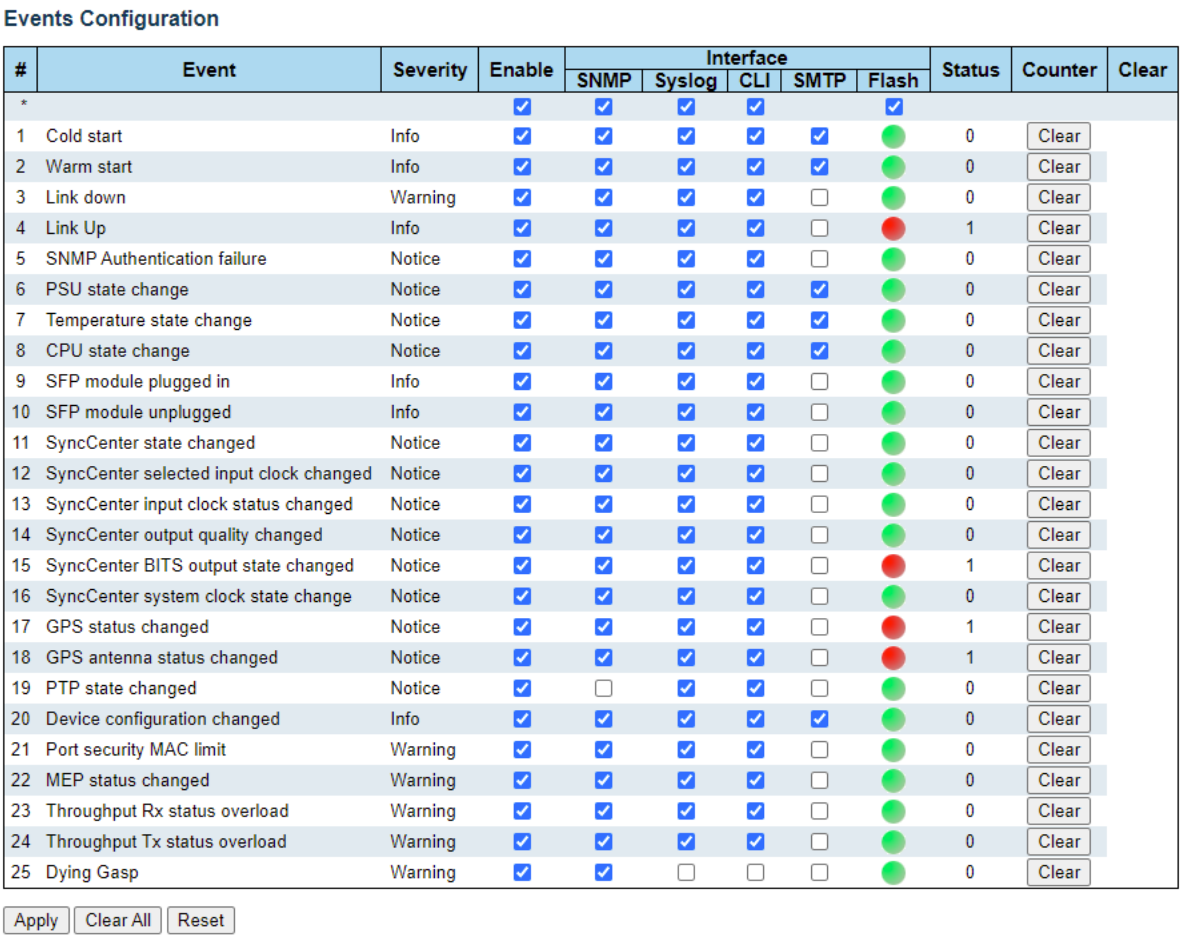
Table 4-10: System Log Configuration Parameters

System Log Configuration	
Server Mode	Indicates the server mode operation. When the mode operation is enabled, the syslog message will send out to syslog server. The syslog protocol is based on UDP communication and received on UDP port 514, and the syslog server will not send acknowledgments back sender since UDP is a connectionless protocol and it does not provide acknowledgments. The syslog packet will always send out even if the syslog server does not exist. Possible modes are: **Enabled**: Enable server mode operation. **Disabled:** Disable server mode operation.
Server Address	Indicates the IPv4 host address of syslog server. If the switch provides DNS feature, it also can be a domain name.
Syslog Level	Indicates what kind of message will send to syslog server. Possible modes are: • **Error**: Send the specific messages which severity code is less or equal than Error (3). • **Warning**: Send the specific messages which severity code is less or equal than Warning (4). • **Notice**: Send the specific messages which severity code is less or equal than Notice (5). • **Informational**: Send the specific messages which severity code is less or equal than Informational (6).

4.3.8 Events

This page allows the user to change (enable/disable) and their corresponding interfaces to the current events configuration.

Web GUI: Configuration > System > Events



Events Configuration

#	Event	Severity	Enable	Interface					Status	Counter	Clear
				SNMP	Syslog	CLI	SMTP	Flash			
*			☑	☑	☑	☑		☑			
1	Cold start	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
2	Warm start	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
3	Link down	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
4	Link Up	Info	☑	☑	☑	☑	☐	🔴	1	Clear	
5	SNMP Authentication failure	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
6	PSU state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
7	Temperature state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
8	CPU state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
9	SFP module plugged in	Info	☑	☑	☑	☑	☐	🟢	0	Clear	
10	SFP module unplugged	Info	☑	☑	☑	☑	☐	🟢	0	Clear	
11	SyncCenter state changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
12	SyncCenter selected input clock changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
13	SyncCenter input clock status changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
14	SyncCenter output quality changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
15	SyncCenter BITS output state changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
16	SyncCenter system clock state change	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
17	GPS status changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
18	GPS antenna status changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
19	PTP state changed	Notice	☑	☐	☑	☑	☐	🟢	0	Clear	
20	Device configuration changed	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
21	Port security MAC limit	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
22	MEP status changed	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
23	Throughput Rx status overload	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
24	Throughput Tx status overload	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
25	Dying Gasp	Warning	☑	☑	☐	☐	☐	🟢	0	Clear	

Figure 4-13: Events Configuration

Table 4-11: Events Configuration Parameters

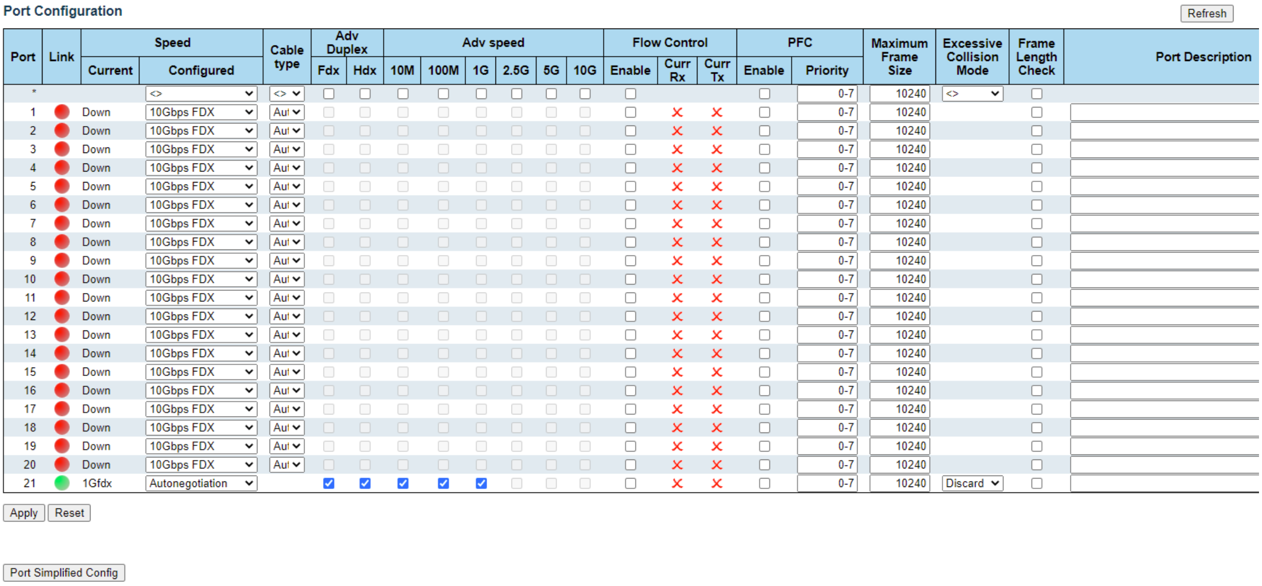
#	Event Index
Event	Unique Name of the Event.
Severity	Indicates the severity of the event (Notice, Info, Warning).
Enable	Disable/Enable Event (Change will take effect on all checked interfaces: SNMP, syslog, cli).
Interface	Distribute event on a given interface: SNMP, Syslog, CLI, Flash.
Status	Indication whether an event occurred or not.
Counter	The number of occurrences of the event since last Clear operation.
Clear	Clear event occurred indication.

4.4 Ports Configuration and Monitoring

This section shows current port configurations. Ports may be configured here.

Ports are also monitored here.

Web GUI: Configuration > System > Ports



Port Configuration

Port	Link	Speed		Cable type	Adv Duplex		Adv speed						Flow Control			PFC		Maximum Frame Size	Excessive Collision Mode	Frame Length Check	Port Description
		Current	Configured		Fdx	Hdx	10M	100M	1G	2.5G	5G	10G	Enable	Curr Rx	Curr Tx	Enable	Priority				
*			<>	<>	☐	☐	☐	☐	☐	☐	☐	☐	☐			☐	0-7	10240	<>	☐	
1	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
2	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
3	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
4	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
5	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
6	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
7	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
8	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
9	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
10	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
11	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
12	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
13	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
14	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
15	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
16	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
17	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
18	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
19	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
20	🔴	Down	10Gbps FDX	Aut	☐	☐	☐	☐	☐	☐	☐	☐	☐	✗	✗	☐	0-7	10240		☐	
21	🟢	1Gfdx	Autonegotiation		☑	☑	☑	☑	☑	☐	☐	☐	☐	✗	✗	☐	0-7	10240	Discard	☐	

Figure 4-14: Port Configuration

Table 4-12: Port Configuration Parameters

Port	This is the logical port number for this row.
Link	The current link state is displayed graphically. • "**Green**" indicates that the link is up. • "**Red**" indicates that the link is down. • "**Grey**" Indicates that the port is inactive
Current Speed	Provides the current link speed of the port.
Configured Speed	Selects available link speed for the given switch port. Only speeds supported by the specific port are shown. Possible speeds are: • `Disabled` - Disables the switch port operation. • `Auto` - Port auto negotiating speed and duplex with the link partner and selects the highest speed that is compatible with the link partner. • `10Mbps HDX` - Forces Cu port in 10Mbps half-duplex mode. • `10Mbps FDX` - Forces Cu port in 10Mbps full duplex mode. • `100Mbps HDX` - Forces Cu port in 100Mbps half-duplex mode. • `100Mbps FDX` - Forces Cu port in 100Mbps full duplex mode. • `1Gbps FDX` - Forces port in 1Gbps full duplex mode. • `2.5Gbps FDX` - Forces port in 2.5Gbps full duplex mode. • `10Gbps FDX` - Forces port in 10Gbps full duplex mode. • `25Gbps FDX` - Forces port in 25Gbps full duplex mode.

Cable Type	**AutoSFP** interface in "auto" mode. Automatic SerDes tuning for optical and DAC-3m cables. **DAC-1mSFP** interface in "DAC-1m" mode. Manual SerDes tuning specifically for DAC-1m cables. **DAC-2mSFP** interface in "DAC-2m" mode. Manual SerDes tuning specifically for DAC-2m cables. **DAC-3mSFP** interface in "DAC-3m" mode. Manual SerDes tuning specifically for DAC-3m cables. **DAC-5mSFP** interface in "DAC-5m" mode. Manual SerDes tuning specifically for DAC-5m cables.
Advertise Duplex	When duplex is set as auto i.e., auto negotiation, the port will only advertise the specified duplex as either **FDX** or **HDX** to the link partner. By default, port will advertise all the supported duplexes if the Duplex is Auto.
Advertise Speed	When speed is set as auto, i.e., auto negotiation, the port will only advertise the specified speeds (**10M, 100M, 1G, 2.5G, 10G, 25G**) to the link partner. By default, port will advertise all the supported speeds if speed is set as Auto.
Flow Control	When "**Auto Speed"** is selected for a port, this section indicates the flow control capability that is advertised to the link partner. When a fixed speed setting is selected, traffic that is what is selected. **Current Rx**: This column indicates whether pause frames on the port are obeyed. **Current Tx:** This column indicates whether pause frames on the port are transmitted. The Rx and Tx settings are determined by the result of the last Auto-Negotiation. **Configured**: Check the configured column to use flow control; this setting is related to the setting for **Configured Link Speed.** NOTICE: The 100FX standard does not support Auto Negotiation, so when in 100FX mode the flow control capabilities will always be shown as "disabled".
PFC	When PFC (802.1Qbb Priority Flow Control) is enabled on a port then flow control on a priority level is enabled. Through the **Priority** field, range (one or more) of priorities can be configured, e.g., '0-3,7' which equals '0,1,2,3,7'. PFC is not supported through auto negotiation. PFC and Flow control cannot both be enabled on the same port.
Maximum Frame Size	Enter the maximum frame size allowed for the switch port, including FCS. The range is 1518-9600 bytes.
Excessive Collision Mode	Configure port transmit collision behavior: **Discard**: Discards frame after 16 collisions (default). **Restart**: Restarts backoff algorithm after 16 collisions.

Description	Indicates the description of the port. Maximum length of the Port description String is 64. Port description can be null. When port description is not null, it cannot contain space.
Frame Length Check	Configures if frames with incorrect frame length in the EtherType/Length field shall be dropped. An Ethernet frame contains a field EtherType which can be used to indicate the frame payload size (in bytes) for values of 1535 and below. If the EtherType/Length field is above 1535, it indicates that the field is used as an EtherType (indicating which protocol is encapsulated in the payload of the frame). If "frame length check" is enabled, frames with payload size less than 1536 bytes are dropped, if the EtherType/Length field doesn't match the actual payload length. If "frame length check" is disabled, frames are not dropped due to frame length mismatch. Note: No drop counters count frames dropped due to frame length mismatch
RS-FEC / FEC Mode	Toggle Enable/Disable Reed-Solomon Forward Error Correction
Description	User defined free text (up to 63 characters)
Buttons	**Apply** - **Reset** - **Refresh** - **Port detailed** - **Port Simplified Config** -

4.4.1 Port State

This section provides an overview of the current switch port states (Each R Class series device has its own Port State display).

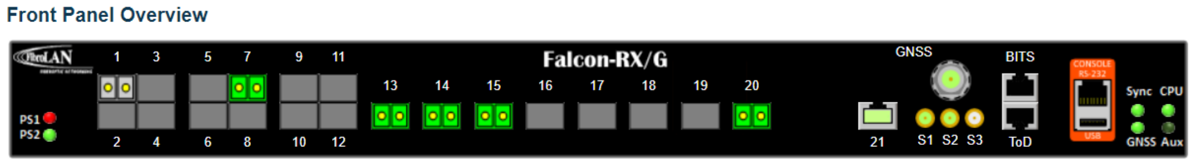
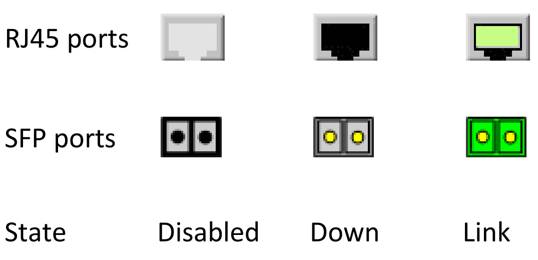

Front Panel Overview
Falcon-RX/G
1
3
5
7
9
11
2
4
6
8
10
12
13
14
15
16
17
18
19
20
PS1
PS2
GNSS
BITS
21
S1
S2
S3
ToD
CONSOLE RS-232
USB
Sync
CPU
GNSS
Aux

Figure 4-15: Port State

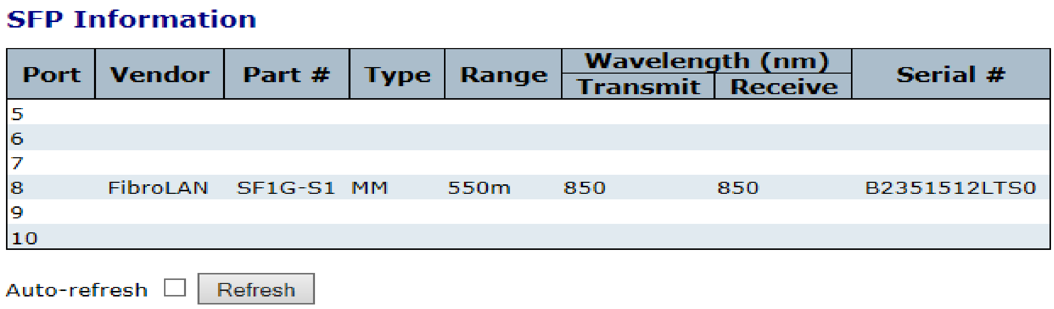
The port states are illustrated as follows:


RJ45 ports
SFP ports
State
Disabled
Down
Link

4.4.2 SFP Information

This section shows SFP Information.

Web GUI: Monitor > Ports > SFP Info



SFP Information

Port	Vendor	Part #	Type	Range	Wavelength (nm)		Serial #
					Transmit	Receive	
5							
6							
7							
8	FibroLAN	SF1G-S1	MM	550m	850	850	B2351512LTS0
9							
10							

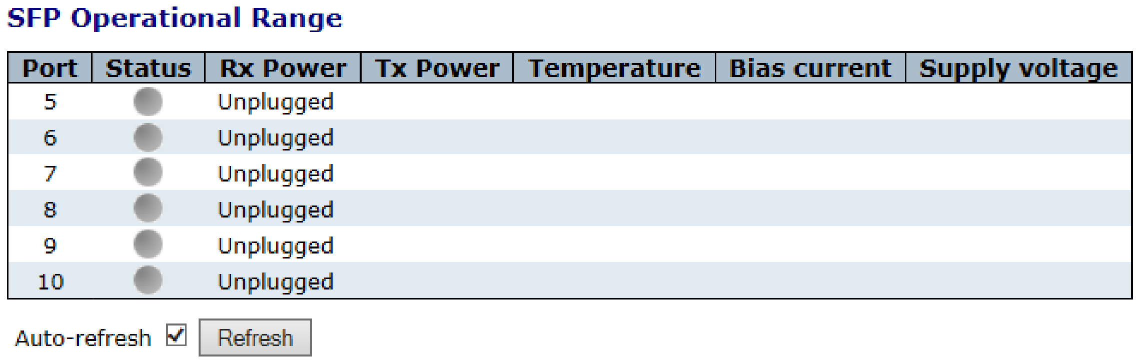
Figure 4-16: SFP information

Table 4-13: SFP Information Parameters

Vendor #	Indicates vendor's name.
Part #	Indicates part number.
Type	Indicates module Type.
Range	Indicates the SFP's nominal optical range.
Wavelength	Indicates the SFP wavelength (separately for transmit and receive).
Serial	Indicates the SFP's serial number.

4.4.3 SFP Operational Range

This section shows SFP operational range.

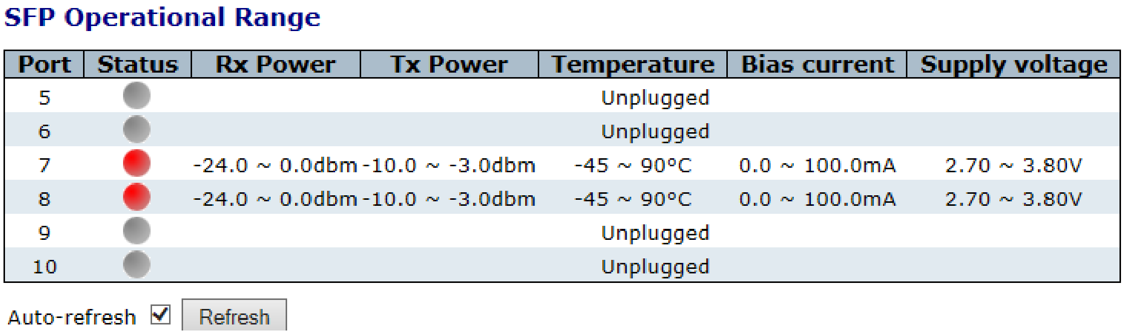


SFP Operational Range

Port	Status	Rx Power	Tx Power	Temperature	Bias current	Supply voltage
5	●	Unplugged				
6	●	Unplugged				
7	●	Unplugged				
8	●	Unplugged				
9	●	Unplugged				
10	●	Unplugged				

If you insert SFPs into port s 7 and 8 you get the following display which show the operational range. The red indicators under status imply a low Rx error since there is no reception

Web GUI: Monitor > Ports > SFP Op Range



SFP Operational Range

Port	Status	Rx Power	Tx Power	Temperature	Bias current	Supply voltage
5	●			Unplugged		
6	●			Unplugged		
7	🔴	-24.0 ~ 0.0dbm	-10.0 ~ -3.0dbm	-45 ~ 90°C	0.0 ~ 100.0mA	2.70 ~ 3.80V
8	🔴	-24.0 ~ 0.0dbm	-10.0 ~ -3.0dbm	-45 ~ 90°C	0.0 ~ 100.0mA	2.70 ~ 3.80V
9	●			Unplugged		
10	●			Unplugged		

Figure 4-17: Operational Range

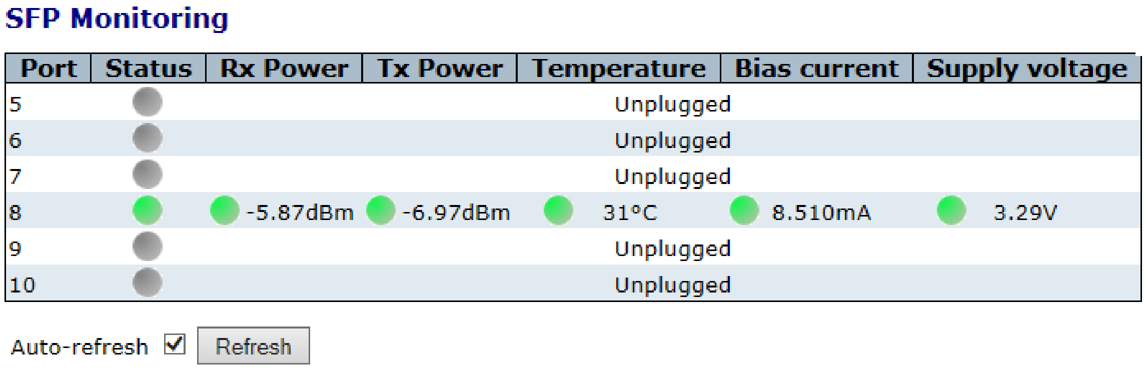
Table 4-14: SFP Operational Range Parameters

Port	The physical port in which the SFP is installed
Status	The status of the SFP port: **grey**=unplugged **Red**=when SFP is plugged and operational; **Green** when the SFP is connected to another similar SFP (installed in another device)
RX Power	Module's allowed receive optical power range [dBm].
TX Power	Module's allowed transmit optical power range [dBm]
Temperature	Module's allowed internal temperature range.
Bias Current	Module's allowed transmitter bias current range [mA].
Supply voltage	Module's allowed supply voltage range [V].

4.4.4 SFP Monitoring

This section shows SFP digital diagnostic information

Web GUI: Monitor > Ports > SFP Monitor



SFP Monitoring

Port	Status	Rx Power	Tx Power	Temperature	Bias current	Supply voltage
5	●			Unplugged		
6	●			Unplugged		
7	●			Unplugged		
8	🟢	🟢 -5.87dBm	🟢 -6.97dBm	🟢 31°C	🟢 8.510mA	🟢 3.29V
9	●			Unplugged		
10	●			Unplugged		

Figure 4-18: SFP Monitoring

Table 4-15: SFP Monitoring Parameters

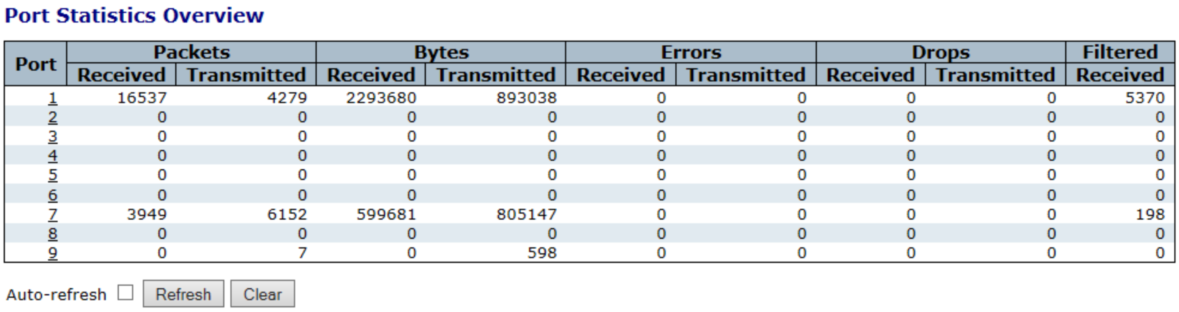
RX Power	Modules receive optical power [dBm].
TX Power	Modules transmit optical power [dBm].

Temperature	Module's internal temperature.
Bias Current	Module's transmitter bias current [mA].
Supply voltage	Module's supply voltage [V].

Note: Green indicator implies that the parameters are within the allowed range

4.4.5 Traffic Overview

Web GUI: Monitor > Ports > Traffic Overview



Port Statistics Overview

Port	Packets		Bytes		Errors		Drops		Filtered
	Received	Transmitted	Received	Transmitted	Received	Transmitted	Received	Transmitted	Received
1	16537	4279	2293680	893038	0	0	0	0	5370
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	3949	6152	599681	805147	0	0	0	0	198
8	0	0	0	0	0	0	0	0	0
9	0	7	0	598	0	0	0	0	0

Figure 4-19: Port Statistics

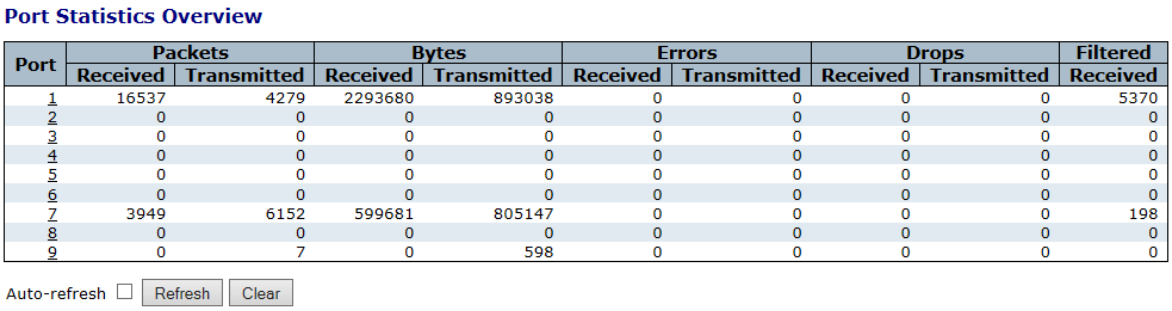
Table 4-16: Port Statistics Overview Parameters

Port #	The logical port for the settings contained in the same row.
Packets#	The number of received and transmitted packets per port.
Bytes	The number of received and transmitted bytes per port.
Errors	The number of frames received in error and the number of incomplete transmissions per port
Drops	The number of frames discarded due to ingress or egress congestion
Filtered	The number of frames discarded due to ingress or egress congestion

Note: By clicking on any underlined port, you get its detailed Statistics info. Refer to next page.

4.4.6 QoS Statistics

Web GUI: Monitor > Ports > Traffic Overview



Port Statistics Overview

Port	Packets		Bytes		Errors		Drops		Filtered
	Received	Transmitted	Received	Transmitted	Received	Transmitted	Received	Transmitted	Received
1	16537	4279	2293680	893038	0	0	0	0	5370
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	3949	6152	599681	805147	0	0	0	0	198
8	0	0	0	0	0	0	0	0	0
9	0	7	0	598	0	0	0	0	0

Figure 4-20: Queuing Counters Display

Table 4-17: Queuing Counters Parameters

Port	The logical port for the settings contained in the same row.
Qn	There are 8 QoS queues per port. Q0 is the lowest priority queue.
Rx/Tx	The number of received and transmitted packets per queue.

By clicking selected port number, you get its detailed port statistics page. For details, refer to Detailed Port Statistics.

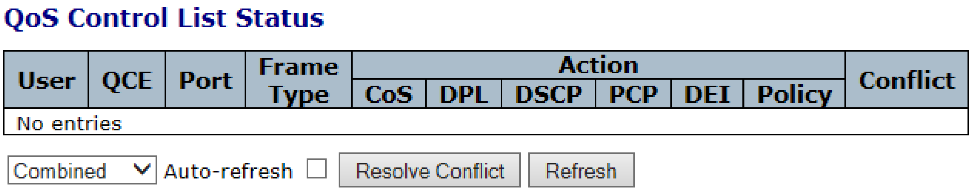
4.4.7 QoS Control List Status

This section shows the QCL status by different QCL users. Each row describes the **QCE** that is defined. It is a conflict if a specific QCE is not applied to the hardware due to hardware limitations. The maximum number of QCEs is **256** on each switch.

QCL is an acronym for **Q**oS **C**ontrol **L**ist. It is the list table of QCEs, containing QoS control entries that classify to a specific QoS class on specific traffic objects. Each accessible traffic object contains an identifier to its QCL. The privileges determine specific traffic object to specific QoS class.

QCE is an acronym for **Q**oS **C**ontrol **E**ntry. It describes QoS class associated with a particular QCE ID. There are six QCE frame types: Ethernet Type, VLAN, UDP/TCP Port, DSCP, TOS, and Tag Priority. Frames can be classified by one of 4 different QoS classes: "Low", "Normal", "Medium", and "High" for individual application.

Web GUI: Monitor > Ports > QCL Status



QoS Control List Status

User	QCE	Port	Frame Type	Action						Conflict
				CoS	DPL	DSCP	PCP	DEI	Policy	
No entries										

Figure 4-21: QoS Control List Status

Table 4-18: QoS Control List Status Parameters

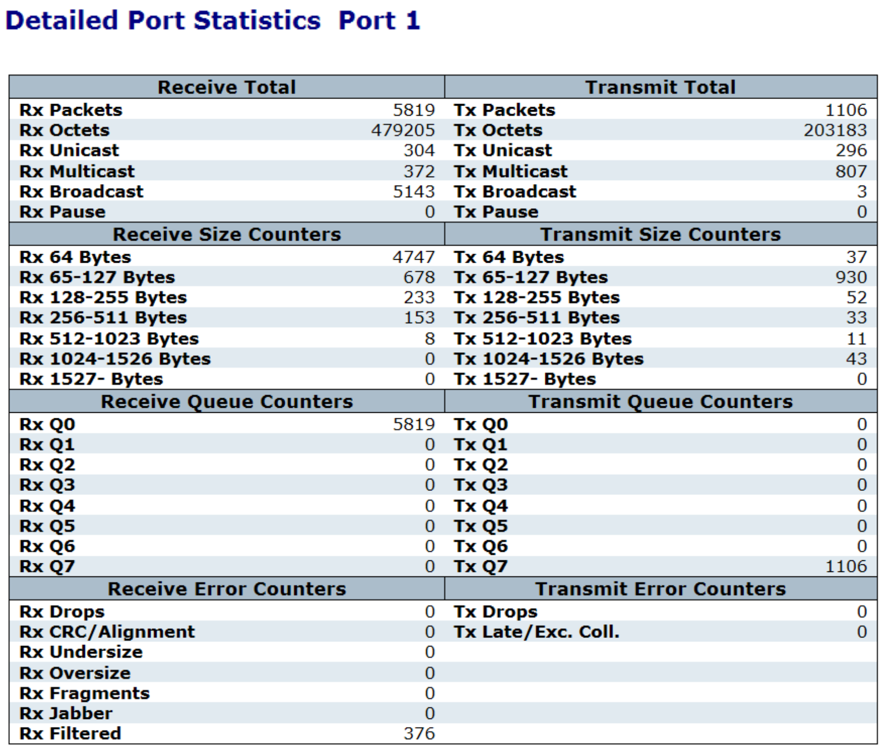
User	Indicates the QCL user.
QCE	Indicates the index of QCE.
Frame type	Indicates the type of frame to look for incoming frames. Possible frame types are: • **Any**: Match any frame type. • **Ethernet**: Match Ether type frames. • **LLC:** Match (LLC) frames • **SNAP**: Match (SNAP) frames • **IPv4**: Match IPV4 frames. • **IPv6:** Match IPV6 frames.
Port	Indicates the list of ports configured with the QCE.
Action	Indicates the classification action taken on ingress frame if Parameters configured are matched with the frame's content. • There are three action fields: Class, DPL and DSCP. • CoS: Classify Class of Service • DPL: Classify Drop Precedence Level • DSCP: Classify DSCP value • PCP: Classify PCP value • DEI: Classify DEI value. • Policy: Classify ACL Policy number. • Ingress Map: Classify Ingress Map ID.
Conflict	Displays Conflict status of QCL entries. As H/W resources are shared by multiple applications. It may happen that the resources required to add a QCE may not be available, in that case it shows conflict status as 'Yes', otherwise it is always 'No'. Please note that conflict can be resolved by releasing the H/W resources required to add QCL entry on pressing 'Resolve Conflict' button.
Buttons	**Combined**: Select the QCL status from this drop-down list **Resolve Conflict:** Click to release the resources required to add QCL entry in case the conflict status for any QCL entry is 'yes'.

4.4.8 Detailed Port Statistics

This section provides detailed traffic statistics for a specific switch port. Use the port select box to select which switch port details to display.

The displayed counters are the totals for receive and transmit, the size counters for receive and transmit, and the error counters for receive and transmit.

Web GUI: Monitor > Ports > QCL Status



Detailed Port Statistics Port 1

Receive Total		Transmit Total	
Rx Packets	5819	Tx Packets	1106
Rx Octets	479205	Tx Octets	203183
Rx Unicast	304	Tx Unicast	296
Rx Multicast	372	Tx Multicast	807
Rx Broadcast	5143	Tx Broadcast	3
Rx Pause	0	Tx Pause	0
Receive Size Counters		**Transmit Size Counters**	
Rx 64 Bytes	4747	Tx 64 Bytes	37
Rx 65-127 Bytes	678	Tx 65-127 Bytes	930
Rx 128-255 Bytes	233	Tx 128-255 Bytes	52
Rx 256-511 Bytes	153	Tx 256-511 Bytes	33
Rx 512-1023 Bytes	8	Tx 512-1023 Bytes	11
Rx 1024-1526 Bytes	0	Tx 1024-1526 Bytes	43
Rx 1527- Bytes	0	Tx 1527- Bytes	0
Receive Queue Counters		**Transmit Queue Counters**	
Rx Q0	5819	Tx Q0	0
Rx Q1	0	Tx Q1	0
Rx Q2	0	Tx Q2	0
Rx Q3	0	Tx Q3	0
Rx Q4	0	Tx Q4	0
Rx Q5	0	Tx Q5	0
Rx Q6	0	Tx Q6	0
Rx Q7	0	Tx Q7	1106
Receive Error Counters		**Transmit Error Counters**	
Rx Drops	0	Tx Drops	0
Rx CRC/Alignment	0	Tx Late/Exc. Coll.	0
Rx Undersize	0		
Rx Oversize	0		
Rx Fragments	0		
Rx Jabber	0		
Rx Filtered	376		

Figure 4-22: Detailed Port Statistics

Table 4-19: Detailed Port Statistics Parameters

Receive Total and Transmit Total	
Rx and Tx Packets	The number of received and transmitted (good and bad) packets.
Rx and Tx Octets	The number of received and transmitted (good and bad) bytes. Includes FCS but excludes framing bits.
Rx and Tx Unicast	The number of received and transmitted (good and bad) unicast packets
Rx and Tx Multicast	The number of received and transmitted (good and bad) multicast packets
Rx and Tx Broadcast	The number of received and transmitted (good and bad) broadcast packets.
Rx and Tx Pause	A count of the MAC Control frames received or transmitted on this port that have an opcode indicating a PAUSE operation
Receive and Transmit Size Counters	The number of received and transmitted (good and bad) packets split into categories based on their respective frame sizes.
Receive and Transmit Queue Counters	The number of received and transmitted packets per input and output queue.
Receive and Transmit Size Counters	
The number of received and transmitted (good and bad) packets split into categories based on their respective frame sizes.	

Receive and Transmit Queue Counters	
The number of received and transmitted packets per input and output queue.	
Receive Error Counters	
Rx Drops	The number of frames dropped due to lack of receives buffers or egress congestion.
Rx CRC/Alignment	The number of frames received with CRC or alignment errors.
Rx Undersize	The number of short[1] frame received with valid CRC. [1] Short frames are frames that are smaller than 64 bytes.
Rx Oversize	The number of long[2] frames received with valid CRC. [2] Long frames are frames that are longer than the configured maximum frame length for this port.
Rx Fragments	The number of short[1] frame received with invalid CRC.
Rx Jabber	The number of long[2] frames received with invalid CRC.
Rx Filtered	The number of received frames filtered by the forwarding process.
[1] Short frames are frames that are smaller than 64 bytes. [2] Long frames are frames that are longer than the configured maximum frame length for this port.	
Transmit Error Counters	
Tx Drops	The number of frames dropped due to output buffer congestion.
Tx Late/Exc. Coll	The number of frames dropped due to excessive or late collisions.

4.4.9 Green Ethernet

This page allows the user to configure the port power savings features.

EEE is an abbreviation for Energy Efficient Ethernet defined in IEEE 802.3az. EEE is a power saving option that reduces the power usage when there is low or no traffic utilization.

EEE works by powering down circuits when there is no traffic. When a port gets data to be transmitted all circuits are powered up. The time it takes to power up the circuits is named wakeup time. The default wakeup time is 17 us for 1Gbit links and 30 us for other link speeds. EEE devices must agree upon the value of the wakeup time in order to make sure that both the receiving and transmitting device has all circuits powered up when traffic is transmitted. The devices can exchange wakeup time information using the LLDP protocol.

EEE works for ports in auto-negotiation mode, where the port is negotiated to either 1G or 100 Mbit full duplex mode.

For ports that are not EEE-capable the corresponding EEE checkboxes are grayed out and thus impossible to enable EEE for.

The EEE port settings relate to the currently selected stack unit, as reflected by the page header.

When a port is powered down for saving power, outgoing traffic is stored in a buffer until the port is powered up again. Because there are some overheads in turning the port down and up, more power can be saved if the traffic can be buffered up until a large burst of traffic can be transmitted. Buffering traffic will give some latency in the traffic.

Note: For Port Power Savings refer to "Port Power Savings Configuration"

For Port Power Savings Status, refer to "Port Power Saving Status".

4.4.10 Thermal Protection

For Thermal Protection Configuration, refer to "Thermal Protection Configuration".

For Thermal Protection Status, refer to "Thermal Protection Status".

4.5 MAC Learning Table

This section details the MAC Learn Table functionality.

Switching of frames is based upon the DMAC address contained in the frame. The switch builds up a table that maps MAC addresses to switch ports for knowing which ports the frames should be delivered to (Based upon the DMAC address in the frame). This table contains both static and dynamic entries. The static entries are configured by the network administrator if the administrator wants to do a fixed mapping between the DMAC address and switch ports.

The frames also contain a MAC address (SMAC address), which shows the MAC address of the equipment sending the frame. The SMAC address is used by the switch to automatically update the MAC table with these dynamic MAC addresses. Dynamic entries are removed from the MAC table if no frame with the corresponding SMAC address has been seen after a configurable age time.

The R Class series MAC address space is up to 8K addresses.

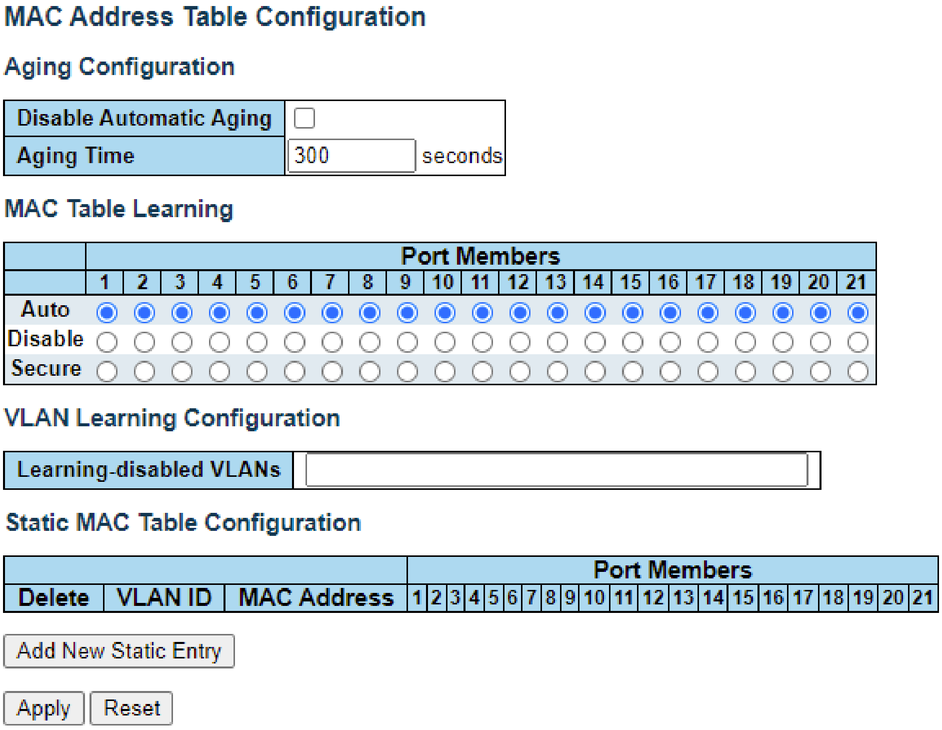
4.5.1 Configuring the MAC Address Table

The MAC Address Table is configured on this section. Set timeouts for entries in the dynamic MAC Table and configure the static MAC table

By default, the R Class series is configured for automatic learning on all ports. The table is sorted first by VLAN ID, then by MAC address.

Timeouts are set for entries in the dynamic MAC address and Configuration is performed in the static MAC table.

Web GUI: Configuration > MAC Table



MAC Address Table Configuration

Aging Configuration

Disable Automatic Aging	☐
Aging Time	300 seconds

MAC Table Learning

	Port Members																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Auto	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Disable	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Secure	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

VLAN Learning Configuration

Learning-disabled VLANs	

Static MAC Table Configuration

			Port Members																				
Delete	VLAN ID	MAC Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Figure 4-23: MAC Address Table Configuration displays

Table 4-20: MAC Address Table Configuration Parameters

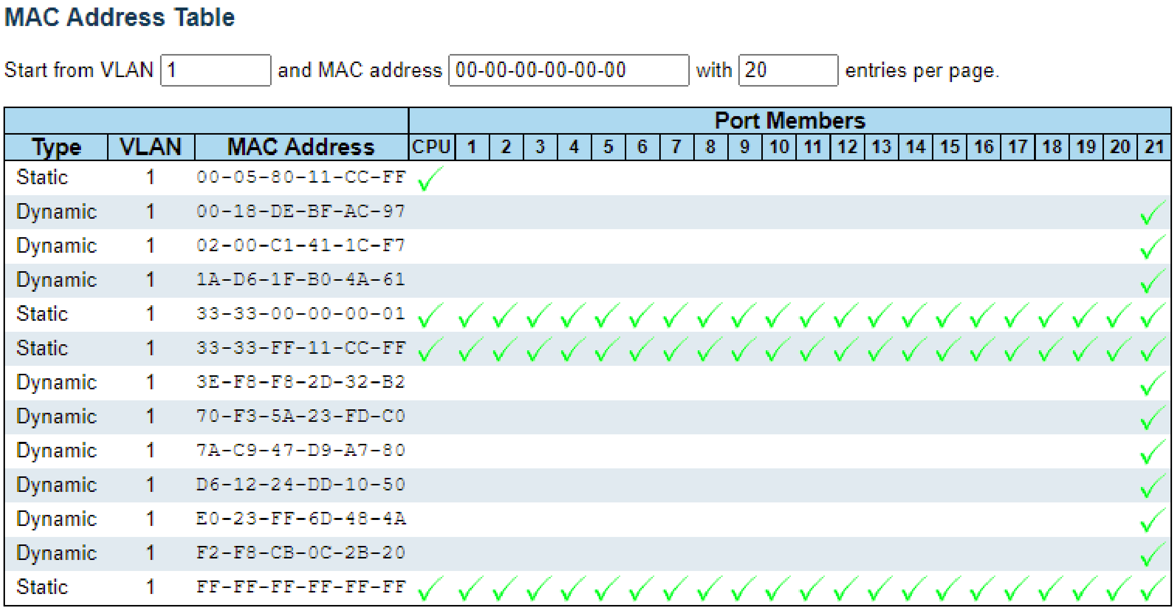
Aging Configuration	
Aging Configuration	By default, dynamic entries are removed from the MAC after 300 seconds. This removal is also called aging. Configure aging time by entering a value here in seconds; for example, **Age Time**: ☐ seconds**.** The allowed range is 10 to 10000000 seconds. Check this box to disable the automatic aging of dynamic entries. **Disable Automatic Aging**.
MAC Table Learning	
MAC Table Learning	If the learning mode for a given port is grayed out, another module is in control of the mode, so that it cannot be changed by the user. An example of such a module is the MAC-Based Authentication under 802.1X. Each port is capable of learning based upon the following settings: **Auto**: Learning is done automatically as soon as a frame with an unknown SMAC is received. **Disable**: No learning is done. **Secure**: Only static MAC entries are learned; all other frames are dropped. ***Note:*** *Make sure that the link used for managing the switch is added to the Static Mac Table before changing to secure learning mode, otherwise the management link is lost and can only be restored by using another non-secure port or by connecting to the switch via the serial interface.*
VLAN Learning Configuration	
Learning-disabled VLANs	This field shows the Learning-disabled VLANs. When a NEW MAC arrives to a learning-disabled VLAN, the MAC won't be learnt. By the default, the field is empty. More VLANs may be created by using a list syntax where the individual elements are separated by commas. Ranges are specified with a dash separating the lower and upper bound. The following example will create VLANs 1, 10, 11, 12, 13, 200, and 300: 1,10-13,200,300. Spaces are allowed in between the delimiters.

Static MAC Table Configuration	
Static MAC Table Configuration	The static entries in the MAC table are shown in this table. The static MAC table can contain up to a maximum 64 entries. The MAC table is sorted first by VLAN ID and then by MAC address. **Delete**: Check to delete the entry. It will be deleted during the next save. **VLAN ID**: The VLAN ID for the entry. **MAC Address**: The MAC address for the entry. **Port Members**: Checkmarks indicate which ports are members of the entry. Check or uncheck as needed to modify the entry. **Add a new static entry**: Click to **Add New Static Entry** to add a new entry to the static MAC table. Specify the VLAN ID, MAC address, and port members for the new entry. Click **Save**.

4.5.2 Monitoring the MAC Address Table

Entries in the MAC Table are shown in the below figure. The MAC Table contains up to 32768 entries, and is sorted first by VLAN ID, then by MAC address.

Web GUI: Monitor > MAC Table



MAC Address Table

Start from VLAN 1 and MAC address 00-00-00-00-00-00 with 20 entries per page.

			Port Members																					
Type	VLAN	MAC Address	CPU	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Static	1	00-05-80-11-CC-FF	✓																					
Dynamic	1	00-18-DE-BF-AC-97																						✓
Dynamic	1	02-00-C1-41-1C-F7																						✓
Dynamic	1	1A-D6-1F-B0-4A-61																						✓
Static	1	33-33-00-00-00-01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Static	1	33-33-FF-11-CC-FF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dynamic	1	3E-F8-F8-2D-32-B2																						✓
Dynamic	1	70-F3-5A-23-FD-C0																						✓
Dynamic	1	7A-C9-47-D9-A7-80																						✓
Dynamic	1	D6-12-24-DD-10-50																						✓
Dynamic	1	E0-23-FF-6D-48-4A																						✓
Dynamic	1	F2-F8-CB-0C-2B-20																						✓
Static	1	FF-FF-FF-FF-FF-FF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 4-24: Monitoring MAC Address Table

4.5.3 Navigating the MAC Table

Each page shows up to 999 entries from the MAC table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the MAC Table. The first displayed will be the one with the lowest VLAN ID and the lowest MAC address found in the MAC Table.

The **Start from MAC address** and **VLAN** input fields allow the user to select the starting point in the MAC Table.

Clicking the **Refresh** button will update the displayed table starting from that or the closest next MAC Table match.

In addition the two input fields will, upon a **Refresh** button click, the Start from VLAN and MAC address fields assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

The **[>>]** button will use the last entry of the currently displayed VLAN/MAC address pairs as a basis for the next lookup.

When the end is reached the text "no more entries" is shown in the displayed table. Use the **[|<<]** button to start over.

Table 4-21: MAC Address Table Configuration Parameters

MAC Table Columns	
Type	Indicates whether the entry is a static or dynamic entry.
VLAN	The VLAN ID of the entry.
MAC Address	The MAC address of the entry.
Port Members	The ports that are members of the entry.

4.6 VLANs and Provider Bridges

Virtual LAN, commonly known as VLAN, is a group of hosts with a common set of requirements that communicate as if they were attached to the same LAN, regardless of their physical location. A VLAN has the same attributes as a physical LAN, but allows for end stations to be grouped together even if they are not located on the same LAN segment. Network reconfiguration can be done through software instead of physically relocating devices.

A VLAN can be thought of as a broadcast domain that exists within a defined set of switches. Ports on a switch can be grouped into VLANs in order to limit traffic flooding since it is limited to ports belonging to that VLAN and its ports. Any switch port can belong to a VLAN. Frames are forwarded and flooded only to ports in the same VLAN. Each VLAN is a logical network, and packets destined for stations that do not belong to the same VLAN must be forwarded through a router.

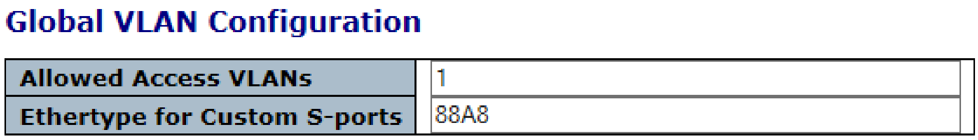
VLANs are essentially Layer 2 constructs, whereas IP subnets are Layer 3 constructs. In a LAN employing VLANs, a one-to-one relationship often exists between VLANs and IP subnets, although it is possible to have multiple subnets on one VLAN or have one subnet spread across multiple VLANs. Virtual LANs and IP subnets provide independent Layer 2 and Layer 3 constructs that map to one another, and this correspondence is useful during the network design process.

In Metro-Ethernet applications VLANs are being used to enable service separation: each VLAN relates to a different service while disallowing different services/users to communicate with each other. The usage of VLANs to enable Metro Ethernet services is further enhanced by the Provider Bridges approach which uses QinQ capabilities as described in Section Provider Bridges (QinQ).

4.6.1 VLAN Configuration

This section allows for controlling VLAN configuration on the switch. The section includes Global VLAN Configuration and –Port VLAN configurations.

Web GUI: Configuration > VLANs > Configuration



Global VLAN Configuration

Allowed Access VLANs	1
Ethertype for Custom S-ports	88A8

Figure 4-25: Global VLAN Configuration

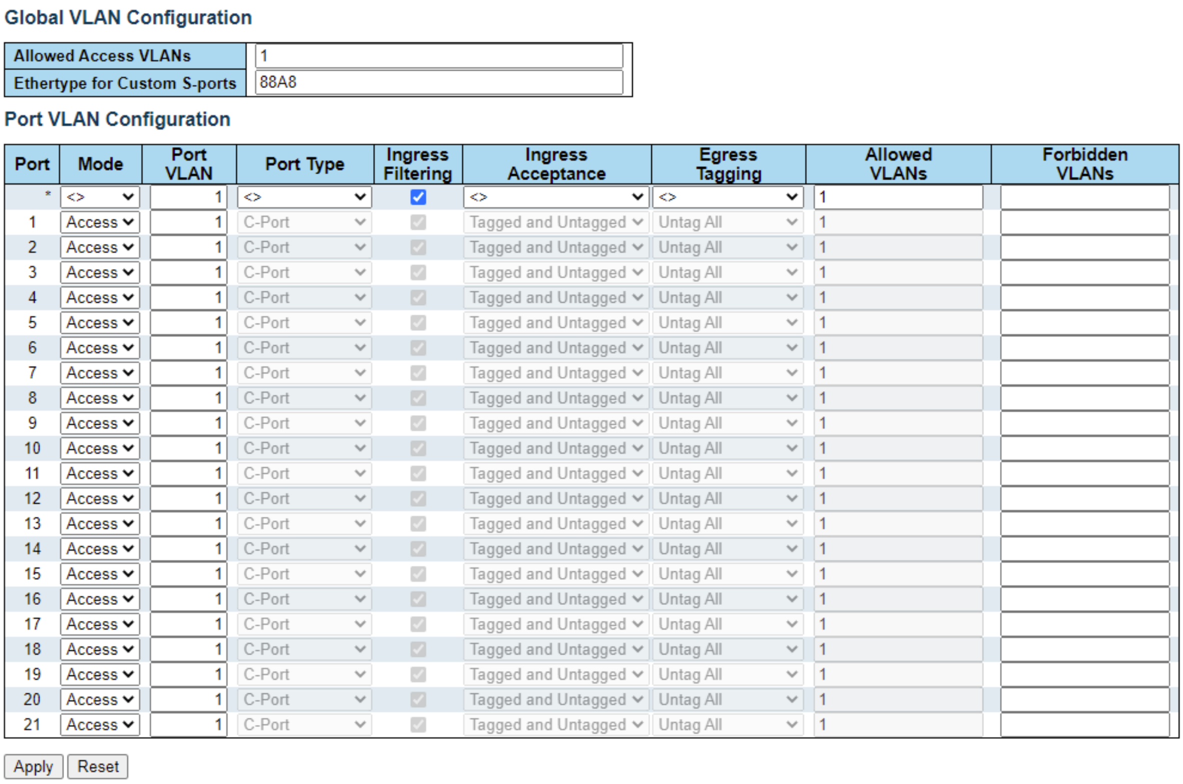
Table 4-22: Global VLAN Configuration Parameters

Global VLAN Configuration	
Allowed Access VLANs	This field shows the allowed **Access VLANs**, i.e., it only affects ports configured as Access ports (the default port mode). Ports in other modes are members of all VLANs specified in the **Allowed VLANs** field (Ports in Trunk and Hybrid mode). By default, only VLAN 1 is enabled. More VLANs may be created by using a list syntax where the individual elements are separated by commas. Ranges are specified with a dash separating the lower and upper bound. The following example will create VLANs 1, 10, 11, 12, 13, 200, and 300: **1,10-13, 200, 300**. Spaces are allowed in between the delimiters
Ethertype for Custom S ports	This field specifies the ethertype/TPID (specified in hexadecimal) used for Custom S-ports. The setting is in force for all ports whose Port Type is set to S-Custom-Port. S-Custom-Port: On ingress, frames with a VLAN tag with a TPID = 0x8100 or equal to the Ethertype configured for Custom-S ports get classified to the VLAN ID embedded in the tag. If a frame is untagged or priority tagged, the frame is classified to the Port VLAN. If frames must be tagged on egress, they will be tagged with the custom S-tag.

4.6.1.1 VLAN Port Configuration

The VLAN Port Configuration is used to configure per port VLAN related Parameters.

Web GUI: Configuration > VLANs > Configuration



Global VLAN Configuration

Allowed Access VLANs	1
Ethertype for Custom S-ports	88A8

Port VLAN Configuration

Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>	1	
1	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
2	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
15	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
16	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
17	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
18	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
19	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
20	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
21	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Figure 4-26: VLAN Port Configuration

Table 4-23: VLAN Port Configuration Table Parameters

Global VLAN Configuration	
Allowed Access VLANs	This field shows the allowed Access VLANs, i.e., it only affects ports configured as Access ports . Ports in other modes are members of all VLANs specified in the Allowed VLANs field. By default, only VLAN 1 is enabled. More VLANs may be created by using a list syntax where the individual elements are separated by commas. Ranges are specified with a dash separating the lower and upper bound. The following example will create VLANs 1, 10, 11, 12, 13, 200, and 300: **1,10-13, 200, 300**. Spaces are allowed in between the delimiters.
Ethernet for Custom S ports	This field specifies the ethertype/TPID (specified in hexadecimal) used for Custom S-ports. The setting is in force for all ports whose Port Type is set to S-Custom-Port.
Port VLAN Configuration	
Port	This is the logical port number for this row.
Mode	The port mode (default is Access) determines the fundamental behavior of the port in question. A port can be in one of three modes as described below. Whenever a particular mode is selected, the remaining fields in that row will be either grayed out or made changeable depending on the mode in question. Grayed out fields show the value that the port will get when the mode is applied **Access:** Access ports are normally used to connect to end stations. Dynamic features like Voice VLAN may add the port to more VLANs behind the scenes. Access ports have the following characteristics: 1. Member of exactly one VLAN, the Port VLAN (a.k.a. Access VLAN), which by default is 1. 2.Accepts untagged and C-tagged frames. 3.Discards all frames that are not classified to the Access VLAN 4.On egress all frames are transmitted untagged. **Trunk:** Trunk ports can carry traffic on multiple VLANs simultaneously and are normally used to connect to other switches. Trunk ports have the following characteristics: 1. By default, a trunk port is member of all VLANs (1-4095). 2. The VLANs that a trunk port is member of may be limited using Allowed VLANs. 3.Frames classified to a VLAN that the port is not a member of are discarded.

	4.By default, all frames but frames classified to the Port VLAN (a.k.a. Native VLAN) get tagged on egress. Frames classified to the Port VLAN do not get C-tagged on egress. 5.Egress tagging can be changed to tag all frames, in which case only tagged frames are accepted on ingress. **Hybrid:** Hybrid ports resemble trunk ports in many ways but adds additional port configuration features. In addition to the characteristics described for trunk ports, hybrid ports have these abilities: 1. Can be configured to be VLAN tag unaware or, C-tag aware, S-tag aware, or S-custom-tag aware. 2.Ingress filtering can be controlled. 3.Ingress acceptance of frames and configuration of egress tagging can be configured independently**.**
Port VLAN	Determines the port's VLAN ID (a.k.a. PVID). Allowed VLANs are in the range 1 through 4095, default being 1. On ingress, frames get classified to the Port VLAN if the port is configured as VLAN unaware, the frame is untagged, or VLAN awareness is enabled on the port, but the frame is priority tagged (VLAN ID = 0). On egress, frames classified to the Port VLAN do not get tagged if Egress Tagging configuration is set to untag Port VLAN. The Port VLAN is called an "Access VLAN" for ports in Access mode and Native VLAN for ports in Trunk or Hybrid mode.
Port Type	Ports in hybrid mode allow for changing the port type, that is, whether a frame's VLAN tag is used to classify the frame on ingress to a particular VLAN, and if so, which TPID it reacts on. Likewise, on egress, the Port Type determines the TPID of the tag, if a tag is required. **Unaware:** On ingress, all frames, whether carrying a VLAN tag or not, get classified to the Port VLAN, and possible tags are not removed on egress. **C-Port:** On ingress, frames with a VLAN tag with TPID = 0x8100 get classified to the VLAN ID embedded in the tag. If a frame is untagged or priority tagged, the frame gets classified to the Port VLAN. If frames must be tagged on egress, they will be tagged with a C-tag. **S-Port:** On ingress, frames with a VLAN tag with TPID = 0x8100 or 0x88A8 get classified to the VLAN ID embedded in the tag. If a frame is untagged or priority tagged, the frame gets classified to the Port VLAN. If frames must be tagged on egress, they will be tagged with an S-tag. **S-Custom-Port:** On ingress, frames with a VLAN tag with a TPID = 0x8100 or equal to the Ethertype configured for Custom-S ports get classified to the VLAN ID embedded in the tag. If a frame is untagged or priority tagged, the frame

	gets classified to the Port VLAN. If frames must be tagged on egress, they will be tagged with the custom S-tag.
Ingress Filtering	Hybrid ports allow for changing ingress filtering. Access and Trunk ports always have ingress filtering enabled. If ingress filtering is enabled (checkbox is checked), frames classified to a VLAN that the port is not a member of get discarded. If ingress filtering is disabled, frames classified to a VLAN that the port is not a member of are accepted and forwarded to the switch engine. However, the port will never transmit frames classified to VLANs that it is not a member of.
Ingress Acceptance	Hybrid ports allow for changing the type of frames that are accepted on ingress. • **Tagged and Untagged**- Both tagged and untagged frames are accepted. • **Tagged Only-** Only tagged frames are accepted on ingress. Untagged frames are discarded. • **Untagged Only-** Only untagged frames are accepted on ingress. Tagged frames are discarded.
Egress Tagging	Ports in Trunk and Hybrid mode may control the tagging of frames on egress. • **Untag Port VLAN-** Frames classified to the Port VLAN are transmitted untagged. Other frames are transmitted with the relevant tag. • **Tag All**- All frames, whether classified to the Port VLAN or not, are transmitted with a tag. • **Untag All**- All frames, whether classified to the Port VLAN or not, are transmitted without a tag. This option is only available for ports in Hybrid mode.
Allowed VLANs	Ports in Trunk and Hybrid mode may control which VLANs they are allowed to become members of. Access ports can only be member of one VLAN, the Access VLAN. The field's syntax is identical to the syntax used in the Enabled VLANs field. By default, a Trunk or Hybrid port will become member of all VLANs and is therefore set to **1-4095**. The field may be left empty, which means that the port will not become member of any VLANs.
Forbidden VLANs	A port may be configured to never be member of one or more VLANs. This is particularly useful when dynamic VLAN protocols like MVRP and GVRP must be prevented from dynamically adding ports to VLANs. The trick is to mark such VLANs as forbidden on the port in question. The syntax is identical to the syntax used in the Enabled VLANs field. By default, the field is left blank, which means that the port may become a member of all possible VLANs.

4.6.1.2 VLAN Membership Status and VLAN Name configuration for Combined users

This section provides an overview of membership status of VLAN users and configure VLAN name.

VLAN User

Various internal software modules may use VLAN services to configure VLAN memberships on the fly. The drop-down list on the right allows for selecting between showing VLAN memberships as configured by an administrator (Admin) or as configured by one of these internal software modules. The "Combined" entry will show a combination of the administrator and internal software modules configuration, and basically reflects what is configured in hardware.

Navigating the VLAN Membership Status page

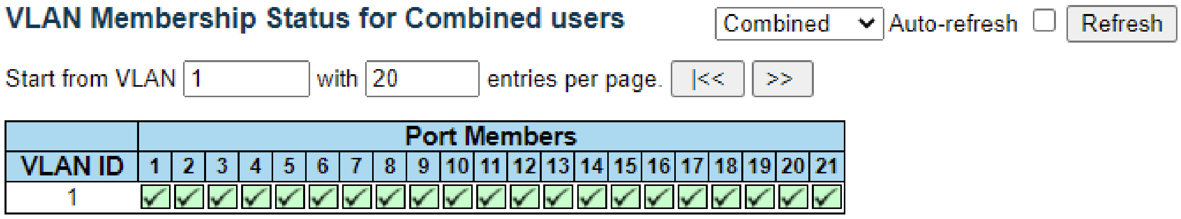
Each page shows up to 99 entries from the VLAN table, default being 20, selected through the "entries per page" input field.

When first visited, the web page will show the first 20 entries from the beginning of the VLAN Table. The first displayed will be the one with the lowest VLAN ID found in the VLAN Table.

The "VLAN" input fields allow the user to select the starting point in the VLAN Table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next VLAN Table match.

The **>>** will use the last entry of the currently displayed VLAN entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

Web GUI: Monitor > VLANs > Membership



VLAN Membership Status for Combined users

Combined

Auto-refresh ☐

Start from VLAN 1 with 20 entries per page.

VLAN ID	Port Members																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 4-27: VLAN Membership Status and VLAN Name configuration.

Table 4-24: VLAN Membership Status and VLAN Name configuration Parameters

VLAN ID	VLAN ID for which the Port members are displayed.
VLAN Name	VLAN Name for which the Port members are displayed.
Port Members	A row of check boxes for each port is displayed for each VLAN ID. If a port is included in a VLAN, the following image ✓ will be displayed. If a port is in the forbidden port list, an image ✗ will be displayed. If a port is in the forbidden port list and at the same time attempted included in the VLAN, the following image will be displayed: ✗. The port will not be a member of the VLAN in this case.
Buttons	Select function associated VLAN from this drop-down list.

4.6.1.3 VLAN Port Status for Combined users

This section provides VLAN Port Status.

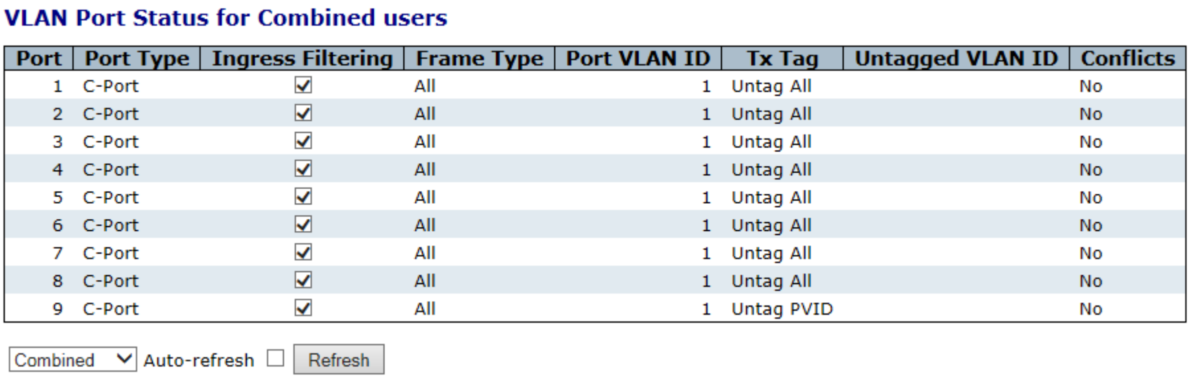
VLAN USER

Various internal software modules may use VLAN services to configure VLAN port configuration on the fly.

The drop-down list on the right allows for selecting between showing VLAN memberships as configured by an administrator (Admin) or as configured by one of these internal software modules.

The “Combined” entry will show a combination of the administrator and internal software modules configuration, and basically reflects what is configured in hardware. If a given software modules hasn’t overridden any of the port settings, the text “No data exists for the selected user” is shown in the table.

Web GUI: Monitor > VLANs > Ports



VLAN Port Status for Combined users

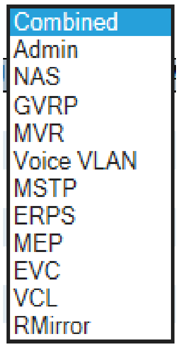
Port	Port Type	Ingress Filtering	Frame Type	Port VLAN ID	Tx Tag	Untagged VLAN ID	Conflicts
1	C-Port	☑	All	1	Untag All		No
2	C-Port	☑	All	1	Untag All		No
3	C-Port	☑	All	1	Untag All		No
4	C-Port	☑	All	1	Untag All		No
5	C-Port	☑	All	1	Untag All		No
6	C-Port	☑	All	1	Untag All		No
7	C-Port	☑	All	1	Untag All		No
8	C-Port	☑	All	1	Untag All		No
9	C-Port	☑	All	1	Untag PVID		No

Combined Auto-refresh ☐ Refresh

Figure 4-28: VLAN Port Status for Combined Users

Table 4-25: VLAN Port Status for Combined Users Parameters

Port	The logical port for the settings contained in the same row.
Port Type	Shows the port type (Unaware, C-Port, S-Port, S-Custom-Port.) that a given user wants to configure on the port. The field is empty if not overridden by the selected user.
Ingress Filtering	Shows whether a given user wants ingress filtering enabled or not. The field is empty if not overridden by the selected user.
Frame Type	Shows the acceptable frame types (All, Tagged, Untagged) that a given user wants to configure on the port. The field is empty if not overridden by the selected user.
Port VLAN ID	Shows the Port VLAN ID (PVID) that a given user wants the port to have. The field is empty if not overridden by the selected user.
Tx Tag	Shows the Tx Tag requirements (Tag All, Tag PVID, Tag UVID, Untag All, Untag PVID, Untag UVID) that a given user has on a port. The field is empty if not overridden by the selected user.

Untagged VLAN ID	If Tx Tag is overridden by the selected user and is set to Tag or Untag UVID, then this field will show the VLAN ID the user wants to tag or untag on egress. The field is empty if not overridden by the selected user.
Conflicts	Two users may have conflicting requirements to a port's configuration. For instance, one user may require all frames to be tagged on egress while another requires all frames to be untagged on egress. Since both users cannot win, this gives rise to a conflict, which is solved in a prioritized way. The Administrator has the least priority. Other software modules are prioritized according to their position in the drop-down list: The higher in the list, the higher priority. If conflicts exist, it will be displayed as "Yes" for the "Combined" user and the offending software module. The "Combined" user reflects what is configured in hardware.
Buttons	Select function associated VLAN from this drop-down list.  Combined Admin NAS GVRP MVR Voice VLAN MSTP ERPS MEP EVC VCL RMirror

4.6.2 VLAN Membership Status for Combined users

This section provides an overview of membership status of VLAN users.

VLAN User

Various internal software modules may use VLAN services to configure VLAN memberships on the fly. The drop-down list on the right allows for selecting between showing VLAN memberships as configured by an administrator (Admin) or as configured by one of these internal software modules.

The "Combined" entry will show a combination of the administrator and internal software modules configuration, and basically reflects what is configured in hardware.

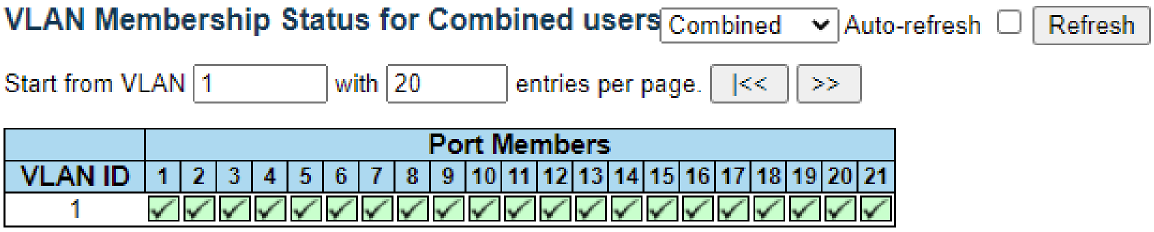
Navigating the VLAN Membership Status page

Each page shows up to 99 entries from the VLAN table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the VLAN Table. The first displayed will be the one with the lowest VLAN ID found in the VLAN Table.

The "VLAN" input fields allow the user to select the starting point in the VLAN Table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next VLAN Table match.

The **>>** will use the last entry of the currently displayed VLAN entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

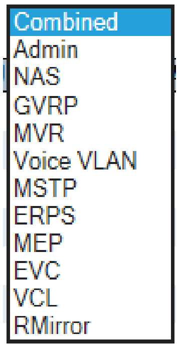
Web GUI: Monitor > VLANs > Membership


VLAN Membership Status for Combined users
Combined
Auto-refresh ☐
Refresh
Start from VLAN 1 with 20 entries per page.
|<<
>>

VLAN ID	Port Members																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 4-29: VLAN Membership Status for Combined Users

Table 4-26: VLAN Membership Status for Combined users Parameters

VLAN ID	VLAN ID for which the Port members are displayed.
VLAN Name	VLAN Name for which the Port members are displayed.
Port Members	A row of check boxes for each port is displayed for each VLAN ID. If a port is included in a VLAN, the following image ✓ will be displayed. If a port is in the forbidden port list, an image ✗ will be displayed. If a port is in the forbidden port list and at the same time attempted included in the VLAN, the following image will be displayed: ✗. The port will not be a member of the VLAN in this case.
Buttons	: Select VLAN Users from this dropdown list  Combined Admin NAS GVRP MVR Voice VLAN MSTP ERPS MEP EVC VCL RMirror

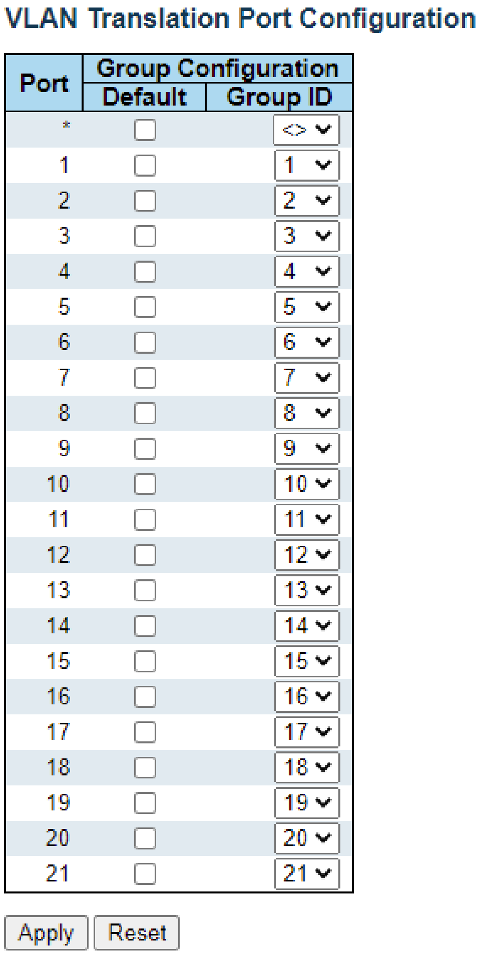
4.6.3 **VLAN Translation**

VLAN Translation allows the user to swap existing VID on the port ingress to a different VID. The translation is done per group of ports. By default, each port is assigned as an independent group.

4.6.3.1 VLAN Translation Port Configuration

This section allows you to configure switch Ports to use a given VLAN Translation Mapping Group. This will enable all VLAN Translation mappings of that group (if any) on the selected switch port.

Web GUI: Configuration > VLAN Translation > Port to Group Configuration



VLAN Translation Port Configuration

Port	Group Configuration	
	Default	Group ID
*	☐	<>
1	☐	1
2	☐	2
3	☐	3
4	☐	4
5	☐	5
6	☐	6
7	☐	7
8	☐	8
9	☐	9
10	☐	10
11	☐	11
12	☐	12
13	☐	13
14	☐	14
15	☐	15
16	☐	16
17	☐	17
18	☐	18
19	☐	19
20	☐	20
21	☐	21

Figure 4-30: VLAN Translation Port Configuration

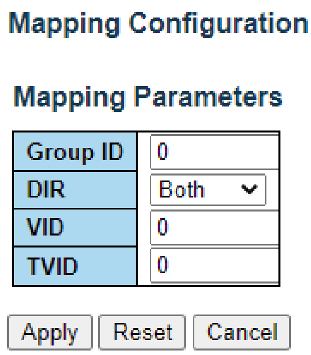
Table 4-27: Port to Group mapping Table Parameters

Port	The Port column shows the list of ports for which you can configure the VLAN Translation Mapping Group.
Default	To set the switch port to use the default VLAN Translation Group click the checkbox and press Save.
Group ID	The VLAN Translation mappings are organized into Groups, identified by the Group ID. This way a port is configured to use several VLAN Translation mappings easily by simply configuring it to use a given group. Then the number of possible groups in a switch is equal to the number of ports present in this switch. A port can be configured to use any of the groups, but only one at any given time. Multiple ports can be configured to use the same group. A valid Group ID is an integer value from 1 to 21. *Note: By default, each port is set to use the group with Group ID equal to the port number. For example, port #1 is by default set to use group with GID = 1.* For example, port #1 is by default set to use group with GID = 1.

4.6.3.2 VLAN Translation Mapping Table

This section allows you to create mappings of VLANs -> Translated VLANs and organize these mappings into global Groups.

Web GUI: Configuration > VLAN Translation > VLAN Translation Mapping



Mapping Configuration

Mapping Parameters

Group ID	0
DIR	Both
VID	0
TVID	0

Figure 4-31: VLAN Translation Mapping Table

Table 4-28: VLAN Translation Mapping Table parameters

Group ID	The VLAN Translation mappings are organized into Groups, identified by the Group ID. This way a port is configured to use several VLAN Translation mappings easily by simply configuring it to use a given group. Then number of possible groups in a switch is equal to the number of ports present in this switch. A port can be configured to use any of the groups, but only one at any given time. Multiple ports can be configured to use the same group. A valid Group ID is an integer value from 1 to 10. ***Note:*** *By default, each port is set to use the group with Group ID equal to the port number. For example, port #1 is by default set to use group with GID = 1.*
Direction	Indicates the direction of the VLAN Translation and it refers to the switch. The direction can be 'Ingress', where the translation takes place on the VLAN ID of frames entering the switch port, 'Egress', where the translation takes place on the VLAN ID of frames exiting the switch port, or 'Both', where the translation takes place on both above directions.
VID	Indicates the ID to which Group ID will be mapped. A valid VLAN ID ranges from 1-4095.
TVID	Indicates the VLAN ID to which VLAN ID of an ingress frame will be translated to (granted that the mapping is enabled on the ingress port that the frame arrived at). A valid VLAN ID ranges from 1 to 4095.
Buttons	**Remove All:** Click to remove all VLAN Translation mappings.

Modification Buttons	You can modify each VLAN Translation mapping in the table using the following buttons: ⓔ: Edits the mapping row. ⊗: Deletes the mapping. ⊕: Adds a new mapping.

4.6.4 **Provider Bridges (QinQ)**

The use of an extra VLAN header (service provider tag) as part of the Ethernet frame header to provide differentiation between traffic flows (whether a separate service, or a separate customer) is common in service provider networks. It extends the notion of bridging from that of bridging between LAN segments or virtual LANs (defined by traditional VLAN tags), to bridging between customers or services.

Providers can use the service provider VLAN tag to identify Ethernet traffic that belongs to a specific Service, and give it the correct treatment (e.g., if the service is more important or time sensitive than others it can get the right QoS handling).

Falcon RX is designed to serve as an NTU for Metro-Ethernet access applications. Such applications use the Provider Bridges (802.1ad) standard to enable Ethernet services implementation.

The Provider Edge Bridge inserts a Service Tag (S-Tag) on all frames received from the Customer network.

This enables implementation of transparent L2 service for high numbers of customers.

Determination of which service to assign a frame to can be based on:

- **Ingress port** – All frames received on a specific ingress port will be assigned to a single service (encapsulated with the same **S-Tag**). Such functionality when used for point-to-point service is defined as EPL (Ethernet Private Line) in MEF specs.
- **Ingress port + C-Tag** – A frame received on a specific ingress port will be assigned to a service based on the port and a table that maps the VLAN tag, on the incoming frame (C-Tag) to the service tag (S-Tag). Such functionality, when used for point-to-point service, is defined as EVPL (Ethernet Virtual Private Line) in MEF specs.

4.6.5 **Private VLANs (PVLANs)**

Private VLAN is not actually a VLAN (as per IEEE802.1q) feature, but are based on the source port mask, which facilitates switch port segmentation. It segregates a selected groups of ports from other ports on the switch that are not part of the Private VLAN group.

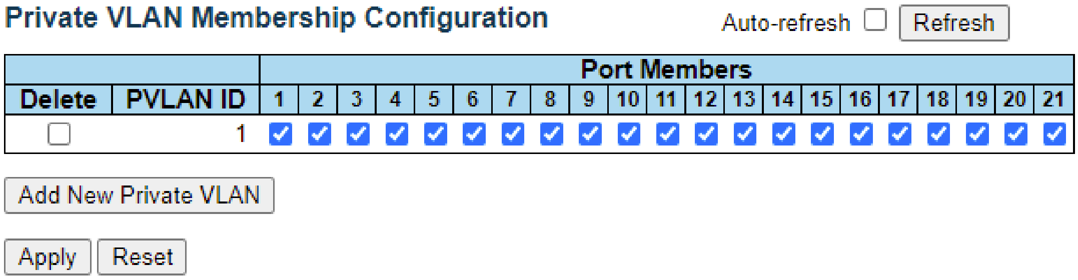
4.6.5.1 Private VLAN Membership Configuration

The Private VLAN membership configurations for the switch can be monitored and modified here. Private VLANs can be added or deleted. Port members of each Private VLAN can be added or removed.

Private VLANs are based on the source port mask, and there are no connections to VLANs. This means that VLAN IDs and Private VLAN IDs can be identical.

A port must be a member of both a VLAN and a Private VLAN to be able to forward packets. By default, **all ports are VLAN unaware and members of VLAN 1 and Private VLAN 1**. A VLAN unaware port can only be a member of one VLAN, but it can be a member of multiple Private VLANs.

Web GUI: Configuration > Private VLANs > Membership



Private VLAN Membership Configuration

		Port Members																				
Delete	PVLAN ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
☐	1	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Figure 4-32: Private VLAN Membership Configuration display

Table 4-29: Private VLAN Membership Configuration Parameters

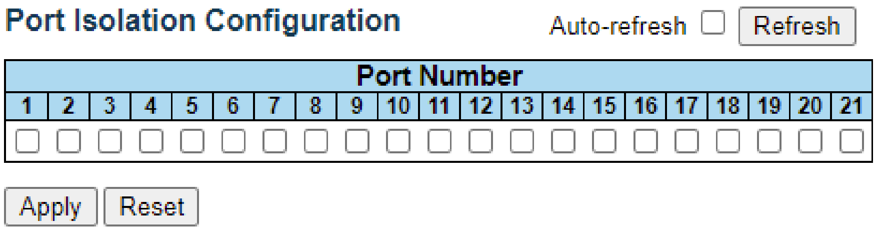
Delete	To delete a private VLAN entry, check this box. The entry will be deleted during the next Save.
Private VLAN ID	Indicates the ID of this private VLAN.
Port Members	A row of check boxes for each port is displayed for each private VLAN ID. To include a port in a private VLAN, check the box. To remove or exclude the port from the private VLAN, make sure the box is unchecked. By default, no ports are members, and all boxes are unchecked.
Add a New Private VLAN	Click to add a new private VLAN ID. An empty row is added to the table, and the private VLAN can be configured as needed. The allowed range for a private VLAN ID is the same as the switch port number range. Any values outside this range are not accepted, and a warning message appears. Click "OK" to discard the incorrect entry or click "Cancel" to return to the editing and make a correction. The Private VLAN is enabled when you click "**Save**". The **"Delete"** button can be used to undo the addition of new Private VLANs.

4.6.5.2 Port Isolation Configuration

This section is used for enabling or disabling port isolation for ports in a Private VLAN.

A port member of a VLAN can be isolated to other isolated ports on the same VLAN and Private VLAN.

Web GUI: Configuration > Private VLANs > Port Isolation



Port Isolation Configuration

Port Number																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 4-33: Private VLAN Port Isolation Configuration

Table 4-30: Private VLAN Port Isolation Configuration Parameters

Port Members	A check box is provided for each port of a private VLAN. When checked, port isolation is enabled for that port. When unchecked, port isolation is disabled for that port. By default, port isolation is disabled for all ports.

4.6.6 VCL

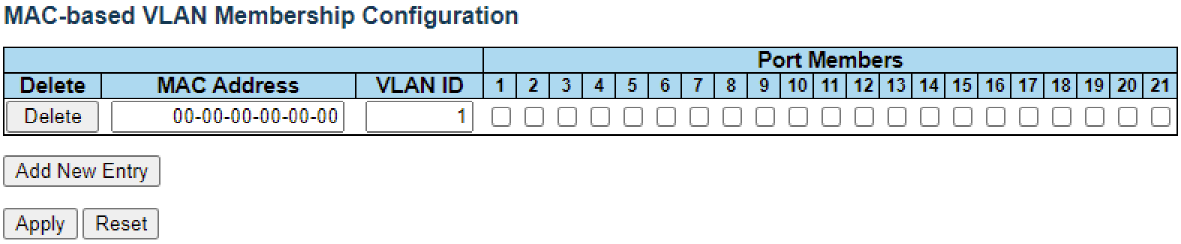
This section includes the following subjects:

MAC-based VLAN Membership Configuration. Protocol to Group Mapping Table. Group Name to VLAN mapping Table IP Subnet-based VLAN Membership Configuration.

4.6.6.1 MAC-based VLAN Membership Configuration

This section allows adding and deleting MAC-based VLAN Classification List entries and assigning the entries to different ports.

Web GUI: Configuration > VCL > MAC-based VLAN



MAC-based VLAN Membership Configuration

Delete	MAC Address	VLAN ID	Port Members 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Delete	00-00-00-00-00-00	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 4-34: MAC based VLAN Membership Configuration display

Table 4-31: MAC based VLAN Membership Configuration parameters

Delete	To delete a MAC to VLAN ID mapping entry, check this box and press save. The entry will be deleted in the stack.
MAC Address	Indicates the MAC address of the mapping.
VLAN ID	Indicates the VLAN ID the above MAC will be mapped to.
Port Members	A row of check boxes for each port is displayed for each MAC to VLAN ID mapping entry. To include a port in the mapping, check the box. To remove or exclude the port from the mapping, make sure the box is unchecked. By default, no ports are members, and all boxes are unchecked.

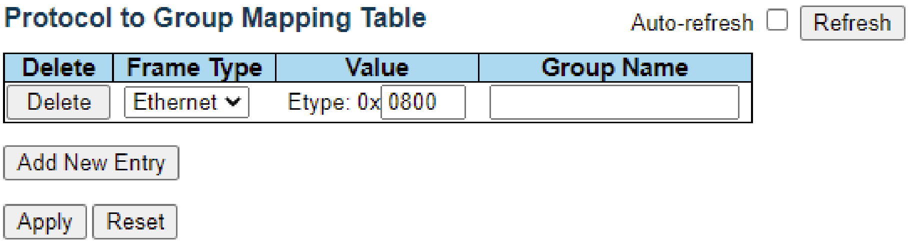
Adding a New MAC to VLAN ID mapping entry

Click **Add New Entry** to add a new MAC to VLAN ID mapping entry. An empty row is added to the table, and the mapping can be configured as needed. Any unicast MAC address can be used to configure the mapping. No broadcast or multicast MAC addresses are allowed. Legal values for a VLAN ID are **1** through **4095**. The MAC to VLAN ID entry is enabled when you click **Save** A mapping without any port members will not be added when you click **Save**. The **Delete** button can be used to undo the addition of new mappings. The maximum possible MAC to VLAN ID mapping entries is limited to 256.

4.6.6.2 Protocol based VLAN

This section allows you to add a new Protocol to a Group Name (each protocol can be part of only one Group) mapping entries as well as allow you to see and delete already mapped entries for the There are two subjects:

- Protocol to Group Mapping Table.
- Group Name to VLAN mapping Table**Web GUI: Configuration > VCL > Protocol-based VLAN > Protocol to Group**



Protocol to Group Mapping Table

Delete	Frame Type	Value	Group Name
Delete	Ethernet	Etype: 0x 0800	

Figure 4-35: Protocol to Group Mapping Table display

Table 4-32: Protocol to Group Mapping Table parameters

Delete	To delete a Protocol to Group Name map entry, check this box. The entry will be deleted from the switch during the next Save.
Frame Type	Frame type can have one of the following values: • Ethernet • LLC • SNAP *Note: When changing the Frame type field, the valid value of the following text field will vary depending on the new frame type you selected.*
Value	Valid value that can be entered in this text field depends on the option selected from the preceding Frame Type selection menu. Below are the criteria for the three different Frame Types: • **Ethernet:** Value in the text field when Ethernet is selected as a Frame Type is called etype. Valid values for etype range between 0x0600 and 0xffff. • **LLC:** Valid value in this case is comprised of two different sub-values. ○ **DSAP:** 1-byte long string (0x00-0xff) ○ **SSAP:** 1-byte long string (0x00-0xff). • **SNAP:** Valid value in this case is also comprised of two different sub-values. ○ **OUI:** OUI (Organizationally Unique Identifier) is a parameter in the format of xx-xx-xx where each pair (xx) in the string is a hexadecimal value ranging between 0x00 and 0xff. ○ **PID:** PID (Protocol ID). If OUI is hexadecimal 000000, then the protocol ID is the Ethernet type (EtherType) field value for the

	protocol running on top of SNAP; if OUI is an OUI for a particular organization, the protocol ID is a value assigned by that organization to the protocol running on top of SNAP. In other words, if the value of OUI field is 00-00-00 then the value of PID will be etype (0x0600-0xffff) and if the value of OUI is other than 00-00-00 then valid values of PID will be any value between 0x0000 and 0xffff.
Group Name	A valid Group Name is a 16-character long string, unique for every entry, which consists of a combination of alphabets (a-z or A-Z) and integers (0-9): *Note: Special characters and underscores (_) are not allowed.*

Adding a New Group to VLAN mapping entry

Click **Add New Entry** to add a new entry in the mapping table. An empty row is added to the table, where Frame Type, Value and the Group Name can be configured as needed.

The **Delete** button can be used to undo the addition of new entry. The maximum possible Protocol to Group mapping entries is limited to 128.

4.6.6.3 Group Name to VLAN mapping Table

This sub section allows you to map a Group Name (already configured or to be configured in the future) to a VLAN for the

Web GUI: Configuration > VCL > Protocol-based VLAN > Group to VLAN

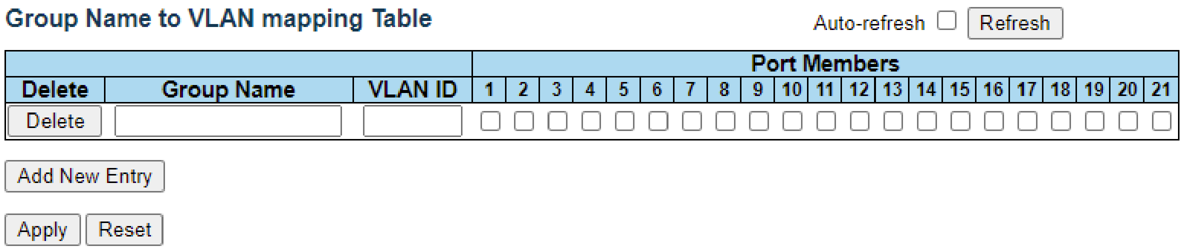

Group Name to VLAN mapping Table
Auto-refresh ☐
Refresh
Port Members
Delete
Group Name
VLAN ID
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Delete
☐ ☐
Add New Entry
Apply
Reset

Figure 4-36: Group Name to VLAN Mapping Table display

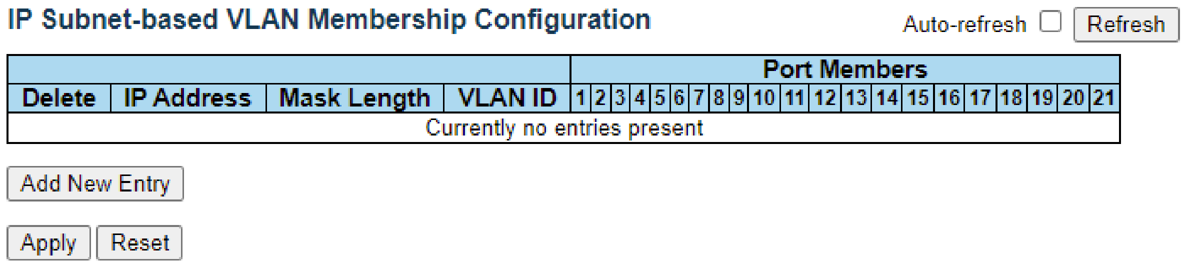
Table 4-33: Group Name to VLAN Mapping Table parameters

Delete	To delete a Group Name to VLAN mapping, check this box. The entry will be deleted from the switch during the next Save.
Group Name	A valid Group Name is a string, at the most 16 characters long, which consists of a combination of alphabets (a-z or A-Z) and integers (0-9) with no special characters allowed. You may either use a Group that already includes one or more protocols (see Protocol to Group mappings) or create a Group to VLAN ID mapping that will become active the moment you add one or more protocols inside that Group. Furthermore, the Group to VLAN ID mapping is not unique, as long as the port lists of these mappings are mutually exclusive (e.g., Group1 can be mapped to VID 1 on port#1 and to VID 2 on port#2).
VLAN ID	Indicates the VLAN ID to which the Group Name will be mapped. A valid VLAN ID ranges from 1 to 4095
Port Members	A row of check boxes for each port is displayed for each Group Name to VLAN ID mapping. To include a port in the mapping, check the box. To remove or exclude the port from the mapping, make sure the box is unchecked. By default, no ports are members, and all boxes are unchecked.
Adding a New Group to VLAN mapping entry Click **Add New Entry** to add a new entry in the mapping table. An empty row is added to the table and the Group Name, VLAN ID and port members can be configured as needed. Legal values for a VLAN ID are **1** through **4095**. The **Delete** button can be used to undo the addition of new entry. The maximum possible Group to VLAN mappings is limited to 256.	

4.6.6.4 IP Subnet based VLAN Membership Configuration

The IP subnet to VLAN ID mappings can be configured here. This section allows adding, updating, and deleting IP subnet to VLAN ID mapping entries and assigning them to different ports.

Web GUI: Configuration > VCL > IP Subnet-based VLAN



				Port Members																				
Delete	IP Address	Mask Length	VLAN ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Currently no entries present																								

Figure 4-37: IP Subnet based VLAN Membership Configuration display

Table 4-34: IP Subnet based VLAN Membership Configuration parameters

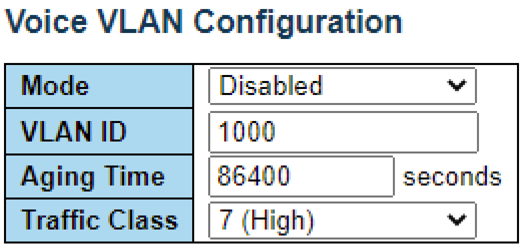
Delete	To delete a mapping, check this box and press save. The entry will be deleted in the stack.
IP Address	Indicates the subnet's IP address (Any of the subnet's host addresses can be also provided here, the application will convert it automatically).
Mask Length	Indicates the subnet's mask length.
VLAN ID	Indicates the VLAN ID the subnet will be mapped to. IP Subnet to VLAN ID is a unique matching.
Port Members	A row of check boxes for each port is displayed for each IP subnet to VLAN ID mapping entry. To include a port in a mapping, simply check the box. To remove or exclude the port from the mapping, make sure the box is unchecked. By default, no ports are members, and all boxes are unchecked
Adding a New IP subnet based VLAN Click **Add New Entry:** to add a new IP subnet to VLAN ID mapping entry. An empty row is added to the table, and the mapping can be configured as needed. Any IP address/mask can be configured for the mapping. Legal values for the VLAN ID are **1** to **4095**. The IP subnet to VLAN ID mapping entry is enabled when you click on **Save**. The **Delete** button can be used to undo the addition of new mappings The maximum possible IP subnet to VLAN ID mappings are limited 128	

4.6.7 Voice VLAN

The Voice VLAN feature enables voice traffic forwarding on the Voice VLAN, then the switch can classify and schedule network traffic. It is recommended that there be two VLANs on a port - one for voice, one for data. Before connecting the IP device to the switch, the IP phone should configure the voice VLAN ID correctly. It should be configured through its own GUI.

4.6.7.1 Voice VLAN Configuration

Web GUI: Configuration > Voice VLAN > Configuration



Voice VLAN Configuration

Mode	Disabled
VLAN ID	1000
Aging Time	86400 seconds
Traffic Class	7 (High)

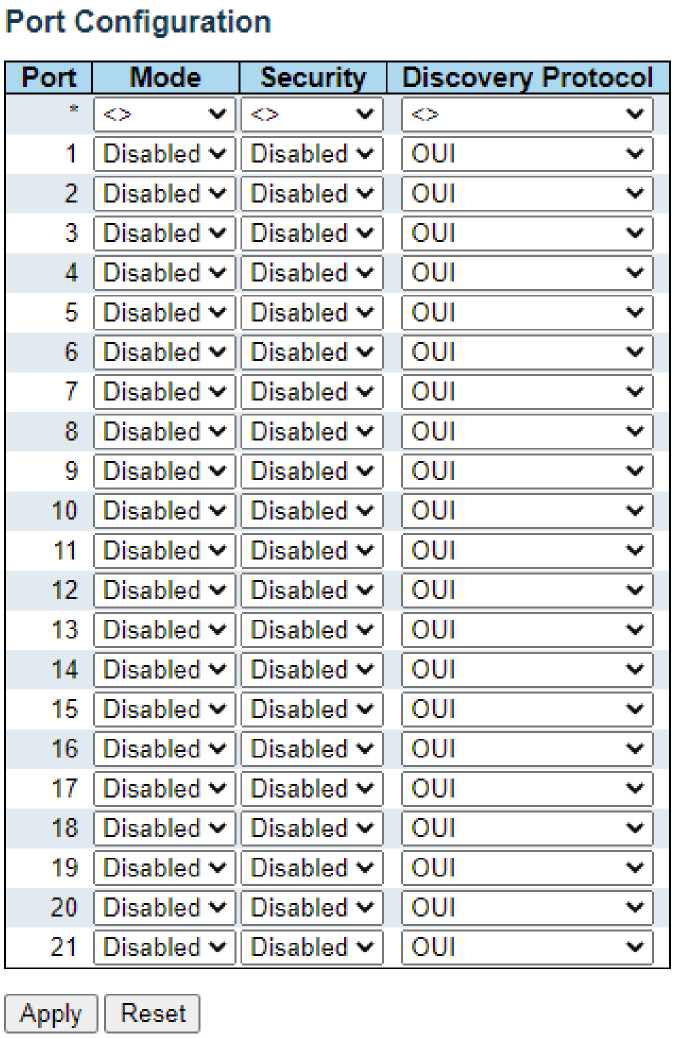
Figure 4-38: Voice VLAN Configuration display.

Table 4-35: Voice VLAN Configuration parameters.

Voice VLAN Configuration	
Mode	Indicates the Voice VLAN mode operation. We must disable MSTP feature before we enable Voice VLAN. It can avoid the conflict of ingress filtering. Possible modes are: • **Enabled**: Enable Voice VLAN mode operation. • **Disabled**: Disable Voice VLAN mode operation.
VLAN ID	Indicates the Voice VLAN ID. It should be a unique VLAN ID in the system and cannot equal each port PVID. It is a conflict in configuration if the value equals management VID, MVR VID, PVID etc. The allowed range is **1** to **4095**.
Aging Time	Indicates the Voice VLAN secure learning aging time. The allowed range is **10** to **10000000** seconds. It is used when security mode or auto detect mode is enabled. In other cases, it will be based on hardware aging time. The actual aging time will be situated between the [age time; 2 * age time] interval.
Traffic Class	Indicates the Voice VLAN traffic class. All traffic on the Voice VLAN will apply this class.

4.6.7.2 Port Configuration

Web GUI: Configuration > Voice VLAN > Configuration



Port Configuration

Port	Mode	Security	Discovery Protocol
*	<>	<>	<>
1	Disabled	Disabled	OUI
2	Disabled	Disabled	OUI
3	Disabled	Disabled	OUI
4	Disabled	Disabled	OUI
5	Disabled	Disabled	OUI
6	Disabled	Disabled	OUI
7	Disabled	Disabled	OUI
8	Disabled	Disabled	OUI
9	Disabled	Disabled	OUI
10	Disabled	Disabled	OUI
11	Disabled	Disabled	OUI
12	Disabled	Disabled	OUI
13	Disabled	Disabled	OUI
14	Disabled	Disabled	OUI
15	Disabled	Disabled	OUI
16	Disabled	Disabled	OUI
17	Disabled	Disabled	OUI
18	Disabled	Disabled	OUI
19	Disabled	Disabled	OUI
20	Disabled	Disabled	OUI
21	Disabled	Disabled	OUI

Figure 4-39: Port Configuration display

Table 4-36: Port Configuration parameters

Port Configuration	
Port	The logical port for the settings contained in the same row.
Mode	Indicates the Voice VLAN port mode. Possible modes are: • **Disabled**: Disjoin from Voice VLAN. • **Auto**: Enable auto detect mode. It detects whether there is VoIP phone attached to the specific port and configures the Voice VLAN members automatically. • **Forced**: Force join to Voice VLAN.

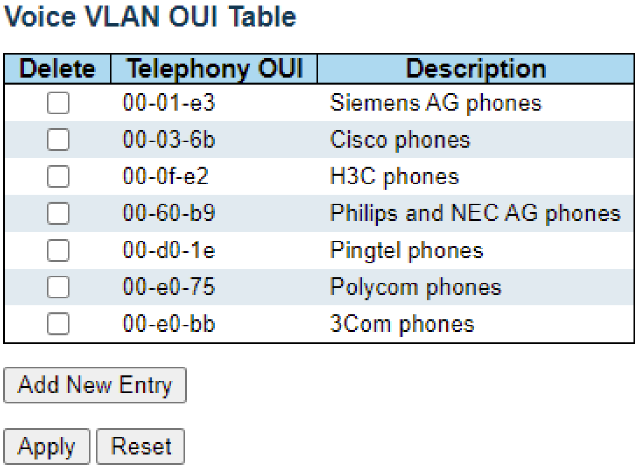
Port Configuration	
Security	Indicates the Voice VLAN port security mode. When the function is enabled, all non-telephonic MAC addresses in the Voice VLAN will be blocked for 10 seconds. Possible port modes are: **Enabled**: Enable Voice VLAN security mode operation. **Disabled**: Disable Voice VLAN security mode operation.
Discovery Protocol	Indicates the Voice VLAN port discovery protocol. It will only work when auto detect mode is enabled. We should enable LLDP feature before configuring discovery protocol to "LLDP" or "Both". Changing the discovery protocol to "OUI" or "LLDP" will restart auto detect process. Possible discovery protocols are: • **OUI**: Detect telephony device by OUI address. • **LLDP**: Detect telephony device by LLDP. • **Both**: Both OUI and LLDP.

4.6.7.3 Voice VLAN OUI Table

Configure VOICE VLAN OUI table on this page. The maximum number of entries is **16**. Modifying the OUI table will restart auto detection of OUI process

OUI is the organizationally unique identifier. An OUI address is a globally unique identifier assigned to a vendor by IEEE. You can determine which vendor a device belongs to according to the OUI address which forms the first 24 bits of a MAC address.

Web GUI: Configuration > Voice VLAN > Oui



Delete	Telephony OUI	Description
☐	00-01-e3	Siemens AG phones
☐	00-03-6b	Cisco phones
☐	00-0f-e2	H3C phones
☐	00-60-b9	Philips and NEC AG phones
☐	00-d0-1e	Pingtel phones
☐	00-e0-75	Polycom phones
☐	00-e0-bb	3Com phones

Figure 4-40: Voice VLAN OUI Table display

Table 4-37: Voice VLAN OUI Table parameters

Delete	Check to delete the entry. It will be deleted during the next save.
Telephony OUI	A telephony OUI address is a globally unique identifier assigned to a vendor by IEEE. It must be 6 characters long and the input format is "xx-xx-xx" (x is a hexadecimal digit).
Description	The description of OUI address. Normally, it describes which vendor telephony device it belongs to. The allowed string length is **0** to **32**.
Buttons	**Add New Entry**: Click to add a new access management entry.

4.6.8 Multicast VLAN Registration (MVR)

This section provides MVR related configurations. The MVR feature enables multicast traffic forwarding on the Multicast VLANs. In a multicast television application, a PC or a network television or a set-top box can receive the multicast stream. Multiple set-top boxes or PCs can be connected to one subscriber port, which is a switch port configured as an MVR receiver port. When a subscriber selects a channel, the set-top box or PC sends an IGMP/MLD report message to Switch A to join the appropriate multicast group address. Uplink ports that send and receive multicast data to and from the multicast VLAN are called MVR source ports. It is allowed to create at maximum 4 MVR VLANs with corresponding channel profile for each Multicast VLAN. The channel profile is defined by the IPMC Profile, which provides the filtering conditions.

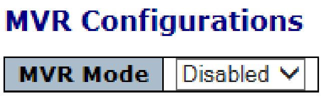
The Querier should connect on the source port. By giving the static membership of MVR VLAN, device only forwards the IGMP reports from downstream(receiver ports) to upstream(source ports) and the Query packet which comes from the downstream will be ignored silently. After the MVR VLAN members are properly configured, it is required to associate an IPMC profile with the specific MVR VLAN to be the expected channel. The channel profile is defined by the IPMC Profile which provides the filtering conditions. Notice that the profile only works when the global profile mode is enabled. It is allowed to create at maximum 4 MVR VLANs with corresponding channel profile.

The MVR includes the following subjects:

- MVR Configuration
- VLAN Interface Setting
- Immediate Leave Setting
- MVR Statistics
- MVR Channels (Groups) Information
- MVR SFM Information

4.6.8.1 MVR Configurations

Web GUI: Configuration > Voice VLAN > Oui


MVR Configurations

MVR Mode: Disabled

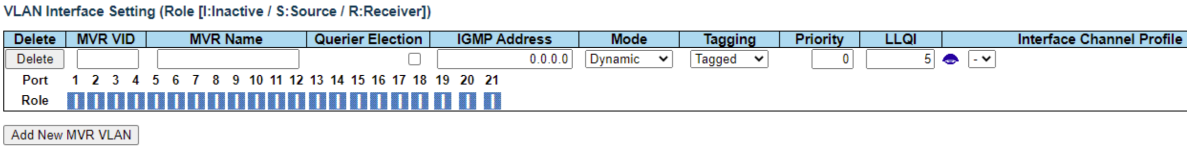
Figure 4-41: MVR Configurations

Table 4-38: MVR Configuration parameters

MVR Mode	Enable/Disable the Global MVR. The Unregistered Flooding control depends on the current configuration in IGMP/MLD Snooping. It is suggested to enable Unregistered Flooding control when the MVR group table is full.

4.6.8.2 VLAN Interface Setting

Web GUI: Configuration > MVR



VLAN Interface Setting (Role [I:Inactive / S:Source / R:Receiver])

Delete	MVR VID	MVR Name	Querier Election	IGMP Address	Mode	Tagging	Priority	LLQI	Interface Channel Profile
Delete			☐	0.0.0.0	Dynamic	Tagged	0	5	-

Port 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Figure 4-42: VLAN Interface Setting display

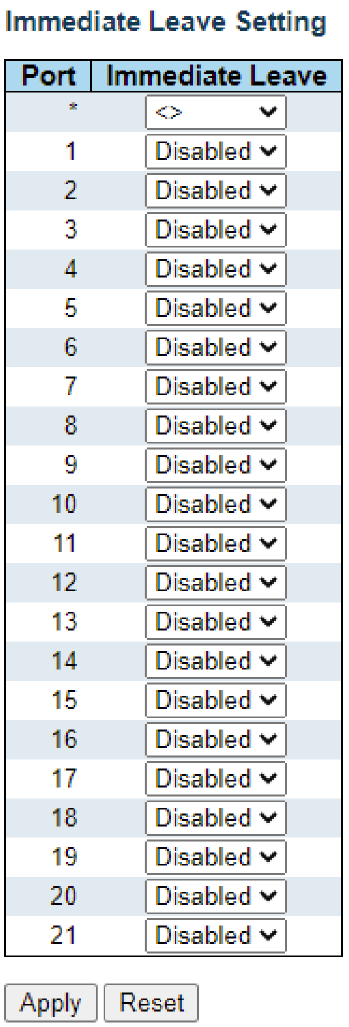
Table 4-39: VLAN Interface Setting parameters

VLAN Interface Setting	
Delete	Check to delete the entry. The designated entry will be deleted during the next save.
MVR VID	Specify the Multicast VLAN ID. **Be Caution**: MVR source ports are not recommended to be overlapped with management VLAN ports.
MVR Name	MVR Name is an optional attribute to indicate the name of the specific MVR VLAN. Maximum length of the MVR VLAN Name string is 16. MVR VLAN Name can only contain alphabets or numbers. When the optional MVR VLAN name is given, it should contain at least one alphabet. MVR VLAN name can be edited for the existing MVR VLAN entries, or it can be added to the new entries.
IGMP Address	Define the IPv4 address as source address used in IP header for IGMP control frames. The default IGMP address is not set (0.0.0.0). When the IGMP address is not set, system uses IPv4 management address of the IP interface associated with this VLAN. When the IPv4 management address is not set, system uses the first available IPv4 management address.
Mode	Specify the MVR mode of operation. In Dynamic mode, MVR allows dynamic MVR membership reports on source ports. In Compatible mode, MVR membership reports are forbidden on source ports. The default is Dynamic mode.
Tagging	Specify whether the traversed IGMP/MLD control frames will be sent as Untagged or Tagged with MVR VID. The default is Tagged.
Priority	Specify how the traversed IGMP/MLD control frames will be sent in prioritized manner. The default Priority is 0.
LLQI	Define the maximum time to wait for IGMP/MLD report memberships on a receiver port before removing the port from multicast group

	membership. The value is in units of tenths of a second. The range is from 0 to 31744. The default LLQI is 5 tenths or one-half second.
Interface Channel Profile	When the MVR VLAN is created, select the IPMC Profile as the channel filtering condition for the specific MVR VLAN. Summary about the Interface Channel Profiling (of the MVR VLAN) will be shown by clicking the view button. Profile selected for designated interface channel is not allowed to have overlapped permit group address.
Profile Management Button	You can inspect the rules of the designated profile by using the following button: Navigate: List the rules associated with the designated profile.
Port	The logical port for the settings.
Port Role	Configure an MVR port of the designated MVR VLAN as one of the following roles. • **Inactive**: The designated port does not participate MVR operations. • **Source**: Configure uplink ports that receive and send multicast data as source ports. Subscribers cannot be directly connected to source ports. • **Receiver**: Configure a port as a receiver port if it is a subscriber port and should only receive multicast data. It does not receive data unless it becomes a member of the multicast group by issuing IGMP/MLD messages. • **Be Caution**: MVR source ports are not recommended to be overlapped with management VLAN ports. Select the port role by clicking the Role symbol to switch the setting. **I** means Inactive; **S** means Source; **R** means Receiver. The default Role is Inactive.
Buttons	**Add New Click MVR VLAN**: Click to add new MVR VLAN. Specify the VID and configure the new entry. Click "Save".

4.6.8.3 Immediate Leave Setting

Web GUI: Configuration > MVR



Immediate Leave Setting

Port	Immediate Leave
*	<>
1	Disabled
2	Disabled
3	Disabled
4	Disabled
5	Disabled
6	Disabled
7	Disabled
8	Disabled
9	Disabled
10	Disabled
11	Disabled
12	Disabled
13	Disabled
14	Disabled
15	Disabled
16	Disabled
17	Disabled
18	Disabled
19	Disabled
20	Disabled
21	Disabled

Figure 4-43: Immediate Leave Setting display

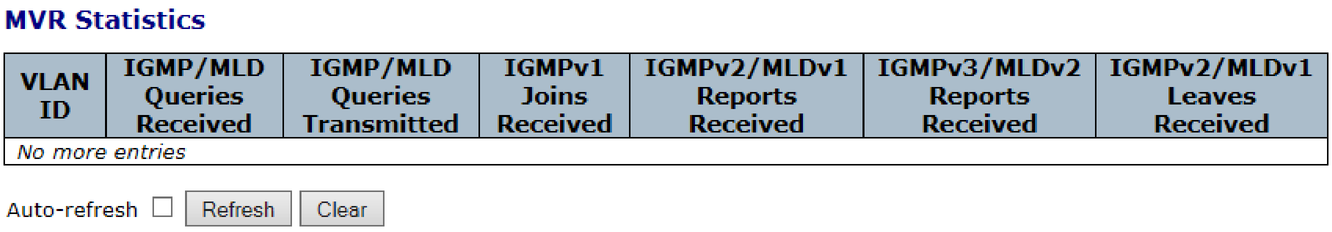
Table 4-40: VLAN Interface Setting parameters

Port	The logical port for the settings.
Immediate Leave	Enable the fast leave on the port. Multicast snooping **Fast Leav**e processing allows the switch to remove an interface from the forwarding-table entry without first sending out group specific queries to the interface. The VLAN interface is pruned from the multicast tree for the multicast group specified in the original leave message. Fast-leave processing ensures optimal bandwidth management for all hosts on a switched network, even when multiple multicast groups are in use simultaneously. This processing applies to IGMP and MLD.

4.6.8.4 MVR Statistics

This section provides MVR Statistics information.

Web GUI: Monitor > MVR > Statistics



VLAN ID	IGMP/MLD Queries Received	IGMP/MLD Queries Transmitted	IGMPv1 Joins Received	IGMPv2/MLDv1 Reports Received	IGMPv3/MLDv2 Reports Received	IGMPv2/MLDv1 Leaves Received
No more entries						

Figure 4-44: MVR Statistics display

Table 4-41: MVR Statistics parameters

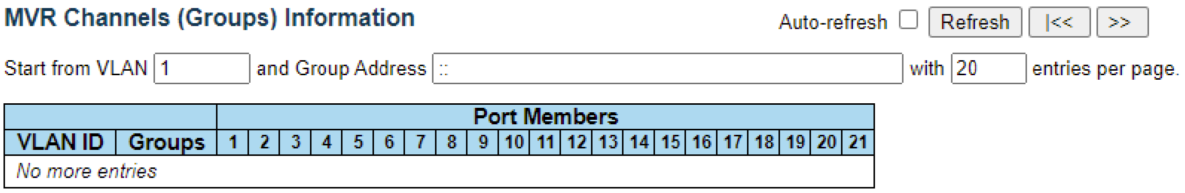
MVR Statistics	
ID VLAN	The Multicast VLAN ID.
IGMP/MLD Queries Received	The number of Received Queries for IGMP and MLD, respectively.
IGMP/MLD Queries Transmitted	The number of Transmitted Queries for IGMP and MLD, respectively.
IGMPv1 Joins Received	The number of Received IGMPv1 Join's.
IGMPv2/MLDv1 Reports Received	The number of Received IGMPv2 Join's and MLDv1 Report's, respectively.
IGMPv3/MLDv2 Reports Received	The number of Received IGMPv1 Join's and MLDv2 Report's, respectively.
IGMPv2/MLDv1 Leaves Received	The number of Received IGMPv2 Leave's and MLDv1 Done's, respectively.

4.6.8.5 MVR Channels (Groups) Information

Entries in the MVR Channels (Groups) Information Table are shown on this section.

The MVR Channels (Groups) Information Table is sorted first by VLAN ID, and then by group.

Web GUI: Monitor > MVR > Statistics



Start from VLAN 1 and Group Address :: with 20 entries per page.

		Port Members																				
VLAN ID	Groups	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No more entries																						

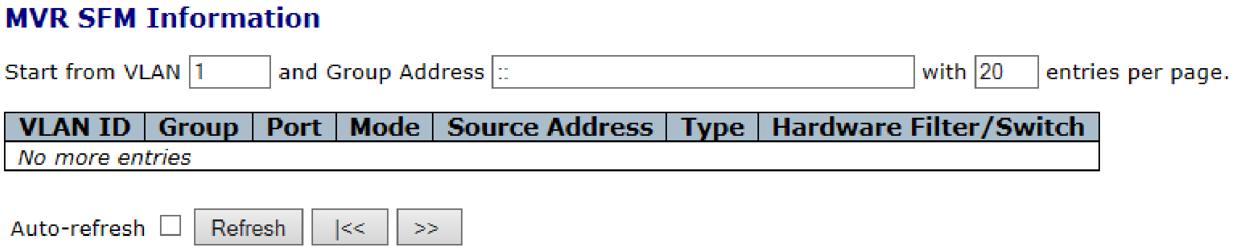
Figure 4-45: MVR Channels (Group) Information display

Table 4-42: MVR Channels (Group) Information parameters

MVR Channels (Groups) Information Table	
VLAN ID	VLAN ID of the group
Group	Group address of the group displayed.
Port Members	Ports under this group.
Navigating the MVR Channels (Groups) Information Table Each page shows up to 99 entries from the MVR Group table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the MVR Channels (Groups) Information Table. The "Start from VLAN", and "Group Address" input fields allow the user to select the starting point in the MVR Channels (Groups) Information Table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next MVR Channels (Groups) Information Table match In addition, the two input fields will - upon a **Refresh** button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address. The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.	

4.6.8.6 MVR SFM Information

Web GUI: Monitor > MVR > MVR SFM Information



MVR SFM Information

Start from VLAN 1 and Group Address :: with 20 entries per page.

VLAN ID	Group	Port	Mode	Source Address	Type	Hardware Filter/Switch
No more entries						

Figure 4-46: MVR SFM Information display

Table 4-43: MVR SFM Information parameters

MVR SFM) Information Table	
ID VLAN	VLAN ID of the group.
Group	Group address of the group displayed.
Port	Switch port number.
Mode	Indicates the filtering mode maintained per (VLAN ID, port number, Group Address) basis. It can be either **Include** or **Exclude**.
Source Address	IP Address of the source. Currently, the maximum number of IP source address for filtering (per group) is 8. When there is no source filtering address, the text "None" is shown in the Source Address field.

Type	Indicates the Type. It can be either **Allow** or **Deny**.
Hardware Filter/Switch	Indicates whether data plane destined to the specific group address from the source IPv4/IPv6 address could be handled by the chip or not.

Navigating the MVR SFM Information Table

Each page shows up to 99 entries from the MVR SFM Information table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the MVR SFM Information table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next MVR SFM Information Table match. In addition, the two input fields will - upon a **Refresh** button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address. The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

4.7 Quality of Service (QoS)

QoS is an acronym for **Q**uality **o**f **S**ervice. It is a method to guarantee a bandwidth relationship between individual applications or protocols. A communications network transports a multitude of applications and data, including high-quality video and delay-sensitive data such as real-time voice. Networks must provide secure, predictable, measurable, and sometimes guaranteed services.

Achieving the required QoS becomes the secret to a successful end-to-end business solution. Therefore, QoS is the set of techniques to manage network resources.

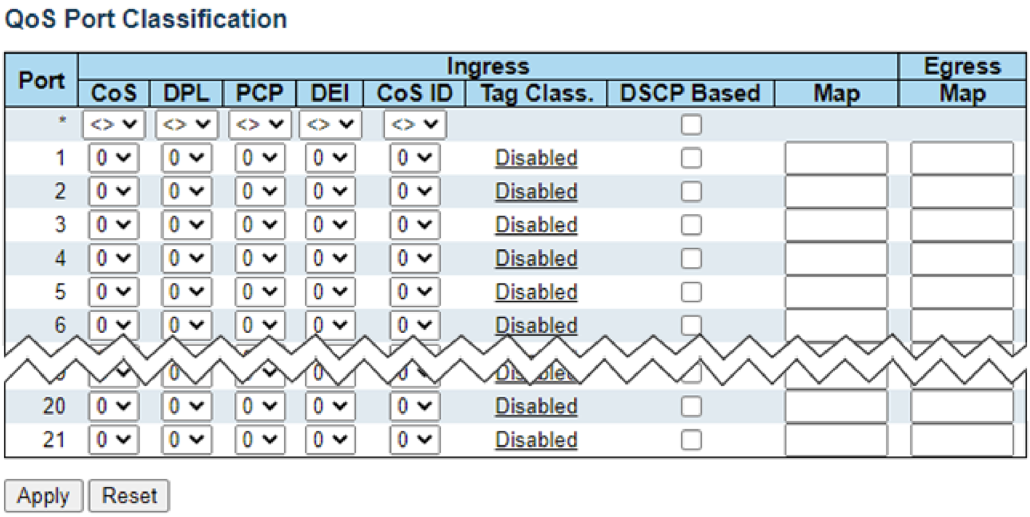
R Class series QoS mechanism integrates a set of techniques to determine how frames pass through the switch. The different functions are briefly described below. See also Frame Processing Overview.

- **Scheduling**: this function is performed in the Scheduler block on the egress side. The egress scheduler supports both Strict Priority scheduling and Weighted Fair Queuing (WFQ). Each egress port has 8 queues.
- **Classification**: this function is performed in the Classifier block on the ingress side. The Classifier checks the header of the frames to decide to which Class of Service to assign the frame. The class of service is the queue number to which the frame is sent on egress (see Scheduling above). The classification is based on L2 to L4 frame header fields. This enables dynamic and flexible QoS based handling of the frames.
- **Rate Limiting**: this function enables control of the traffic flow rate, by policing and shaping using the following techniques (See Rate Limiters for more details):

4.7.1 QoS Ingress Port Classification

This section allows you to configure the basic QoS Ingress Classification settings for all switch ports.

Web GUI: Configuration > QoS > Port Classification



QoS Port Classification

Port	Ingress								Egress
	CoS	DPL	PCP	DEI	CoS ID	Tag Class.	DSCP Based	Map	Map
*	<>	<>	<>	<>	<>		☐		
1	0	0	0	0	0	Disabled	☐		
2	0	0	0	0	0	Disabled	☐		
3	0	0	0	0	0	Disabled	☐		
4	0	0	0	0	0	Disabled	☐		
5	0	0	0	0	0	Disabled	☐		
6	0	0	0	0	0	Disabled	☐		
20	0	0	0	0	0	Disabled	☐		
21	0	0	0	0	0	Disabled	☐		

Figure 4-47: QoS Ingress Port Classification settings

Table 4-44: QoS Ingress Port Classification parameters

QoS Ingress Port Classification	
Port	The port number for which the configuration below applies.
Cos	Controls the default class of service. All frames are classified to a CoS. There is a one-to-one mapping between CoS, queue and priority. A CoS of 0zero) has the lowest priority. If the port is VLAN aware, the frame is tagged and Tag Class. is enabled, then the frame is classified to a CoS that is mapped from the PCP and DEI value in the tag. Otherwise, the frame is classified to the default CoS. The classified CoS can be overruled by a QCL entry. *Note: If the default CoS has been dynamically changed, then the actual default CoS is shown in parentheses after the configured default CoS.*
DPL	Controls the default **Drop Precedence Level**. All frames are classified to a drop precedence level. If the port is VLAN aware, the frame is tagged and Tag Class. is enabled, then the frame is classified to a DPL that is mapped from the PCP and DEI value in the tag. Otherwise, the frame is classified to the default DPL. The classified DPL can be overruled by a QCL entry
PCP	Controls the default PCP (**P**riority **C**ode **P**oint). All frames are classified to a PCP entry If the port is VLAN aware and the frame is tagged, then the frame is classified to the PCP value in the tag Otherwise the frame is classified to the default PCP value.
DEI	Controls the default DEI for untagged frames. All frames are classified to a DEI value If the port is VLAN aware and the frame is tagged, then the frame is classified to the DEI value in the tag Otherwise the frame is classified to the default DEI value.
CoS ID	Controls the default CoS ID value. Every incoming frame is classified to a CoS ID, which later can be used as basis for rewriting of different parts of the frame.
Tag Class.	Shows the classification mode for tagged frames on this port. Disabled: Use default QoS class and DP level for tagged frames. Enabled: Use mapped versions of PCP and DEI for tagged frames. Click on the mode to configure the mode and/or mapping. Note: This setting has no effect if the port is VLAN unaware. Tagged frames received on VLAN unaware ports are always classified to the default CoS and DPL.
DSCP Based	Click to Enable DSCP Based QoS Ingress Port Classification.

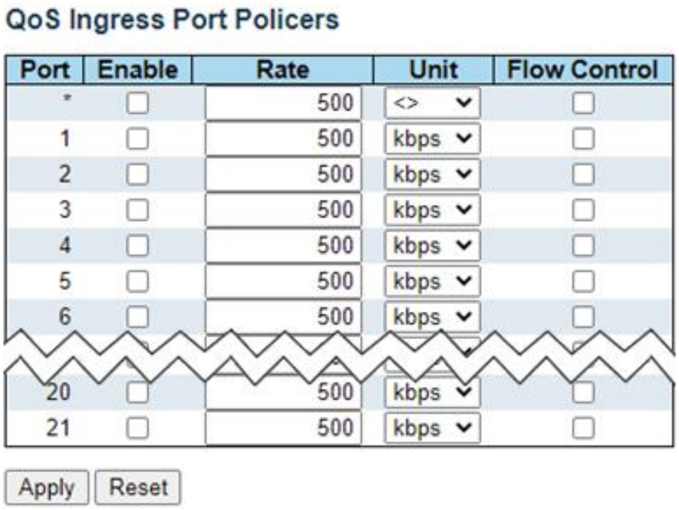
Ingress Map	Controls the Ingress Map selection through the Map ID. The Ingress Map ID ranges from **0** to **255**. An empty field indicates no map selection.
Egress Map	Controls the Egress Map selection through the Map ID. The Egress Map ID ranges from **0** to **511**. An empty field indicates no map selection.

4.7.2 QoS Ingress Port Policers

This section allows you to configure the Policer settings for all switch ports.

A policer can limit the bandwidth of received frames. It is in front of the ingress queue.

Web GUI: Configuration > QoS > Port Policing



QoS Ingress Port Policers

Port	Enable	Rate	Unit	Flow Control
*	☐	500	<>	☐
1	☐	500	kbps	☐
2	☐	500	kbps	☐
3	☐	500	kbps	☐
4	☐	500	kbps	☐
5	☐	500	kbps	☐
6	☐	500	kbps	☐
20	☐	500	kbps	☐
21	☐	500	kbps	☐

Figure 4-48: QoS Ingress Port Policers

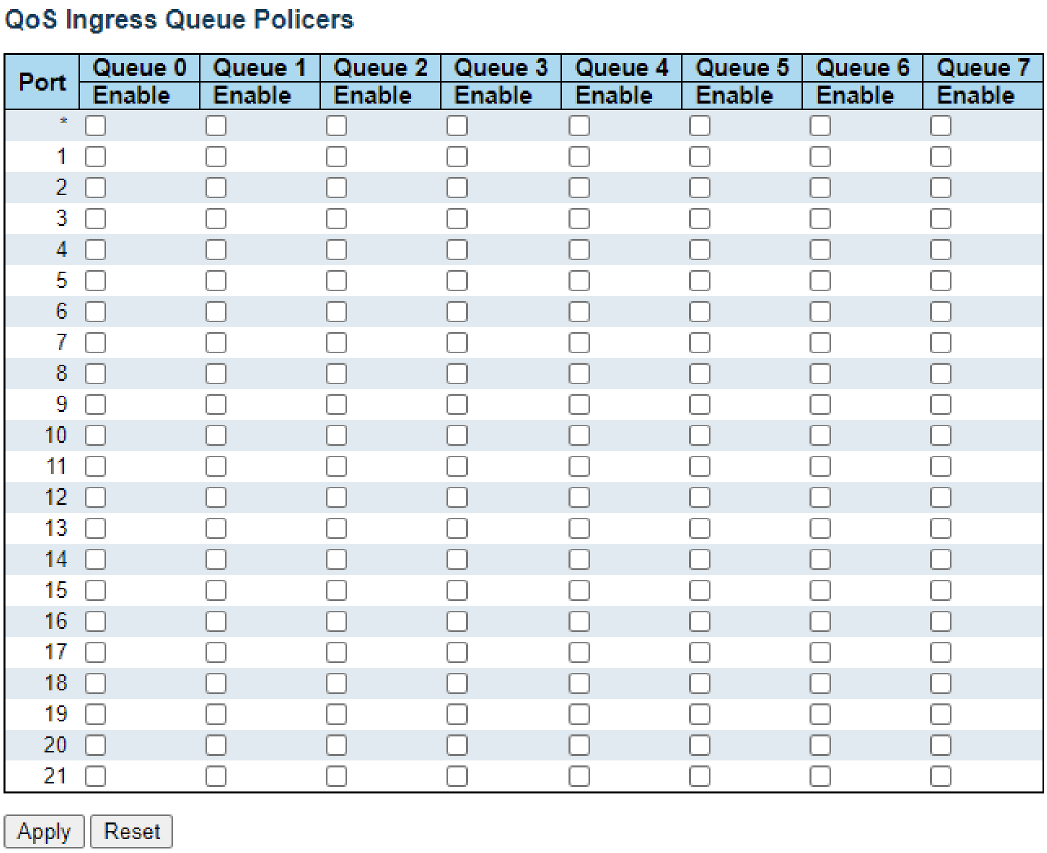
Table 4-45: QoS Ingress Port Policers Parameters

Port	The port number for which the configuration below applies.
Enable	Controls whether the policer is enabled on this switch port.
Rate	Controls the rate for the policer. The default value is 500. This value is restricted to 100-1000000 when the **Unit** is **kbps** or **fps**, and it is restricted to 1-3300 when the **Unit** is **Mbps** or **KFPS**.
Unit	Controls the unit of measure for the policer rate as **kbps**, **Mbps**, **fps** or **KFPS**. The default value is **kbps**.
Flow Control	If flow control is enabled and the port is in flow control mode, then pause frames are sent instead of discarding frames.

4.7.3 QoS Ingress Queue Policers

This section permits to configure the Queue Policer settings for all switch ports. A Policer can limit the bandwidth of received frames. It is in front of the ingress queue.

Web GUI: Configuration > QoS > Queue Policing



QoS Ingress Queue Policers

Port	Queue 0 Enable	Queue 1 Enable	Queue 2 Enable	Queue 3 Enable	Queue 4 Enable	Queue 5 Enable	Queue 6 Enable	Queue 7 Enable
*	☐	☐	☐	☐	☐	☐	☐	☐
1	☐	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐	☐	☐	☐
7	☐	☐	☐	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐	☐
11	☐	☐	☐	☐	☐	☐	☐	☐
12	☐	☐	☐	☐	☐	☐	☐	☐
13	☐	☐	☐	☐	☐	☐	☐	☐
14	☐	☐	☐	☐	☐	☐	☐	☐
15	☐	☐	☐	☐	☐	☐	☐	☐
16	☐	☐	☐	☐	☐	☐	☐	☐
17	☐	☐	☐	☐	☐	☐	☐	☐
18	☐	☐	☐	☐	☐	☐	☐	☐
19	☐	☐	☐	☐	☐	☐	☐	☐
20	☐	☐	☐	☐	☐	☐	☐	☐
21	☐	☐	☐	☐	☐	☐	☐	☐

Figure 4-49: QoS Ingress Queue Policers display

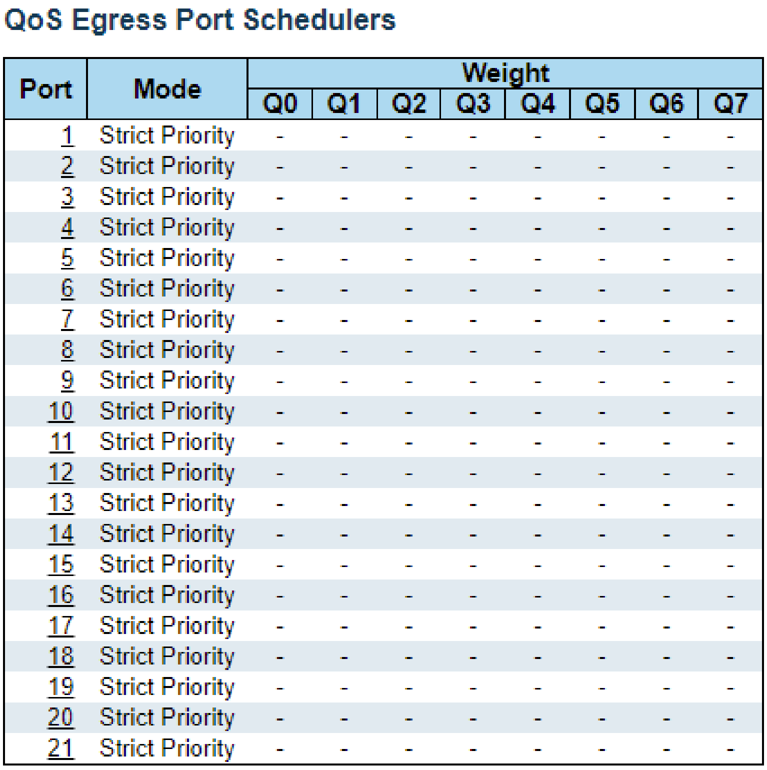
Table 4-46: QoS Ingress Queue Policers Config parameters

Port	The port number for which the configuration below applies.
Enable	Enable or disable the queue policer for this switch port.
Rate	Controls the rate for the queue policer. This value is restricted to 100-3276700 when **Unit** is kbps, and 1-3276 when **Unit** is **Mbps**. The rate is internally rounded up to the nearest value supported by the queue policer.
Unit	Controls the unit of measure for the queue policer rate as kbps, or Mbps This field is only shown if at least one of the queue policers are enabled.

4.7.4 QoS Egress Port Schedulers

This section provides an overview of QoS Egress Port Schedulers for all switch ports.

Web GUI: Configuration > QoS > Port Scheduler



QoS Egress Port Schedulers

Port	Mode	Weight							
		Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
1	Strict Priority	-	-	-	-	-	-	-	-
2	Strict Priority	-	-	-	-	-	-	-	-
3	Strict Priority	-	-	-	-	-	-	-	-
4	Strict Priority	-	-	-	-	-	-	-	-
5	Strict Priority	-	-	-	-	-	-	-	-
6	Strict Priority	-	-	-	-	-	-	-	-
7	Strict Priority	-	-	-	-	-	-	-	-
8	Strict Priority	-	-	-	-	-	-	-	-
9	Strict Priority	-	-	-	-	-	-	-	-
10	Strict Priority	-	-	-	-	-	-	-	-
11	Strict Priority	-	-	-	-	-	-	-	-
12	Strict Priority	-	-	-	-	-	-	-	-
13	Strict Priority	-	-	-	-	-	-	-	-
14	Strict Priority	-	-	-	-	-	-	-	-
15	Strict Priority	-	-	-	-	-	-	-	-
16	Strict Priority	-	-	-	-	-	-	-	-
17	Strict Priority	-	-	-	-	-	-	-	-
18	Strict Priority	-	-	-	-	-	-	-	-
19	Strict Priority	-	-	-	-	-	-	-	-
20	Strict Priority	-	-	-	-	-	-	-	-
21	Strict Priority	-	-	-	-	-	-	-	-

Figure 4-50: QoS Egress Port Schedulers

Table 4-47: QoS Egress Port Schedulers Parameters

Port	The logical port for the settings contained in the same row. Click on the port number to configure the schedulers.
Mode	Shows the scheduling mode for this port.
Qn	Shows the weight for this queue and port.

By clicking on any listed port number, you may access to another display where you may configure the QoS Egress Scheduler and Shapers for a specific selected port.

Refer to next page for an illustrated example

Web GUI: Configuration > QoS > Port Scheduler

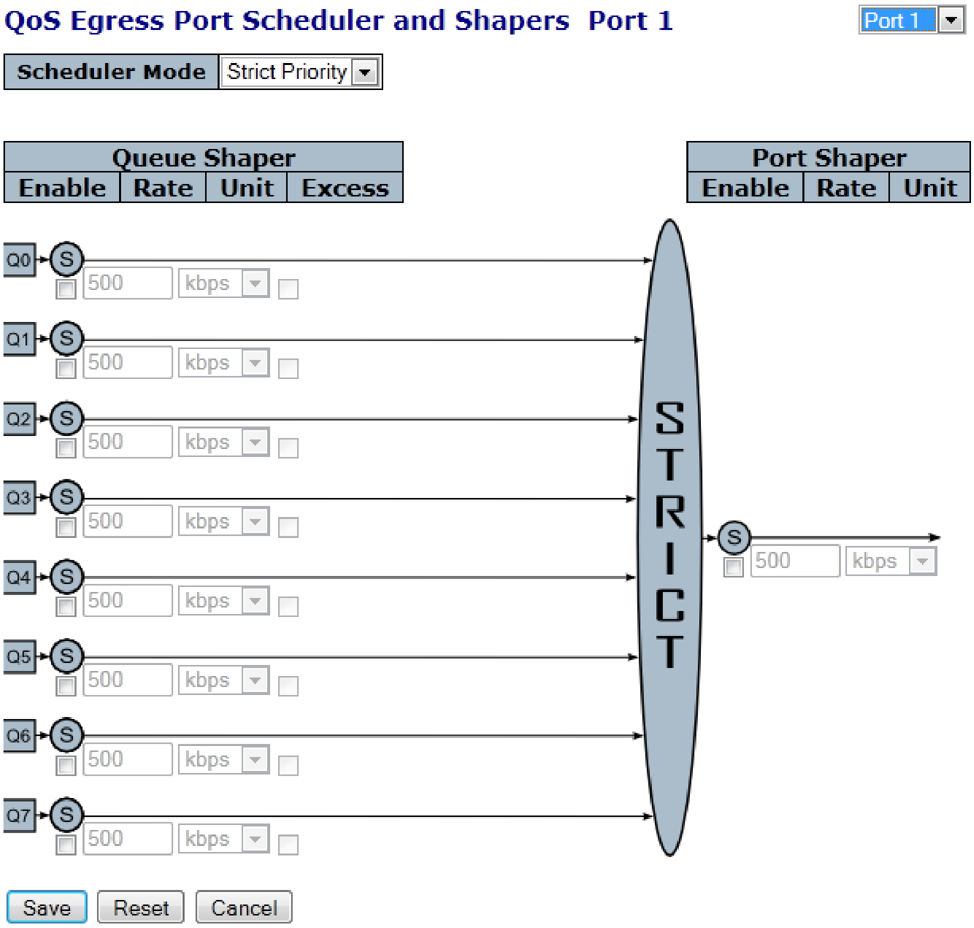

QoS Egress Port Scheduler and Shapers Port 1
Port 1
Scheduler Mode
Strict Priority
Queue Shaper
Enable
Rate
Unit
Excess
Port Shaper
Enable
Rate
Unit
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
S
500
kbps
STRICT
Save
Reset
Cancel

Figure 4-51: QoS Egress Port Schedulers and Shapers

Table 4-48: QoS Egress Port Schedulers and Shapers Parameters

Scheduler Mode	Controls whether the scheduler mode is **Strict Priority** or **Weighted** on this switch port.
Queue Shaper Enable	Controls whether the queue shaper is enabled for this queue on this switch port.
Queue Shaper Rate	Controls the rate for the queue shaper. The default value is 500. This value is restricted to 100-1000000 when the **Unit** is **kbps**, and it is restricted to 1-3300 when the **Unit** is **Mbps**.
Queue Shaper Unit	Controls the unit of measure for the queue shaper rate as **kbps** or **Mbps**. The default value is **kbps**.
Queue Shaper Rate-type	The rate type of the queue shaper. The allowed values are: • **Line**: Specify that this shaper operates online rate. • **Data**: Specify that this shaper operates on data rate.
Queue Scheduler Cut-through	Controls whether the queue has cut-through enabled.
Queue Scheduler Preemption	Controls whether the queue has frame preemption enabled.

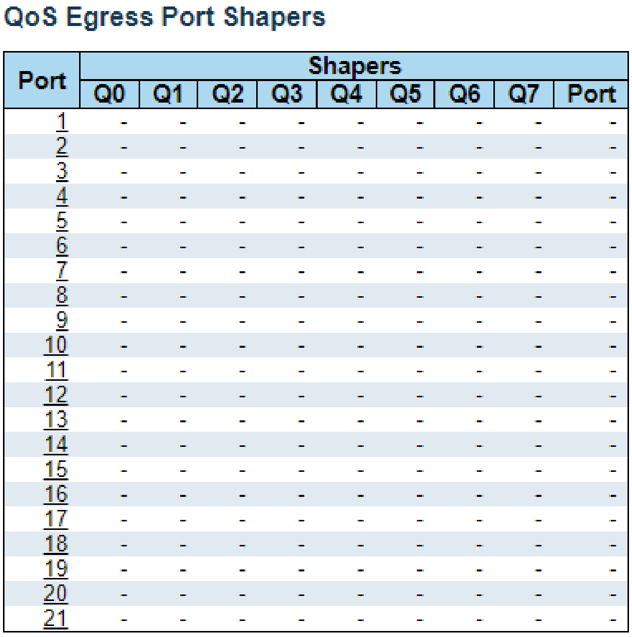
Queue Scheduler Weight	Controls the weight for this queue. The default value is **17.** This value is restricted to 1-100. This parameter is only shown if **Scheduler Mode** is set to **Weighted**.
Queue Scheduler Percent	Shows the weight in percent for this queue. This parameter is only shown if **Scheduler Mode** is set to **Weighted**.
Port Shaper Enable	Controls whether the port shaper is enabled for this switch port.
Port Shaper Rate	Controls the rate for the port shaper. The default value is 500. This value is restricted to 100-1000000 when the **Unit** is **kbps**, and it is restricted to 1-3300 when the **Unit** is **Mbps**.
Port Shaper Unit	Controls the unit of measure for the port shaper rate as **kbps** or **Mbps**. The default value is **kbps**.
Port Shaper Rate-type	The rate type of the port shaper. The allowed values are: • **Line**: Specify that this shaper operates on line rate. • **Data**: Specify that this shaper operates on data rate.

4.7.5 QoS Egress Port Shapers

This page provides an overview of QoS Egress Port Shapers for all switch ports.

This section provides an overview of QoS Egress Port Shapers for all switch ports.

Web GUI: Configuration > QoS > Port Shaping



QoS Egress Port Shapers

Port	Shapers								
	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Port
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-

Figure 4-52: QoS Egress Port Shapers display

Table 4-49: QoS Egress Port Shapers parameters

Port	The logical port for the settings contained in the same row. Click on the port number in order to configure the shapers.
Qn	Shows "-" for disabled or actual queue shaper rate - e.g., "800 Mbps".
Port	Shows "-" for disabled or actual port shaper rate - e.g., "800 Mbps".

By clicking on any port number in the above table, you may access another display, which will allow configuring the QoS Egress Scheduler and Shapers for a specific port.

Web GUI: Configuration > QoS > Port Shaping

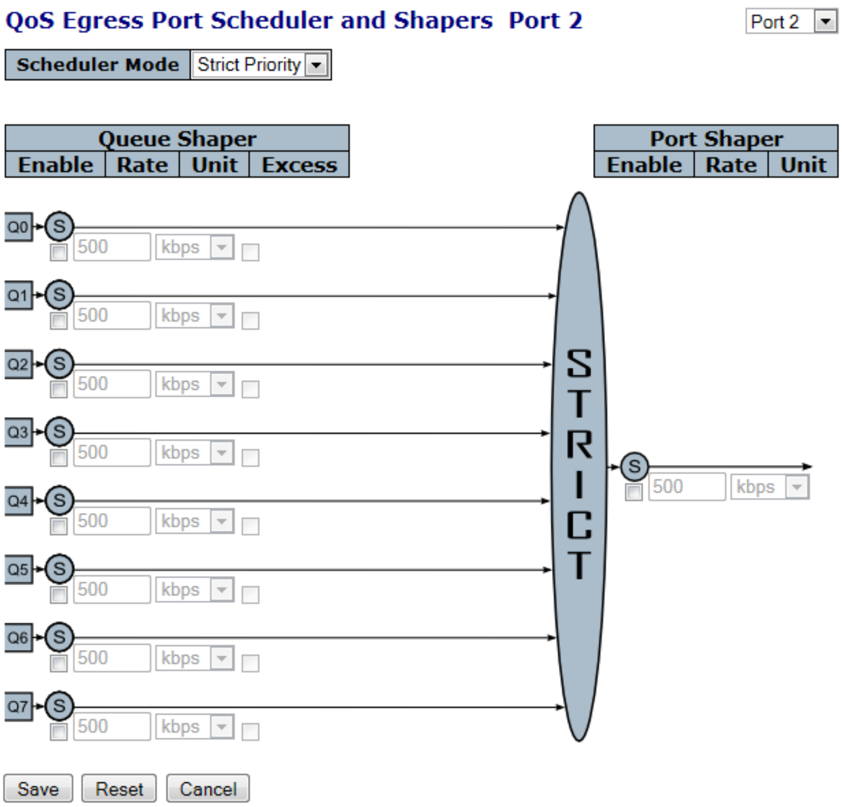

QoS Egress Port Scheduler and Shapers Port 2
Port 2
Scheduler Mode
Strict Priority
Queue Shaper
Enable
Rate
Unit
Excess
Port Shaper
Enable
Rate
Unit
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
S
500
kbps
STRICT
Save
Reset
Cancel

Figure 4-53: QoS Egress Port Scheduler and Shapers Configuration

Table 4-50: QoS Egress Port Scheduler & Shapers Parameters

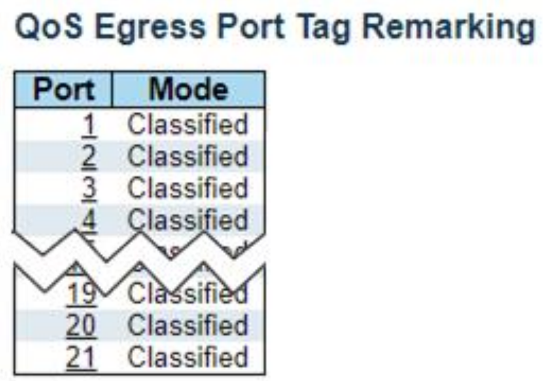
Scheduler Mode	Controls whether the scheduler mode is **Strict Priority** or **Weighted** on this switch port.
Queue Shaper Enable	Controls whether the queue shaper is enabled for this queue on this switch port.
Queue Shaper Rate	Controls the rate for the queue shaper. The default value is 500. This value is restricted to 100-1000000 when the **Unit** is **kbps**, and it is restricted to 1-3300 when the **Unit** is **Mbps**.
Queue Shaper Unit	Controls the unit of measure for the queue shaper rate as **kbps** or **Mbps**. The default value is **kbps**.
Queue Shaper Rate-type	The rate type of the queue shaper. The allowed values are: • **Line**: Specify that this shaper operates online rate. • **Data**: Specify that this shaper operates on data rate.
Queue Scheduler Cut-through	Controls whether the queue has cut-through enabled.
Queue Scheduler Preemption	Controls whether the queue has frame preemption enabled.

Queue Scheduler Weight	Controls the weight for this queue. The default value is "17". This value is restricted to 1-100. This parameter is only shown if "Scheduler Mode" is set to "Weighted".
Queue Scheduler Percent	Shows the weight in percent for this queue. This parameter is only shown if "Scheduler Mode" is set to "Weighted".
Port Shaper Enable	Controls whether the port shaper is enabled for this switch port.
Port Shaper Rate	Controls the rate for the port shaper. The default value is 500. This value is restricted to 100-1000000 when the "Unit" is "kbps", and it is restricted to 1-3300 when the "Unit" is "Mbps".
Port Shaper Unit	Controls the unit of measure for the port shaper rate as "kbps" or "Mbps". The default value is "kbps".
Port Shaper Rate-type	The rate type of the port shaper. The allowed values are: • **Line**: Specify that this shaper operates on line rate. • **Data**: Specify that this shaper operates on data rate.

4.7.6 QoS Egress Port Tag Remarking

This section provides an overview of QoS Egress Port Tag Remarking for all switch ports.

Web GUI: Configuration > QoS > Port Tag Remarking

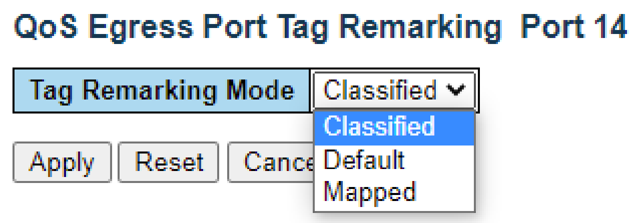


QoS Egress Port Tag Remarking

Port	Mode
1	Classified
2	Classified
3	Classified
4	Classified
19	Classified
20	Classified
21	Classified

Figure 4-54: QoS Egress Port Tag Remarking

By clicking on any port, you may configure the selected port (see example for port 6).



QoS Egress Port Tag Remarking Port 14

Tag Remarking Mode: Classified

Figure 4-55: QoS Egress Port Tag Remarking

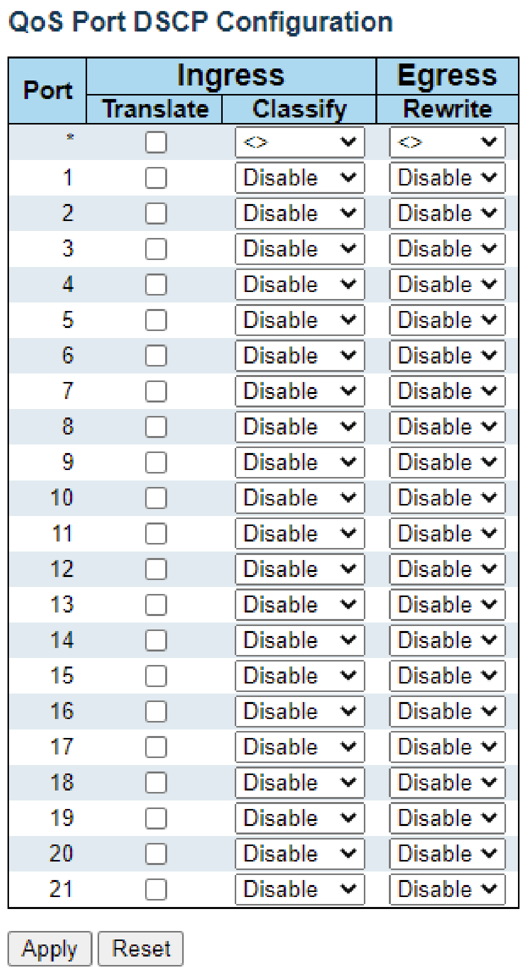
Table 4-51: QoS Egress Port Tag Remarking Parameters

Port	The logical port for the settings contained in the same row. Click on the port number to configure the tag remarking. See example in picture above for port 6
Mode	Shows the tag remarking mode for this port. • **Classified**: Use classified PCP/DEI values. • **Default**: Use default PCP/DEI values. • **Mapped**: Use mapped versions of QoS class and DP level.

4.7.7 Qos Port DSCP Configuration

This section allows you to configure the basic QoS Port DSCP configuration settings for all switch ports. DSCP (**D**ifferentiated **S**ervices **C**ode **P**oint) is a field in the header of IP packets for packet classification purposes.

Web GUI: Configuration > QoS > Port Tag Remarking



QoS Port DSCP Configuration

Port	Ingress		Egress
	Translate	Classify	Rewrite
*	☐	<>	<>
1	☐	Disable	Disable
2	☐	Disable	Disable
3	☐	Disable	Disable
4	☐	Disable	Disable
5	☐	Disable	Disable
6	☐	Disable	Disable
7	☐	Disable	Disable
8	☐	Disable	Disable
9	☐	Disable	Disable
10	☐	Disable	Disable
11	☐	Disable	Disable
12	☐	Disable	Disable
13	☐	Disable	Disable
14	☐	Disable	Disable
15	☐	Disable	Disable
16	☐	Disable	Disable
17	☐	Disable	Disable
18	☐	Disable	Disable
19	☐	Disable	Disable
20	☐	Disable	Disable
21	☐	Disable	Disable

Figure 4-56: QoS Port DSCP Configuration

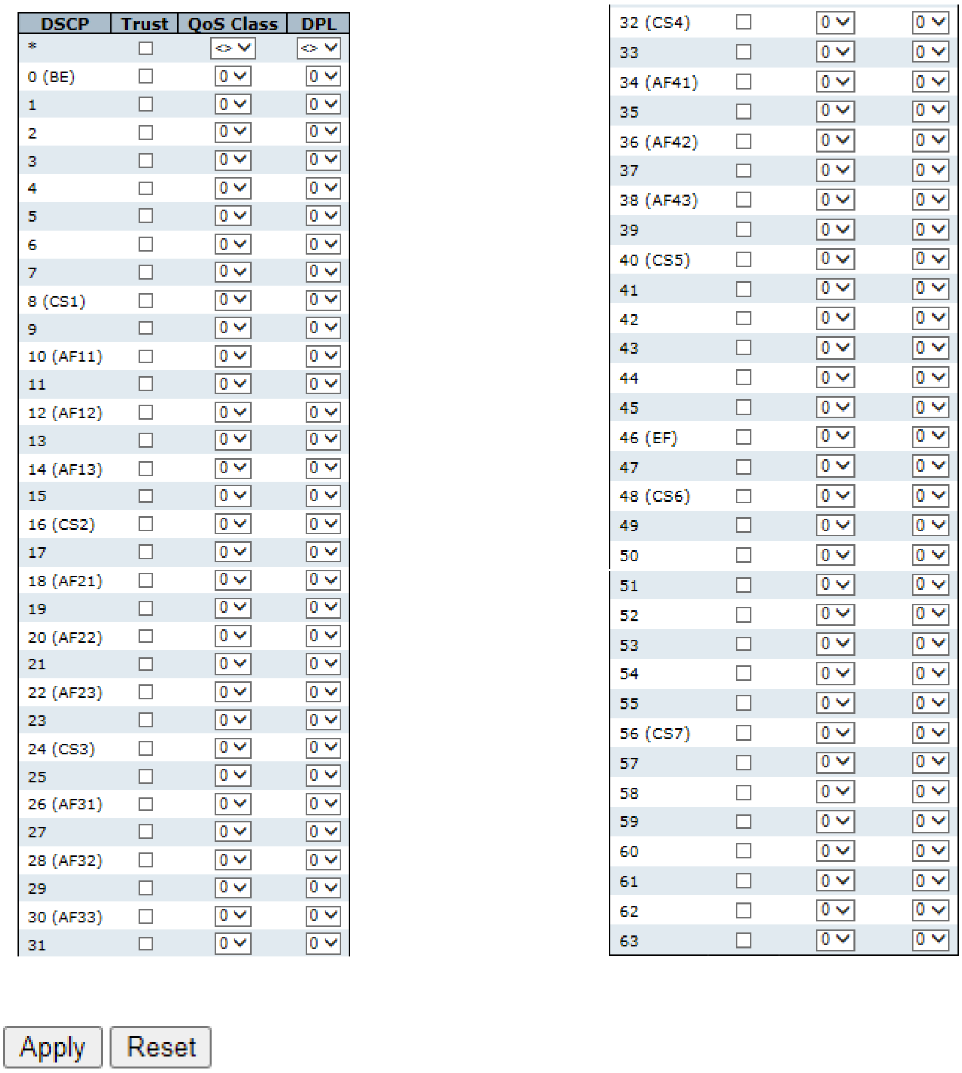
Table 4-52: QoS Port DSCP Configuration Parameters

Port	The Port column shows the list of ports for which you can configure DSCP ingress and egress settings.
Ingress	In Ingress settings you can change ingress translation and classification settings for individual ports. There are two configuration Parameters available in Ingress: **Translate** and **Classify**.
Translate	To Enable the Ingress Translation, click the checkbox.
Classify	Classification for a port has 4 different values. • **Disable**: No Ingress DSCP Classification. • **DSCP**=0: Classify if incoming (or translated if enabled) DSCP is 0. • **Selected**: Classify only selected DSCP for which classification is enabled as specified in DSCP Translation window for the specific DSCP. • **All**: Classify all DSCP.
Egress	Port Egress Rewriting can be one of the following: • **Disable:** No Egress rewrite. • **Enable:** Rewrite enabled without remapping. • **Remap**: DSCP from analyzer is remapped and frame is remarked with remapped DSCP value.

4.7.8 DSCP Based QoS Ingress Classification

This section allows you to configure the basic QoS DSCP based QoS Ingress Classification settings for all switches.

Web GUI: Configuration > QoS > DSCP-Based QoS



DSCP	Trust	QoS Class	DPL
*	☐	<>	<>
0 (BE)	☐	0	0
1	☐	0	0
2	☐	0	0
3	☐	0	0
4	☐	0	0
5	☐	0	0
6	☐	0	0
7	☐	0	0
8 (CS1)	☐	0	0
9	☐	0	0
10 (AF11)	☐	0	0
11	☐	0	0
12 (AF12)	☐	0	0
13	☐	0	0
14 (AF13)	☐	0	0
15	☐	0	0
16 (CS2)	☐	0	0
17	☐	0	0
18 (AF21)	☐	0	0
19	☐	0	0
20 (AF22)	☐	0	0
21	☐	0	0
22 (AF23)	☐	0	0
23	☐	0	0
24 (CS3)	☐	0	0
25	☐	0	0
26 (AF31)	☐	0	0
27	☐	0	0
28 (AF32)	☐	0	0
29	☐	0	0
30 (AF33)	☐	0	0
31	☐	0	0
32 (CS4)	☐	0	0
33	☐	0	0
34 (AF41)	☐	0	0
35	☐	0	0
36 (AF42)	☐	0	0
37	☐	0	0
38 (AF43)	☐	0	0
39	☐	0	0
40 (CS5)	☐	0	0
41	☐	0	0
42	☐	0	0
43	☐	0	0
44	☐	0	0
45	☐	0	0
46 (EF)	☐	0	0
47	☐	0	0
48 (CS6)	☐	0	0
49	☐	0	0
50	☐	0	0
51	☐	0	0
52	☐	0	0
53	☐	0	0
54	☐	0	0
55	☐	0	0
56 (CS7)	☐	0	0
57	☐	0	0
58	☐	0	0
59	☐	0	0
60	☐	0	0
61	☐	0	0
62	☐	0	0
63	☐	0	0

Figure 4-57: DSCP Based QoS Ingress Classification

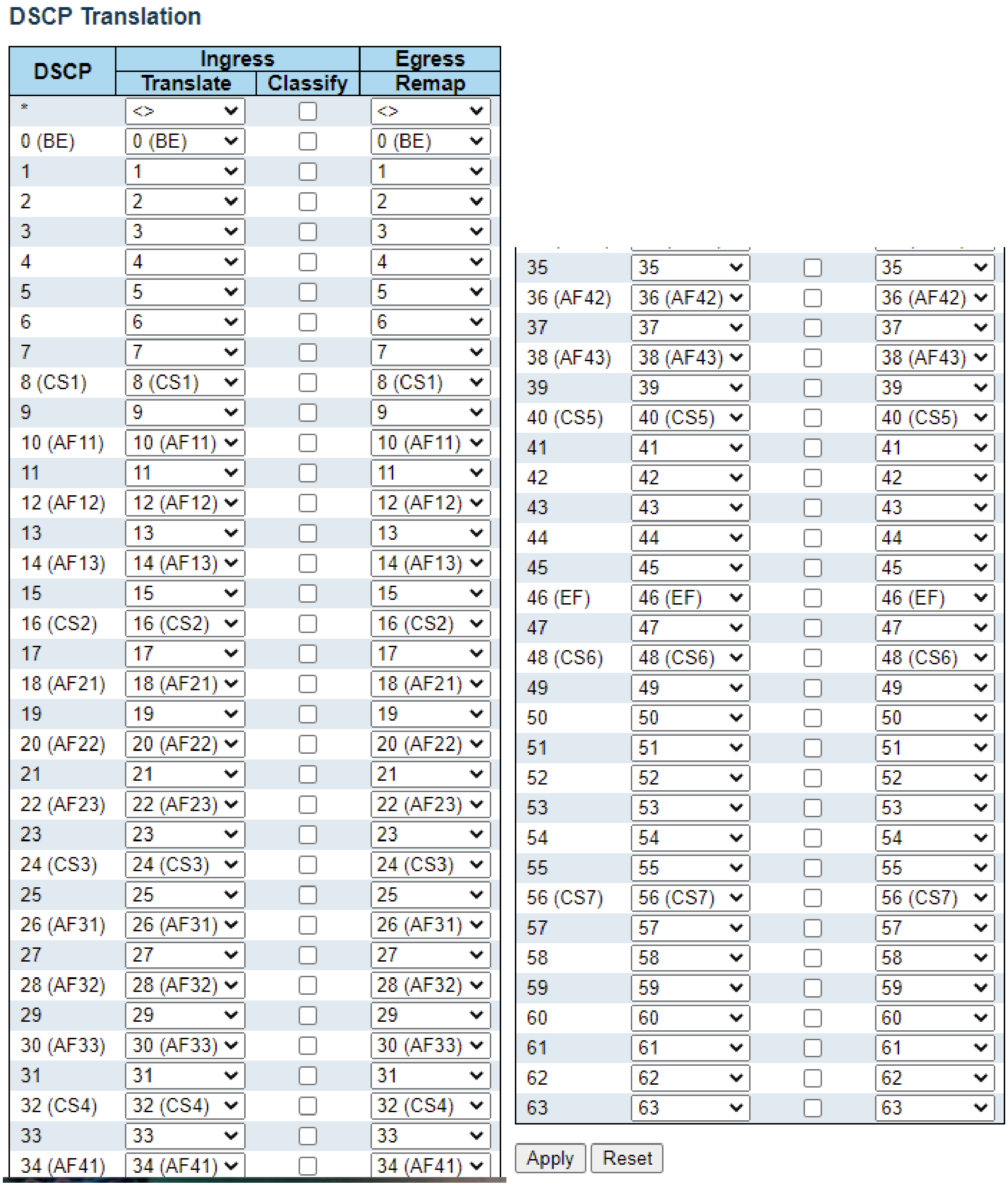
Table 4-53: DSCP Based QoS Ingress Classification Parameters

DSCP	**DSCP** is an acronym for **D**ifferentiated **S**ervices **C**ode **P**oint. It is a field in the header of IP packets for packet classification purposes Maximum number of supported DSCP values is 64.
Trust	Controls whether a specific DSCP value is trusted. Only frames with trusted DSCP values are mapped to a specific QoS class and Drop Precedence Level. Frames with untrusted DSCP values are treated as a non-IP frame.
QoS Class	QoS class value can be any of (0-7)
DPL	Drop Precedence Level (0-1). Every incoming frame is classified to a Drop Precedence Level (DP level), which is used throughout the device for providing congestion control guarantee to the frame according to what was configured for that specific DP level. A DP level of 0 (zero) corresponds to 'Committed' (Green) frames and a DP level of 1 corresponds to 'Discard Eligible' (Yellow) frames.

4.7.9 DSCP Translation

This section allows you to configure the basic QoS DSCP Translation settings for all switches. DSCP translation can be performed in Ingress or Egress.

Web GUI: Configuration > QoS > DSCP Translation



DSCP Translation

DSCP	Ingress		Egress
	Translate	Classify	Remap
*	<>	☐	<>
0 (BE)	0 (BE)	☐	0 (BE)
1	1	☐	1
2	2	☐	2
3	3	☐	3
4	4	☐	4
5	5	☐	5
6	6	☐	6
7	7	☐	7
8 (CS1)	8 (CS1)	☐	8 (CS1)
9	9	☐	9
10 (AF11)	10 (AF11)	☐	10 (AF11)
11	11	☐	11
12 (AF12)	12 (AF12)	☐	12 (AF12)
13	13	☐	13
14 (AF13)	14 (AF13)	☐	14 (AF13)
15	15	☐	15
16 (CS2)	16 (CS2)	☐	16 (CS2)
17	17	☐	17
18 (AF21)	18 (AF21)	☐	18 (AF21)
19	19	☐	19
20 (AF22)	20 (AF22)	☐	20 (AF22)
21	21	☐	21
22 (AF23)	22 (AF23)	☐	22 (AF23)
23	23	☐	23
24 (CS3)	24 (CS3)	☐	24 (CS3)
25	25	☐	25
26 (AF31)	26 (AF31)	☐	26 (AF31)
27	27	☐	27
28 (AF32)	28 (AF32)	☐	28 (AF32)
29	29	☐	29
30 (AF33)	30 (AF33)	☐	30 (AF33)
31	31	☐	31
32 (CS4)	32 (CS4)	☐	32 (CS4)
33	33	☐	33
34 (AF41)	34 (AF41)	☐	34 (AF41)
35	35	☐	35
36 (AF42)	36 (AF42)	☐	36 (AF42)
37	37	☐	37
38 (AF43)	38 (AF43)	☐	38 (AF43)
39	39	☐	39
40 (CS5)	40 (CS5)	☐	40 (CS5)
41	41	☐	41
42	42	☐	42
43	43	☐	43
44	44	☐	44
45	45	☐	45
46 (EF)	46 (EF)	☐	46 (EF)
47	47	☐	47
48 (CS6)	48 (CS6)	☐	48 (CS6)
49	49	☐	49
50	50	☐	50
51	51	☐	51
52	52	☐	52
53	53	☐	53
54	54	☐	54
55	55	☐	55
56 (CS7)	56 (CS7)	☐	56 (CS7)
57	57	☐	57
58	58	☐	58
59	59	☐	59
60	60	☐	60
61	61	☐	61
62	62	☐	62
63	63	☐	63

Figure 4-58: DSCP Translation

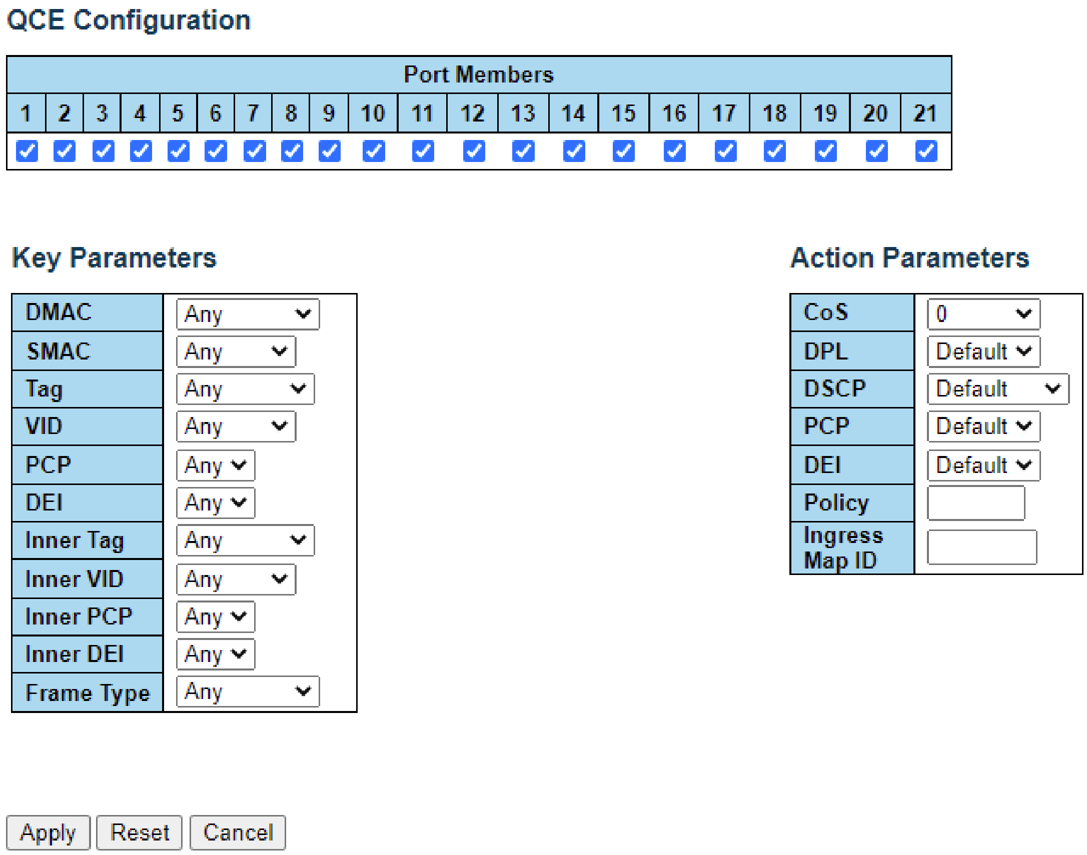
Table 4-54: DSCP Translation Parameters

DSCP	Maximum number of supported DSCP values is 64. and valid DSCP value ranges from 0 to 63.
Ingress	Ingress side DSCP can be first translated to new DSCP before using the DSCP for QoS class and DPL map. There are two configuration Parameters for DSCP Translation. **1. Translate:** DSCP at Ingress side can be translated to any of (0-63) DSCP values. **2. Classify:** Click to enable Classification at Ingress side.
Egress	There are the following configurable Parameters for Egress side. **Remap**: Select the DSCP value from select menu to which you want to remap. DSCP value ranges from 0 to 63.

4.7.10 QoS Control List Configuration

This section shows the QoS Control List (**QCL**), which is made up of the **QCE**s. Each row describes a QCE that is defined. The maximum number of QCEs is **256** on each switch. Click on the lowest plus sign to add a new QCE to the list.

Web GUI: Configuration > QoS > DSCP Translation



QCE Configuration

Port Members																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Key Parameters

DMAC	Any
SMAC	Any
Tag	Any
VID	Any
PCP	Any
DEI	Any
Inner Tag	Any
Inner VID	Any
Inner PCP	Any
Inner DEI	Any
Frame Type	Any

Action Parameters

CoS	0
DPL	Default
DSCP	Default
PCP	Default
DEI	Default
Policy	
Ingress Map ID	

Figure 4-59: Quality of Service Control List Configuration

Table 4-55: Quality of Service Control List Configuration Parameters

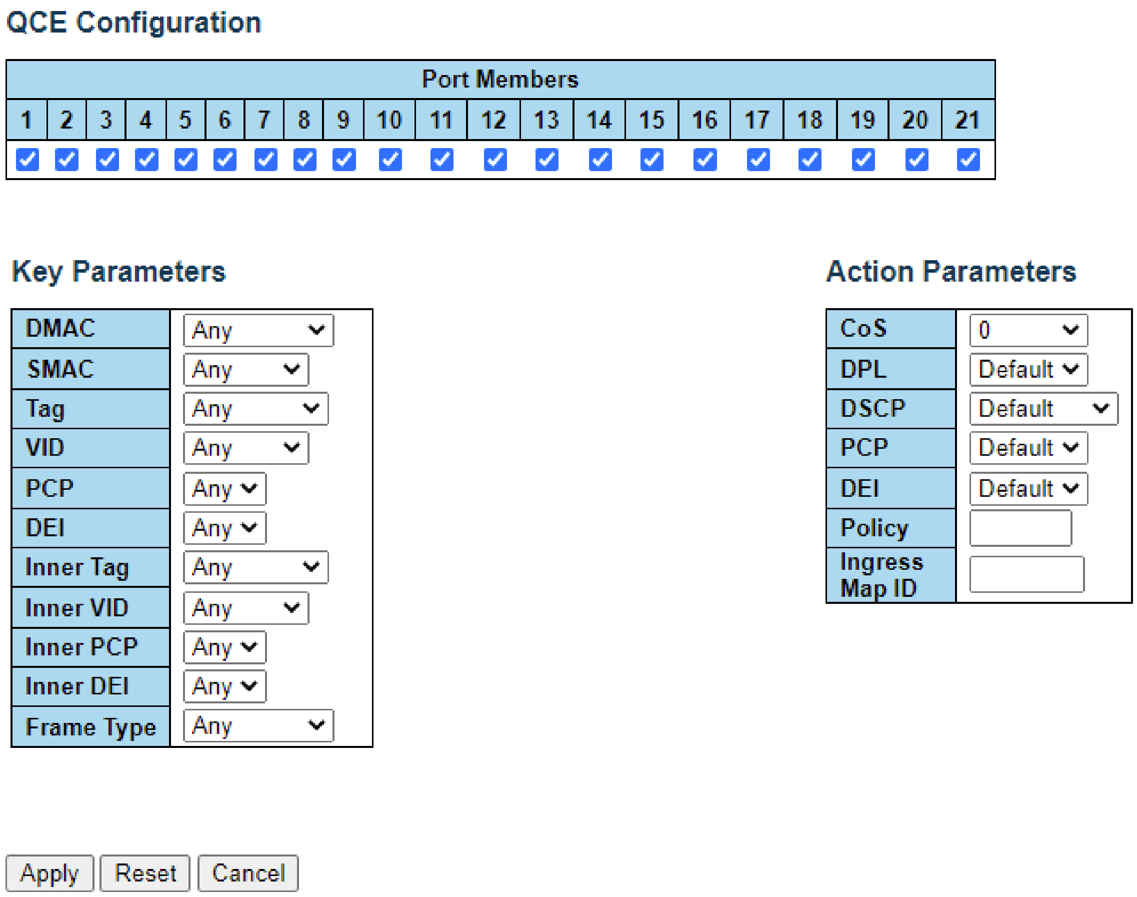
QCE	Indicates the QCE.id
Port	Indicates the list of ports configured with the QCE or **Any**.
DMAC	Specify the type of Destination MAC addresses for incoming frame. Possible values are: • **Any**: All types of Destination MAC addresses are allowed. • **Unicast**: Only Unicast MAC addresses are allowed. • **Multicast**: Only Multicast MAC addresses are allowed. • **Broadcast**: Only Broadcast MAC addresses are allowed. The default value is **Any**.
SMAC	Match specific source MAC address or **Any**. If a port is configured to match on destination addresses, this field indicates the DMAC.
Tag Type	Indicates tag type. Possible values are: • **Any**: Match tagged and untagged frames. • **Untagged**: Match untagged frames. • **Tagged**: Match tagged frames. The default value is 'Any'.
VID	Indicates (VLAN ID), either a specific VID or range of VIDs. VID can be in the range 1-4095 or 'Any
PCP	**Priority Code Point:** Valid value PCP are specific (0, 1, 2, 3, 4, 5, 6, 7) or range (0-1, 2-3, 4-5, 6-7, 0-3, 4-7) or 'Any'.
DEI	**Drop Eligible Indicator**: Valid value of DEI can be any of values between 0, 1 or **Any**.
Frame Type	Indicates the type of frame. Possible values are: **`Any:`** match any frame type. **`Ethernet:`** Match Ethernet type frames **`LLC`**: Only (LLC) frames are allowed. • **LLC**: Match (LLC) frames. • **SNAP**: MMatch (NAP) frames • **IPv4**: Match IPV4 frames. • **IPv6**: Match IPV6 frames.
Action	Indicates the classification action taken on ingress frame if Parameters configured are matched with the frame's content. Possible actions are: • **CoS**: Classify Class of Service • **DPL**: Classify Drop Precedence Level. • **DSCP**: Classify DSCP value • **PCP**: Classify PCP value. • **DEI**: Classify DEI value. • **Policy**: Classify ACL Policy number.
Button Modification	⊕: The lowest plus sign adds a new QCE before the current row.

4.7.11 QCE Configuration

Note: By clicking on the ⊕ sign in the previous QoS Control List Configuration display, we get the below QCE Configuration display, by means of which we can select the required QCE Parameters.

This section allows to edit/insert a single QoS Control Entry at a time. A QCE consists of several Parameters. These Parameters vary according to the frame type that you select.

Web GUI: Configuration > QoS > DSCP Translation



QCE Configuration

Port Members																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Key Parameters

DMAC	Any
SMAC	Any
Tag	Any
VID	Any
PCP	Any
DEI	Any
Inner Tag	Any
Inner VID	Any
Inner PCP	Any
Inner DEI	Any
Frame Type	Any

Action Parameters

CoS	0
DPL	Default
DSCP	Default
PCP	Default
DEI	Default
Policy	
Ingress Map ID	

Figure 4-60: QCE Parameters displays

Table 4-56: QCE Configuration Parameters

Port Members	Check the checkbox button to include the port in the QCL entry. By default, all ports are included.
Key Parameters	Key configuration is described as below: • **DMAC**: Type Destination MAC type: possible values are unicast (UC), multicast (MC), broadcast (BC) or 'Any'. • **SMAC**: Source MAC address: xx-xx-xx (24 MS bits OUI) xx-xx-xx-xx-xx-xx or 'Any'. If a port is configured to match on DMAC/DIP, this field is the Destination MAC address • **Tag**: Value of Tag field can be 'Untagged', 'Tagged', 'C-Tagged', 'S-Tagged' or 'Any'.

	• **VID** Valid value of VLAN ID can be any value in the range 1-4095 or 'Any'; user can enter either a specific value or a range of VIDs. • **PCP** Priority Code Point: Valid value PCP are specific (0, 1, 2, 3, 4, 5, 6, 7) or range (0-1, 2-3, 4-5, 6-7, 0-3, 4-7) or 'Any'. • **DEI** Drop Eligible Indicator: Valid value of DEI can be any of values between 0, 1 or 'Any'. • **Inner Tag** Value of Inner Tag field can be 'Untagged', 'Tagged', 'C-Tagged', 'S-Tagged' or 'Any'. • **Inner VID** Valid value of Inner VLAN ID can be any value in the range 1-4095 or 'Any'; user can enter either a specific value or a range of VIDs. • **Inner PCP** Valid value of Inner PCP are specific (0, 1, 2, 3, 4, 5, 6, 7) or range (0-1, 2-3, 4-5, 6-7, 0-3, 4-7) or 'Any'. • **Inner DEI** Valid value of Inner DEI can be '0', '1' or 'Any'. • **Frame Type** Frame Type can have any of the following values: • 1.Any o Etherr TYype o LLC o SNAP o IPv4 o IPv6 *Note: All frame types are explained below.*
1.Any	Allow all types of frames.
2.Ether Type	**Ether Type** Valid Ethernet type can have a value within 0x600-0xFFFF or 'Any' but excluding 0x800(IPv4) and 0x86DD (IPv6).
3. LLC	**SSAP Address** Valid SSAP (Source Service Access Point) can vary from 0x00 to 0xFF or 'Any'. **DSAP Address** Valid DSAP (Destination Service Access Point) can vary from 0x00 to 0xFF or 'Any'. **Control** Valid Control field can vary from 0x00 to 0xFF or 'Any'
4.SNAP	**PID** Valid PID (a.k.a Ether T If a port is configured to match on DMAC/DIP, this field is the Destination IP address) can be 0x0000-0xFFFF or 'Any'.
5.IPv4	**Protocol** IP protocol number: (0-255, TCP or UDP) or 'Any'. **Source IP** Specific Source IP address in value/mask format or **Any**. IP and Mask are in the format x.y.z.w where x, y, z, and w are decimal numbers between 0 and 255. When Mask is converted to a 32-bit binary string and read from left to right, all bits following the first zero must also be zero. **Destination IP** Specific Destination IP address in value/mask format or **Any**. **IP Fragment** IPv4 frame fragmented option: yes|no|any.

	DSCP DiffServ Code Point value (DSCP): It can be a specific value, range of values or 'Any'. DSCP values are in the range 0-63 including BE, CS1-CS7, EF or AF11-AF43. **Sport** Source TCP/UDP port:(0-65535) or **Any**, specific or port range applicable for IP protocol UDP/TCP. **Dport** Destination TCP/UDP port:(0-65535) or 'Any', specific or port range applicable for IP protocol UDP/TCP.
6. IPv6	**Protocol** IP protocol number: (0-255, TCP or UDP) or **Any**. **Source IP** 32 LS bits of IPv6 source address in value/mask format or **Any**. If a port is configured to match on DMAC/DIP, this field is the Destination IP address.**DSCP** DiffServ Code Point value (DSCP): It can be a specific value, range of values or 'Any'. DSCP values are in the range 0-63 including BE, CS1-CS7, EF or AF11-AF43. **Sport** Source TCP/UDP port:(0-65535) or **Any**, specific or port range applicable for IP protocol UDP/TCP. **Dport** Destination TCP/UDP port:(0-65535) or **Any**, specific or port range applicable for IP protocol UDP/TCP.
Action Parameters	Indicates the classification action taken on ingress frame if Parameters configured are matched with the frame's content. • **CoS**: Class of Service (0-7) or **Default** • **DP:** Drop Precedence Level (0-1) or **Default**. • **DSCP**: DSCP (0-63, BE, CS1-CS7, EF or AF11-AF43) or **Default**. • **PCP** PCP: (0-7) or **Default**. Note: PCP and DEI cannot be set individually. • **DEI** DEI: (0-1) or **Default**. • **Policy** ACL Policy number: (0-255) or 'Default' (empty field). • **Ingress Map ID** (0-255) or no Ingress Map (empty field).

Note: 'Default' means that the default-classified value is not modified by this QCE.

4.7.12 Rate Limiters

Rate Limiters control the rate of traffic sent or received on a network interface. Traffic that is less than or equal to the specified rate is forwarded (and may be delayed by a Shaper), whereas traffic that exceeds the rate is dropped or delayed.

Traffic Policer monitors network traffic for conformity with a traffic contract and if required, drops (or remarks) traffic to enforce compliance with that contract. Traffic sources which are aware of a traffic contract sometimes apply Traffic Shaping to ensure their output stays within the contract and is thus not dropped. Traffic exceeding a traffic contract may be tagged as non-compliant, dropped, or left as-is depending on configuration and circumstance.

Traffic Shaper attempts to control network traffic to optimize or guarantee the bandwidth by delaying packets that exceeds the configured bandwidth profile. Traffic shaping action results in a smooth, evenly distributed flow of frames, complying with the configured rate.

4.7.12.1 Leaky Bucket

The leaky-bucket algorithm is used to realize rate limiting (policing or shaping). A leaky bucket provides a mechanism by which bursty traffic can be limited/shaped to present a steady stream of traffic to the network

The dual leaky bucket implementation is named Two-rate Three Color Marker (TrTCM), for which configuration attributes are assigned:

- CIR: Committed Information Rate: the rate in bits-per-second which the Policer is committed to pass through.
- CBS: Committed Burst Size: the burst size in bytes, allowed for the committed bucket.
- EIR: Excess Information Rate: the rate in bits-per-second which the Policer is allowing to pass through when only excess resources are available.
- EBS: Excess Burst Size: the burst size in bytes, allowed for the excess bucket.

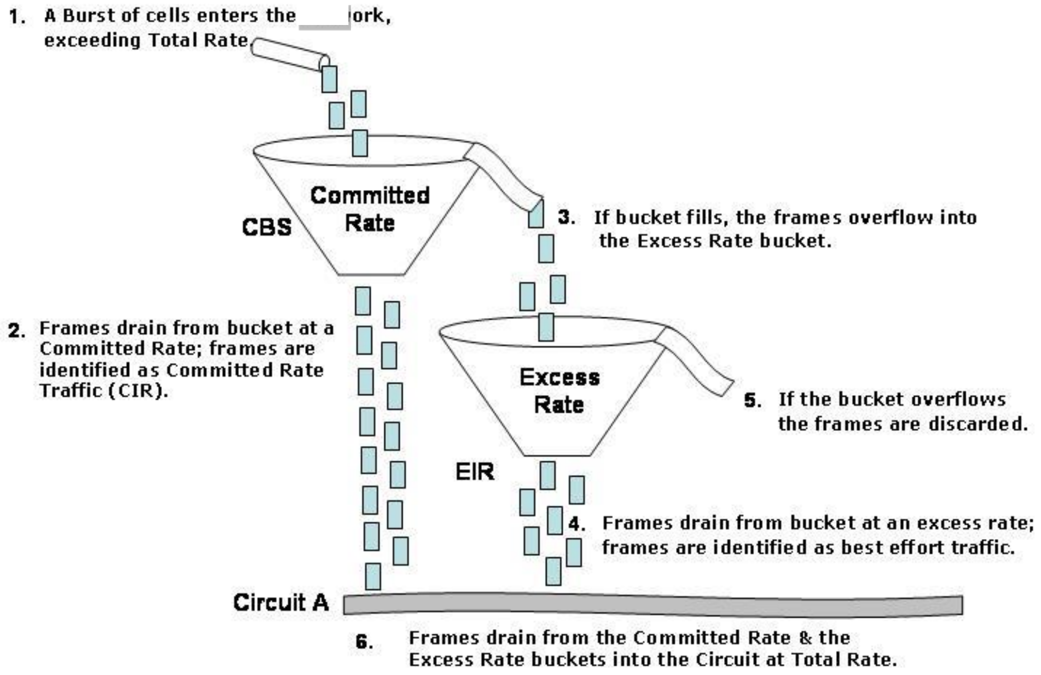

1. A Burst of cells enters the ork, exceeding Total Rate
Committed Rate
CBS
3. If bucket fills, the frames overflow into the Excess Rate bucket.
2. Frames drain from bucket at a Committed Rate; frames are identified as Committed Rate Traffic (CIR).
Excess Rate
5. If the bucket overflows the frames are discarded.
EIR
4. Frames drain from bucket at an excess rate; frames are identified as best effort traffic.
Circuit A
6. Frames drain from the Committed Rate & the Excess Rate buckets into the Circuit at Total Rate.

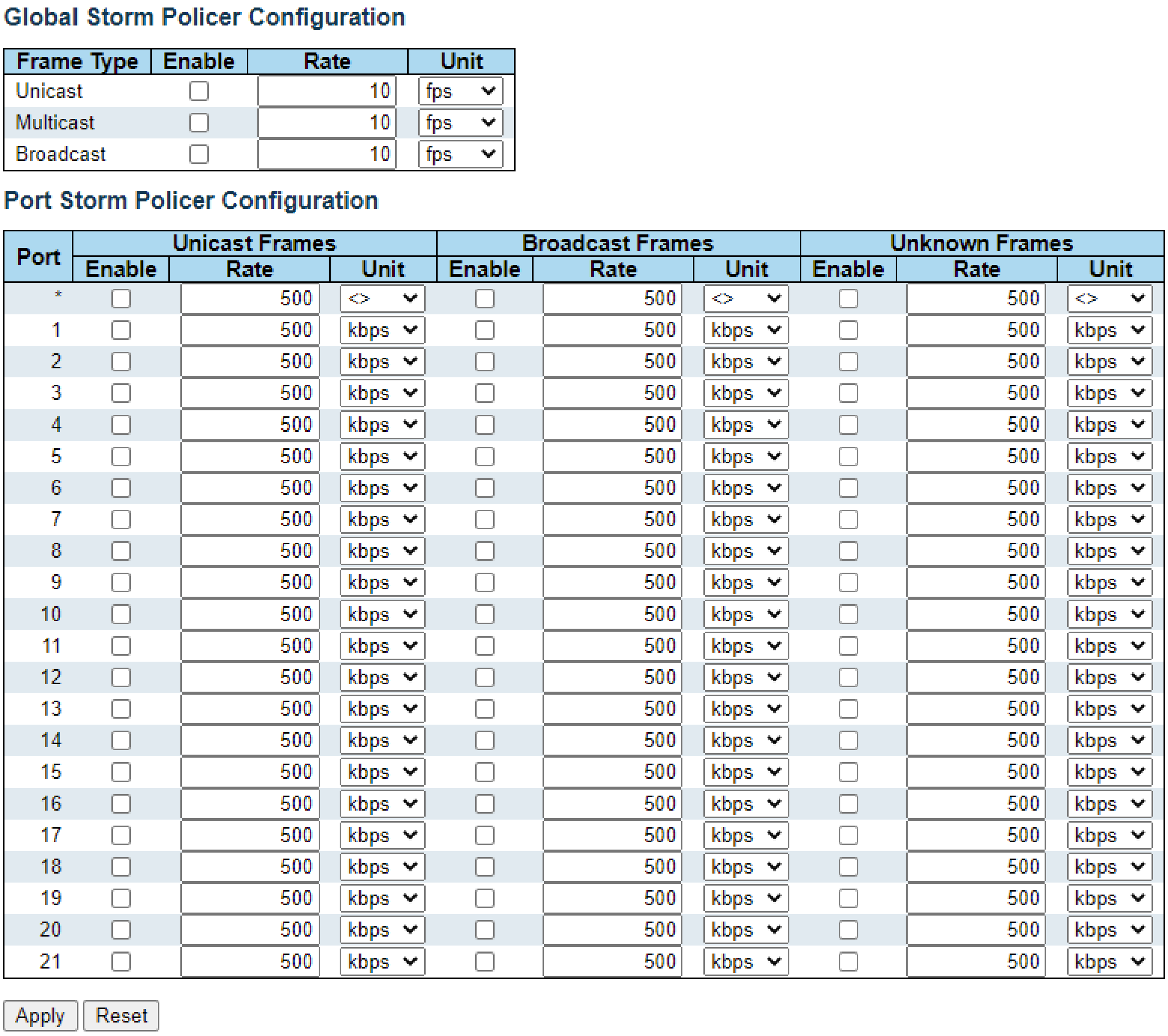
Figure 4-61: Dual Leaky Bucket

4.7.13 Global Storm Policer Configuration

Storm control prevents traffic on a LAN from being overloaded by a broadcast, multicast, or unknown-unicast storm. A LAN storm occurs when packets flood the LAN, creating excessive traffic and degrading network performance. Errors in the protocol-stack implementation, mistakes in network configuration, or users issuing a denial-of-service attack can cause a storm.

There is a unicast storm policer, multicast storm policer, and a broadcast storm policer. These only affect flooded frames, i.e., frames with a (VLAN ID, DMAC) pair not present in the MAC Address table.

Web GUI: Configuration > QoS > Storm Policing



Global Storm Policer Configuration

Frame Type	Enable	Rate	Unit
Unicast	☐	10	fps
Multicast	☐	10	fps
Broadcast	☐	10	fps

Port Storm Policer Configuration

Port	Unicast Frames			Broadcast Frames			Unknown Frames		
	Enable	Rate	Unit	Enable	Rate	Unit	Enable	Rate	Unit
*	☐	500	<>	☐	500	<>	☐	500	<>
1	☐	500	kbps	☐	500	kbps	☐	500	kbps
2	☐	500	kbps	☐	500	kbps	☐	500	kbps
3	☐	500	kbps	☐	500	kbps	☐	500	kbps
4	☐	500	kbps	☐	500	kbps	☐	500	kbps
5	☐	500	kbps	☐	500	kbps	☐	500	kbps
6	☐	500	kbps	☐	500	kbps	☐	500	kbps
7	☐	500	kbps	☐	500	kbps	☐	500	kbps
8	☐	500	kbps	☐	500	kbps	☐	500	kbps
9	☐	500	kbps	☐	500	kbps	☐	500	kbps
10	☐	500	kbps	☐	500	kbps	☐	500	kbps
11	☐	500	kbps	☐	500	kbps	☐	500	kbps
12	☐	500	kbps	☐	500	kbps	☐	500	kbps
13	☐	500	kbps	☐	500	kbps	☐	500	kbps
14	☐	500	kbps	☐	500	kbps	☐	500	kbps
15	☐	500	kbps	☐	500	kbps	☐	500	kbps
16	☐	500	kbps	☐	500	kbps	☐	500	kbps
17	☐	500	kbps	☐	500	kbps	☐	500	kbps
18	☐	500	kbps	☐	500	kbps	☐	500	kbps
19	☐	500	kbps	☐	500	kbps	☐	500	kbps
20	☐	500	kbps	☐	500	kbps	☐	500	kbps
21	☐	500	kbps	☐	500	kbps	☐	500	kbps

Figure 4-62: Global Storm Policer Configuration

Table 4-57: Global Storm Policer Configuration Parameters

Frame Type	The frame type for which the configuration below applies.
Enable	Enable or disable the global storm policer for the given frame type.
Rate	Controls the rate for the global storm policer. This value is restricted to 10-13128147 when **Unit** is **fps** or **kbps**, and 1-13128 when **Unit** is **kfps** or **Mbps**. The rate is internally rounded up to the nearest value supported by the global storm policer. Supported rates are divisible by 10 fps or 25 kbps.
Unit	Controls the unit of measure for the global storm policer rate as **fps**, **kfps**, **kbps** or **Mbps**.

Table 4-58: Port Storm Policer Configuration Parameters

Port	The port number for which the configuration below applies.
Enable	Enable or disable the storm policer for this switch port.
Rate	Controls the rate for the port storm policer. This value is restricted to 10-13128147 when **Unit** is fps or kbps, and 1-13128 when **Unit** is **kfps** or **Mbps**. The rate is internally rounded up to the nearest value supported by the port storm policer. Supported rates are divisible by 10 fps or 25 kbps.
Unit	Controls the unit of measure for the port storm policer rate as **fps**, **kfps**, **kbps** or **Mbps**.

4.8 Security Features

R Class **series** enables a set of security features. Security is realized by several different mechanisms included in the Switch and Network section.

4.8.1 Switch

The Switch section contains the following sub-sections:

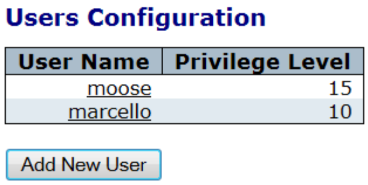
- User Configuration
- Privilege Level Configuration
- Authentication Method Configuration
- SSH Configuration
- HTTPS Configurations
- Access Management Configuration
- Access Management Statistics

4.8.1.1 User Configuration

This subsection provides an overview of the current users.

Currently the only way to login as another user on the web server is to close and reopen the browser.

Web GUI: Configuration > Security > Switch > Users


Users Configuration

User Name	Privilege Level
moose	15
marcello	10

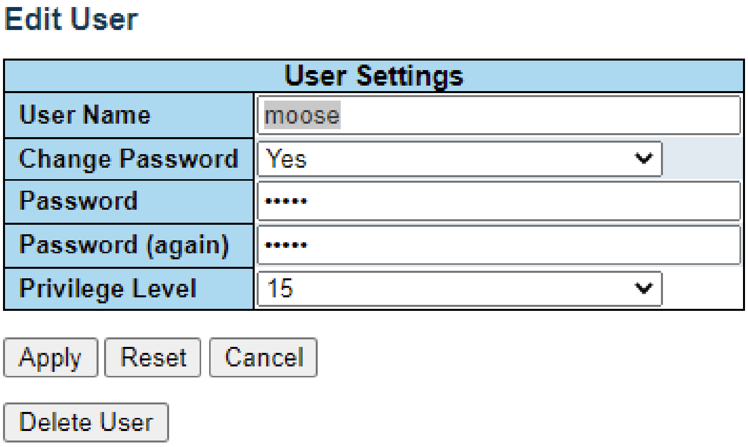
Figure 4-63: User Configuration

Table 4-59: User Configuration Parameters

Username	The name identifying the user.
Privilege level	The privilege level of the user. The allowed range is 0 to 15. If the privilege level value is 15, it can access all groups, i.e., that is granted the fully control of the device. But others value need to refer to each group privilege level. User's privilege should be same or greater than the group privilege level to have the access of that group. By default setting, most groups privilege level 5 has the read-only access and privilege level 10 has the read-write access. And the system maintenance (software upload, factory defaults etc.) need user privilege level 15. Generally, the privilege level 15 can be used for an administrator account, privilege level 10 for a standard user account and privilege level 5 for a guest account.
Buttons	**Add New User:** Click to add a new user. The maximum numbers of users is 20.

	Marcello is a new added User with privilege level 10

By clicking on “Moose" user you get the following edit display which can be modified:

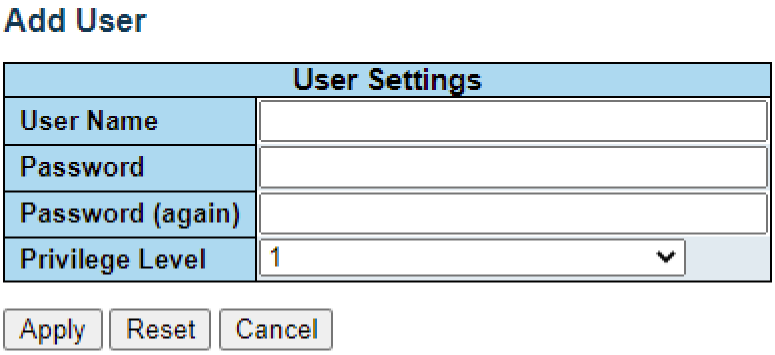


Edit User

User Settings	
User Name	moose
Change Password	Yes
Password	•••••
Password (again)	•••••
Privilege Level	15

By clicking on **Add New User** on the previous User configuration display, you may add a new user Refer to below display

Web GUI: Configuration > Security > Switch > Users



Add User

User Settings	
User Name	
Password	
Password (again)	
Privilege Level	1

Figure 4-64: Add/Edit User Configurations

Table 4-60: Add/Edit User Configuration Parameters

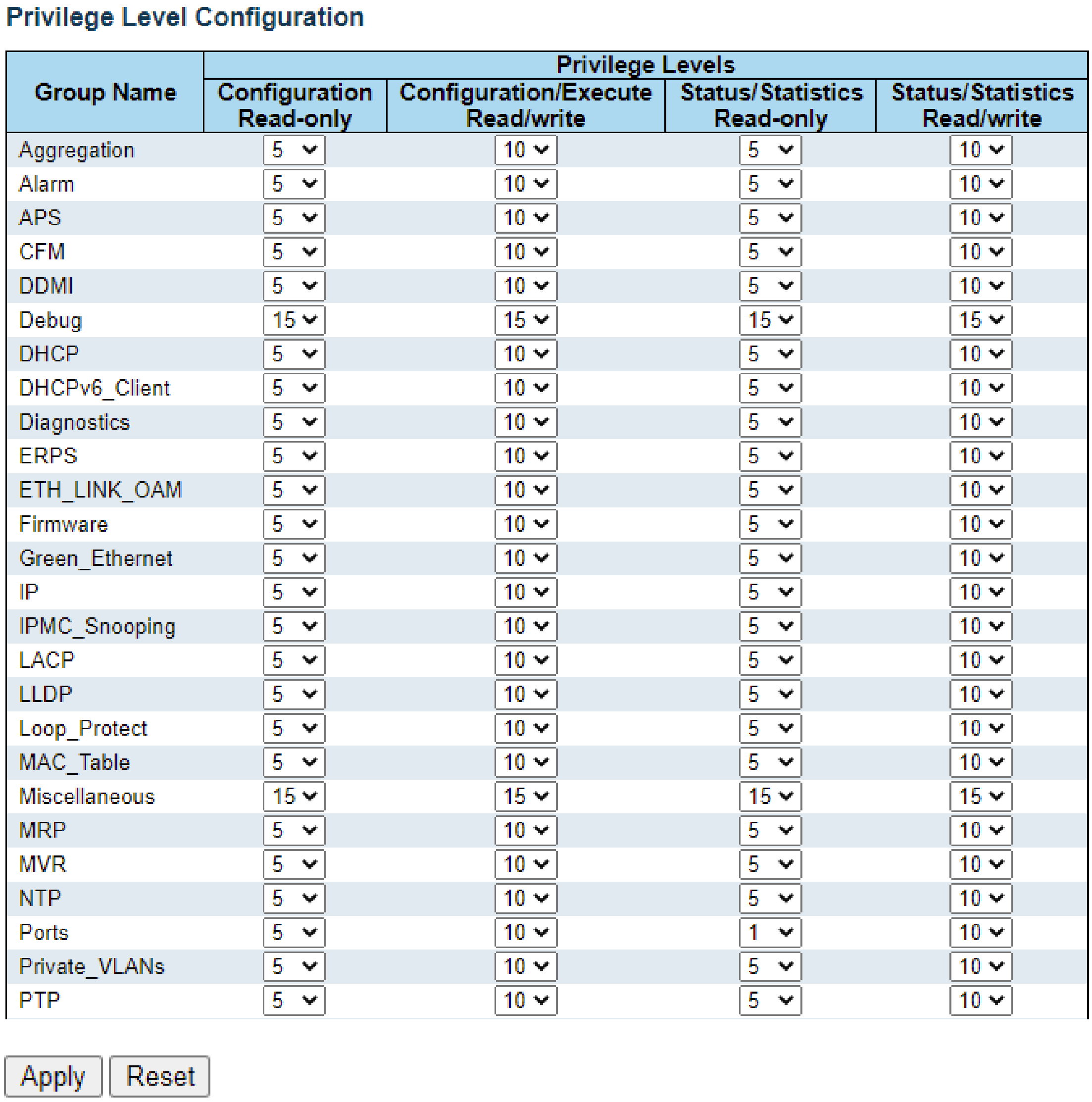
Username	A string identifying the username that this entry should belong to. The allowed string length is 1 to 31. The valid username allows letters, numbers and underscores.
Password	The password of the user. The allowed string length is 0 to 31. Any printable characters including Space is accepted
Privilege level	The privilege level of the user. The allowed range is **0** to **15**. If the privilege level value is 15, it can access all groups, i.e., that is granted the fully control of the device. But other values must refer to each group privilege level. User's privilege should be same or greater than the group privilege level to have the access of that group. By default setting, most groups privilege level 5 has the read-only access and privilege level 10 has the read-write access. And the system maintenance (software upload, factory defaults etc.) need user privilege level 15. Generally, the privilege level 15 can be used for an administrator account, privilege level 10 for a standard user account and privilege level 5 for a guest account.

Buttons	**Delete User:** Delete the current user. This button is not available for new configurations (Add new user). Marcello is a new added User with privilege level 10

4.8.1.2 Privilege Level Configuration

This subsection provides an overview of the privilege levels.

Web GUI: Configuration > Security > Switch > Privelege Levels



Privilege Level Configuration

Group Name	Privilege Levels			
	Configuration Read-only	Configuration/Execute Read/write	Status/Statistics Read-only	Status/Statistics Read/write
Aggregation	5	10	5	10
Alarm	5	10	5	10
APS	5	10	5	10
CFM	5	10	5	10
DDMI	5	10	5	10
Debug	15	15	15	15
DHCP	5	10	5	10
DHCPv6_Client	5	10	5	10
Diagnostics	5	10	5	10
ERPS	5	10	5	10
ETH_LINK_OAM	5	10	5	10
Firmware	5	10	5	10
Green_Ethernet	5	10	5	10
IP	5	10	5	10
IPMC_Snooping	5	10	5	10
LACP	5	10	5	10
LLDP	5	10	5	10
Loop_Protect	5	10	5	10
MAC_Table	5	10	5	10
Miscellaneous	15	15	15	15
MRP	5	10	5	10
MVR	5	10	5	10
NTP	5	10	5	10
Ports	5	10	1	10
Private_VLANs	5	10	5	10
PTP	5	10	5	10

Figure 4-65: Privilege Level Configuration

Table 4-61: Privilege Configuration Level Parameters

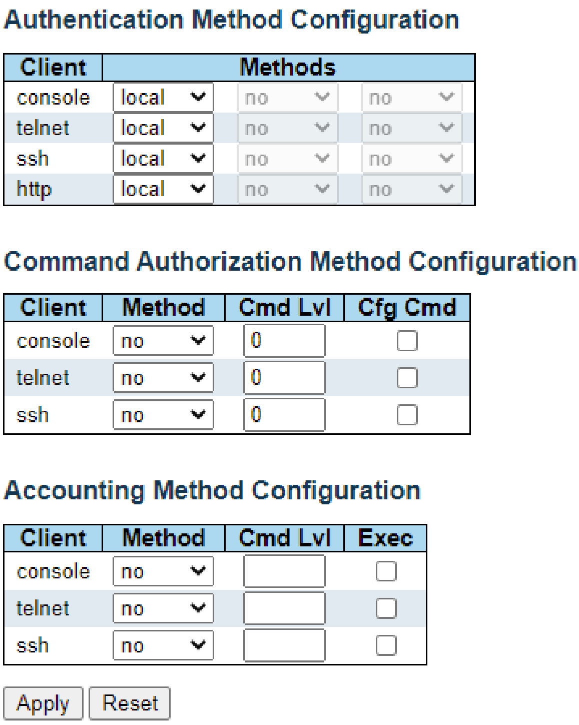
Group Name	The name identifying the privilege group. In most cases, a privilege level group consists of a single module (e.g., LACP, RSTP or QoS), but a few of them contains more than one. The following description defines these privilege level groups in detail: • **System**: Contact, Name, Location, Time zone, Log.

	• **Security:** Authentication, System Access Management, Port (contains Dot1x port, MAC based and the MAC Address Limit), ACL, HTTPS, SSH, ARP Inspection and IP source guard. • **IP**: Everything except 'ping'. • **Port**: Everything except 'VeriPHY'. • **Diagnostics:** 'ping' and 'VeriPHY'. • **Maintenance:** CLI- System Reboot, System Restore Default, System Password, Configuration Save, Configuration Load and Firmware Load. Web- Users, Privilege Levels and everything in Maintenance. • **Debug**: Only present in CLI.
Privilege Levels	The Privilege Levels can be configured between 0 to 15 (where 0 is lowest level and 15 is highest level) Every group has an authorization Privilege level for the following sub-groups: configuration read-only, configuration/execute read-write, status/statistics read-only, status/statistics read-write (e.g., for clearing of statistics). User Privilege should be same or greater than the authorization Privilege level to have the access to that group.

4.8.1.3 Authentication Method Configurations

This subsection allows you to configure how a user is authenticated when he logs into the switch via one of the management client interfaces. The figure has one row for each client type and several columns.

Web GUI: Configuration > Security > Switch > Auth Method



Authentication Method Configuration

Client	Methods		
console	local	no	no
telnet	local	no	no
ssh	local	no	no
http	local	no	no

Command Authorization Method Configuration

Client	Method	Cmd Lvl	Cfg Cmd
console	no	0	☐
telnet	no	0	☐
ssh	no	0	☐

Accounting Method Configuration

Client	Method	Cmd Lvl	Exec
console	no		☐
telnet	no		☐
ssh	no		☐

Figure 4-66: Authentication Method Configurations displays.

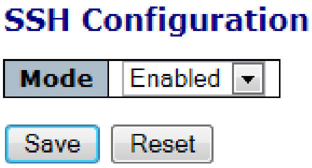
Table 4-62: Authentication Method Configurations Parameters

Authentication Method Configuration	
Client	The management client for which the configuration below applies.
Authentication Methods	Authentication Method can be set to one of the following values: • **No**: authentication is disabled, and login is not possible. • **local**: use the local user database on the switch for authentication. • **radius**: use a remote RADIUS server for authentication. • **tacacs+**: use a remote TACACS+server for authentication
Methods that involve remote servers are timed out if the remote servers are offline. In this case the next method is tried. Each method is tried from left to right and continues until a method either approves or rejects a user. If a remote server is used for primary authentication it is recommended to configure secondary authentication as 'local'. This will enable the management client to login via the local user database if none of the configured authentication servers are alive.	
Command Authorization Method Configuration The command authorization section allows you to limit the CLI commands available to a user.	
Client	The management client for which the configuration below applies.
Method	Method can be set to one of the following values: • **no**: Command authorization is disabled. User is granted access to CLI commands according to his privilege level. • **tacacs**: Use remote TACACS+ server(s) for command authorization. If all remote servers are offline, the user is granted access to CLI commands according to his privilege level.
Cmd Lvl	Authorize all commands with a privilege level higher than or equal to this level. Valid values are in the range of 0 to 15.
Cfg Cmd	Also authorize configuration commands.
Accounting Method Configuration	
Client	The management client for which the configuration below applies.
Method	Method can be set to one of the following values: • **no**: Accounting is disabled. • **tacacs**: Use remote TACACS+ server(s) accounting.
Cmd Lvi	Enable accounting of all commands with a privilege level higher than or equal to this level. Valid values are in the range 0 to 15. Leave the field empty to disable command accounting.
Exec	Enable exec (login) accounting.

4.8.1.4 SSH Configuration

SSH is an acronym for **S**ecure **Sh**ell. It is a network protocol that allows data to be exchanged using a secure channel between two networked devices. The encryption used by SSH provides confidentiality and integrity of data over an insecure network. The goal of SSH was to replace the earlier rlogin, TELNET and RSH protocols, which did not provide strong authentication or guarantee confidentiality

Web GUI: Configuration > Security > Switch > SSH



SSH Configuration

Mode	Enabled

Figure 4-67: SSH Configuration

Table 4-63: Authentication Method Configuration Parameters

Mode	Indicates the SSH mode operation. Possible modes are: • **Enabled**: Enable SSH mode operation. • **Disabled**: Disable SSH mode operation.

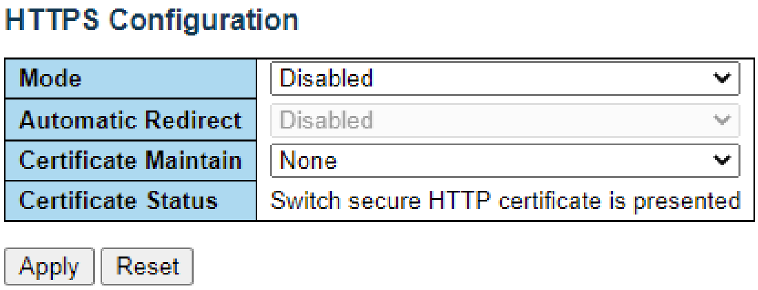
4.8.1.5 HTTPS Configuration

HTP is an acronym for **H**ypertext **T**ransfer **P**rotocol. It is a protocol that used to transfer or convey information on the World Wide Web (WWW).

HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands. For example, when you enter a URL in your browser, this sends an HTTP command to the Web server directing to fetch and transmit the requested Web page. The other main standard that controls how the World Wide Web works is HTML, which covers how Web pages are formatted and displayed.

Any Web server machine contains, in addition to the Web page files it can serve, an HTTP daemon, a program that is designed to wait for HTTP requests and handle them when they arrive. The Web browser is an HTTP client, sending requests to server machines. An HTTP client initiates a request by establishing a Transmission Control Protocol (TCP) connection to a particular port on a remote host (port 80 by default). An HTTP server listening on that port waits for the client to send a request message.

Web GUI: Configuration > Security > Switch > HTTP



HTTPS Configuration

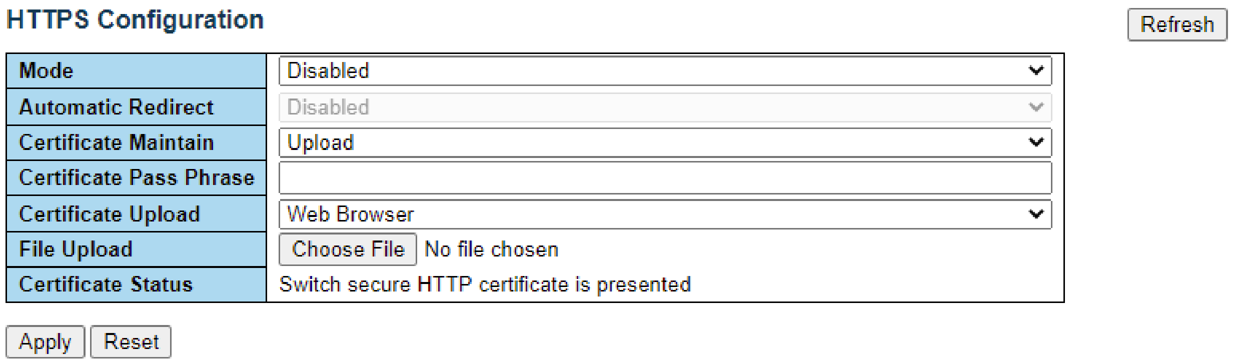
Mode	Disabled
Automatic Redirect	Disabled
Certificate Maintain	None
Certificate Status	Switch secure HTTP certificate is presented

Figure 4-68: HTTPS Configuration

Table 4-64: HTTPS Configuration Parameters

Mode	Indicate the HTTPS mode operation. Possible modes are: **Enabled**: Enable HTTPS mode operation. **Disabled**: Disable HTTPS mode operation.
Automatic Redirect	Indicate the HTTPS redirect mode operation. It is only significant when "HTTPS Mode Enabled" is selected. When the redirect mode is enabled, the HTTP connection will be redirected to HTTPS connection automatically. Notice that the browser may not allow the redirect operation due to the security consideration unless the switch certificate is trusted to the browser. You need to initialize the HTTPS connection manually for this case. Possible modes are: **Enabled**: Enable HTTPS redirect mode operation. **Disabled**: Disable HTTPS redirect mode operation
Certificate Maintain	The operation of certificate maintenance. Possible operations are: Possible operations are: • **None**: No operation. • **Delete**: Delete the current certificate. • **Upload**: Upload a certificate PEM file. Possible methods are Web Browser or URL. • **Generate**: Generate a new self-signed RSA certificate
Certificate Pass Phrase	Enter the pass phrase in this field if your uploading certificate is protected by a specific passphrase.

By choosing the **Upload** option in the Certificate Maintain, the following display is shown, the parameters of which are explained below.



HTTPS Configuration

Mode	Disabled
Automatic Redirect	Disabled
Certificate Maintain	Upload
Certificate Pass Phrase	
Certificate Upload	Web Browser
File Upload	Choose File No file chosen
Certificate Status	Switch secure HTTP certificate is presented

Certificate Upload	Upload a certificate PEM file into the switch. The file should contain the certificate and private key together. If you have two separated files for saving certificate and private key. Use the Linux cat command to combine them into a single PEM file. For example, cat my.cert my.key > my.pem Notice that the RSA certificate is recommended since most of the new version of browsers has removed support for DSA in certificate, e.g., Firefox v37 and Chrome v39. Possible methods are: Web Browser: Upload a certificate via Web browser. URL: Upload a certificate via URL, the supported protocols are HTTP, HTTPS, TFTP and FTP. The URL format is <protocol>://[<username>[:<password>]@]< host>[:<port>][/<path>]/<file_name>.

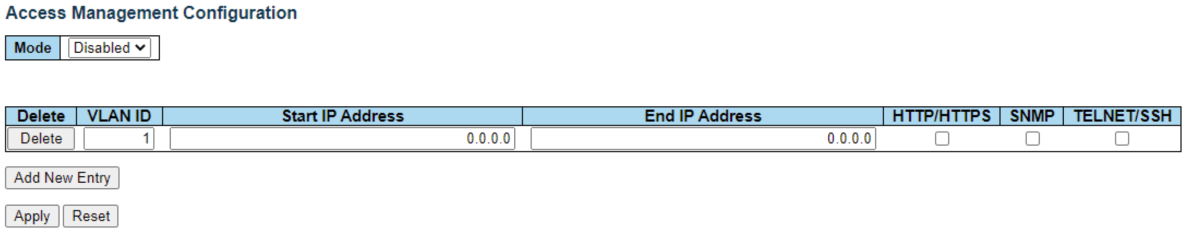
	For example, tftp://10.10.10.10/new_image_path/new_image.dat, http://username:password@10.10.10.10:80/new_image_path/new_image.dat. A valid file name is a text string drawn from alphabet (A-Za-z), digits (0-9), dot (.), hyphen (-), underscore (_). The maximum length is 63 and hyphen must not be first character. The file name content that only contains '.' is not allowed.
Certificate Status	Display the current status of certificate on the switch. Possible statuses are: • Switch secure HTTP certificate is presented. • Switch secure HTTP certificate is not presented. • Switch secure HTTP certificate is generating.

4.8.1.6 Access Management Configuration

In this subsection, you may configure the access management configuration.

The maximum number of entries is **16**. If the application type matches any one of the access management entries, it will allow access to the switch.

Web GUI: Configuration > Security > Switch > Access Management



Access Management Configuration

Mode: Disabled

Delete	VLAN ID	Start IP Address	End IP Address	HTTP/HTTPS	SNMP	TELNET/SSH
Delete	1	0.0.0.0	0.0.0.0	☐	☐	☐

Figure 4-69: Access Management Configuration display

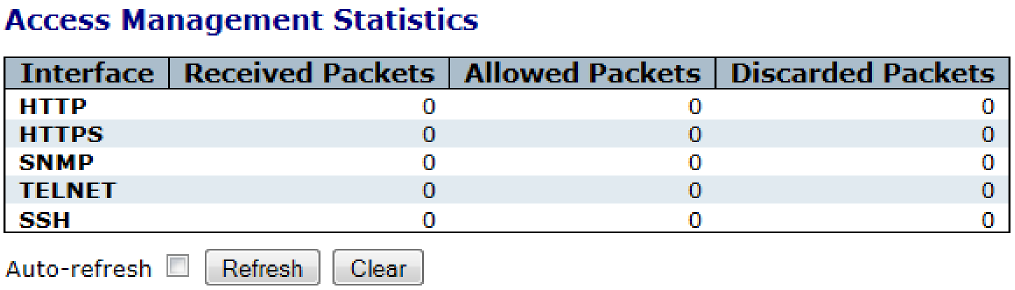
Table 4-65: Access Management Configuration parameters

Mode	Indicates the access management mode operation. Possible modes are: • **Enabled**: Enable access management mode operation. • **Disabled**: Disable access management mode operation.
Delete	Check to delete the entry. It will be deleted during the next save.
VLAN ID	Indicates the VLAN ID for the access management entry.
Start IP address	Indicates the start IP address for the access management entry
End IP address	Indicates the end IP address for the access management entry.
HTTP/HTTPS	Indicates that the host can access the switch from HTTP/HTTPS interface if the host IP address matches the IP address range provided in the entry.
SNMP	Indicates that the host can access the switch from SNMP interface if the host IP address matches the IP address range provided in the entry
TELNET/ SSH	Indicates that the host can access the switch from TELNET/SSH interface if the host IP address matches the IP address range provided in the entry.
Buttons	**Add New Entry:** Click to add a new access management entry.

4.8.1.7 Access Management Statistics

This sub-section provides statistics for selected access management.

Web GUI: Monitor > Security > Access Management Statistics



Access Management Statistics

Interface	Received Packets	Allowed Packets	Discarded Packets
HTTP	0	0	0
HTTPS	0	0	0
SNMP	0	0	0
TELNET	0	0	0
SSH	0	0	0

Figure 4-70: Access Management Statistics display

Table 4-66: Access Management Statistics Parameters

Interface	The interface type through which the remote host can access the switch.
Received Packets	Number of received packets from the interface when access management mode is enabled.
Allowed Packets	Number of allowed packets from the interface when access management mode is enabled.
Discarded Packets	Number of discarded packets from the interface when access management mode is enabled.

4.8.2 **Network Security**

Network Security includes the following subjects:

- MAC Limit
- Port Security switch and Port Security port status
- Network Access Server (NAS)
- Access Control List (ACL)
- IP Source Guard ARP Inspection

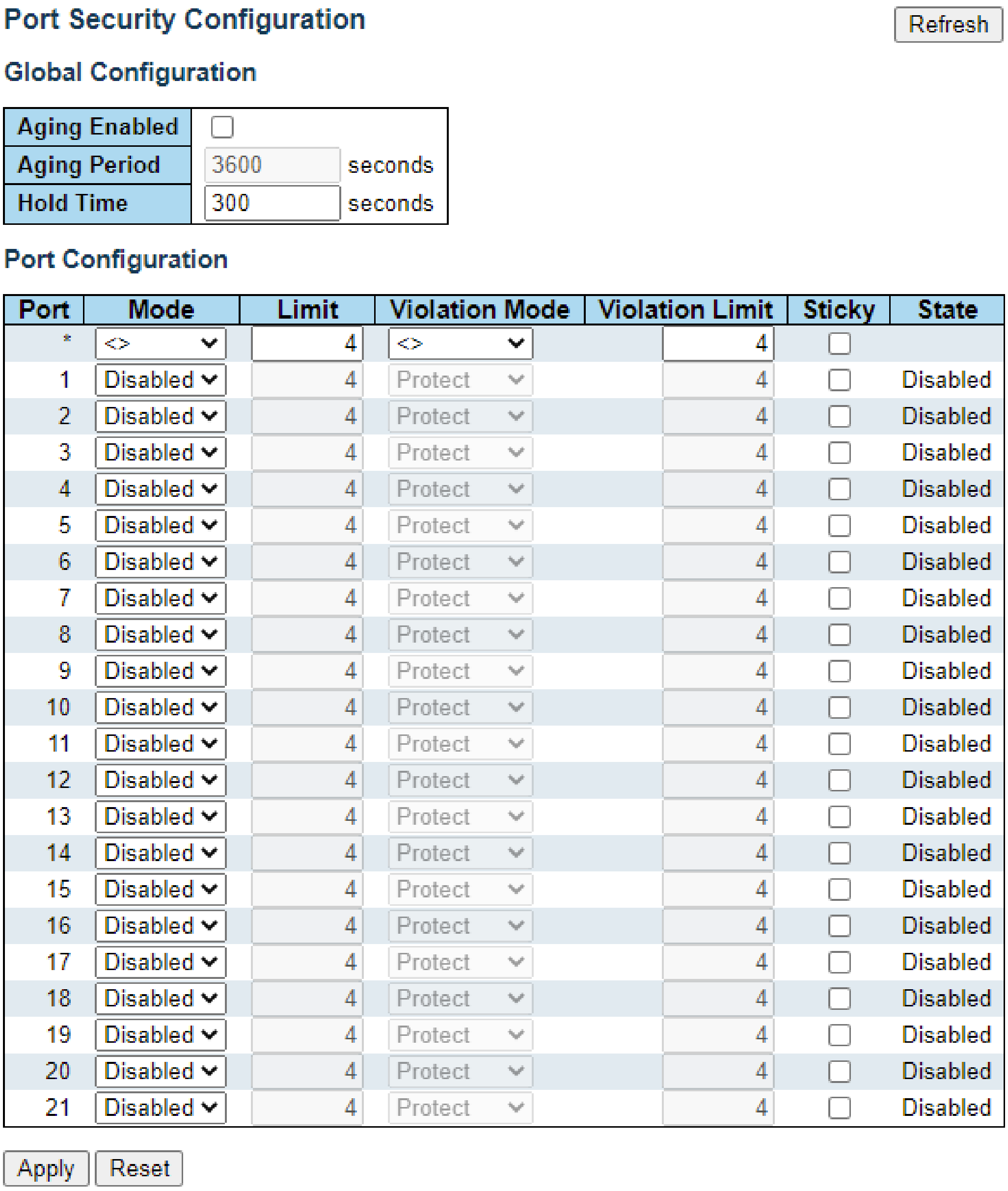
4.8.2.1 MAC Limit Configuration

This section allows you to configure the MAC Limit Control system and port settings.

Limit Control allows for limiting the number of users on a given port. A user is identified by a MAC address and VLAN ID. If Limit Control is enabled on a port, the limit specifies the maximum number of users on the port. (This number cannot exceed 1024). If this number is exceeded, an action takes place. The action can be one of the four different actions as described below. The Limit Control module utilizes a lower-layer module, Port Security module, which manages MAC addresses learnt on the port.

- The Limit Control configuration consists of two sections:
- System Configuration
- Port Configuration

Web GUI: Monitor > Security > Network > Port Security > Configuration



Port Security Configuration

Global Configuration

Aging Enabled	☐	
Aging Period	3600	seconds
Hold Time	300	seconds

Port Configuration

Port	Mode	Limit	Violation Mode	Violation Limit	Sticky	State
*	<>	4	<>	4	☐	
1	Disabled	4	Protect	4	☐	Disabled
2	Disabled	4	Protect	4	☐	Disabled
3	Disabled	4	Protect	4	☐	Disabled
4	Disabled	4	Protect	4	☐	Disabled
5	Disabled	4	Protect	4	☐	Disabled
6	Disabled	4	Protect	4	☐	Disabled
7	Disabled	4	Protect	4	☐	Disabled
8	Disabled	4	Protect	4	☐	Disabled
9	Disabled	4	Protect	4	☐	Disabled
10	Disabled	4	Protect	4	☐	Disabled
11	Disabled	4	Protect	4	☐	Disabled
12	Disabled	4	Protect	4	☐	Disabled
13	Disabled	4	Protect	4	☐	Disabled
14	Disabled	4	Protect	4	☐	Disabled
15	Disabled	4	Protect	4	☐	Disabled
16	Disabled	4	Protect	4	☐	Disabled
17	Disabled	4	Protect	4	☐	Disabled
18	Disabled	4	Protect	4	☐	Disabled
19	Disabled	4	Protect	4	☐	Disabled
20	Disabled	4	Protect	4	☐	Disabled
21	Disabled	4	Protect	4	☐	Disabled

Figure 4-71: Port Security Configuration

Table 4-67: System and Port Configuration Parameters

Global Configuration	
Mode	Indicates if **Limit Control is globally enabled** or disabled on the switch. If globally disabled, other modules may still use the underlying functionality, but limit checks and corresponding actions are disabled.
Aging Enabled	If checked, secured MAC addresses are subject to aging as discussed under **Aging Period**

Aging Period	If **Aging Enabled** is checked, then the aging period is controlled with this input. If other modules are using the underlying port security for securing MAC addresses, they may have other requirements to the aging period. The underlying port security will use the shorter requested aging period of all modules that use the functionality. The Aging Period can be set to a number between 10 and 10,000,000 seconds. To understand why aging may be desired, consider the following scenario: Suppose an end-host is connected to a 3rd party switch or hub, which in turn is connected to a port on this switch on which Limit Control is enabled. The end-host will be allowed to forward if the limit is not exceeded. Now suppose that the end-host logs off or powers down. If it were not for aging, the end-host would still take up resources on this switch and will be allowed to forward. To overcome this situation, enable aging. With aging enabled, a timer is started once the end-host gets secured. When the timer expires, the switch starts looking for frames from the end-host, and if such frames are not seen within the next Aging Period, the end-host is assumed to be disconnected, and the corresponding resources are freed on the switch.
Hold Time	The hold time - measured in seconds - is used to determine how long a MAC address is held in the MAC table if it has been found to violate the limit. Valid range is between 10 and 10000000 seconds with a default of 300 seconds. The reason for holding a violating MAC address in the MAC table is primarily to ensure that the same MAC address doesn't give rise to continuous notifications (if notifications on violation count is enabled).
The table has one row for each port on the selected switch and several columns.	
Port Configuration	
Port	The port number to which the configuration below applies.
Mode	Controls whether Limit Control is enabled on this port. Both this and the Global Mode must be set to Enabled for Limit Control to be in effect. Notice that other modules may still use the underlying port security features without enabling Limit Control on a given port.
Limit	The maximum number of MAC addresses that can be secured on this port. This number cannot exceed 1023. Default is 4. If the limit is exceeded, an action is taken corresponding to the violation mode. The switch is "born" with a total number of MAC addresses from which all ports draw whenever a new MAC address is seen on a Port Security-enabled port. Since all ports draw from the same pool, it may happen that a configured maximum cannot be granted, if the remaining ports have already used all available MAC addresses.

Violation Mode	If Limit is reached, the switch can take one of the following actions: • **Protect**: Do not allow more than Limit MAC addresses on the port but take no further action. • **Restrict**: If Limit is reached, subsequent MAC addresses on the port will be counted and marked as violating. Such MAC addresses are removed from the MAC table when the hold time expires. At most Violation Limit MAC addresses can be marked as violating at any given time. • **Shutdown**: If Limit is reached, one additional MAC address will cause the port to be shut down. This implies that all secured MAC addresses be removed from the port, and no new addresses be learned. There are three ways to re-open the port: 1) In the "Configuration → Ports" page's "Configured" column, first disable the port, then restore the original mode. 2) Make a Port Security configuration change on the port. 3) Boot the switch.
Violation Limit	The maximum number of MAC addresses that can be marked as violating on this port. This number cannot exceed 1023. Default is 4. It is only used when Violation Mode is **Restrict**.
Sticky	Enables sticky learning of MAC addresses on this port. When the port is in sticky mode, all MAC addresses that would otherwise have been learned as dynamic are learned as sticky. Sticky MAC addresses are part of the running-config and can therefore be saved to startup-config. Sticky MAC addresses survive link changes (in contrast to Dynamic, which will have to be learned again). They also survive reboots if running-config is saved to startup-config. A port can be Sticky-enabled whether or not Port Security is enabled on that interface. In that way, it is possible to add sticky MAC addresses management-wise before enabling Port Security. To do that, use the "Configuration→Security→Port Security→MAC Addresses" page.
State	This column shows the current state of the port as seen from the Limit Control's point of view. The state takes one of four values: • **Disabled**: Limit Control is either globally disabled or disabled on the port. • **Ready**: The limit is not yet reached. This can be shown for all actions. • **Limit** Reached: Indicates that the limit is reached on this port. This state can only be shown if Action is set to None or Trap. **Shutdown**: Indicates that the port is shut down by the Limit Control module. This state can only be shown if Action is set to Shut down or Trap & Shutdown.

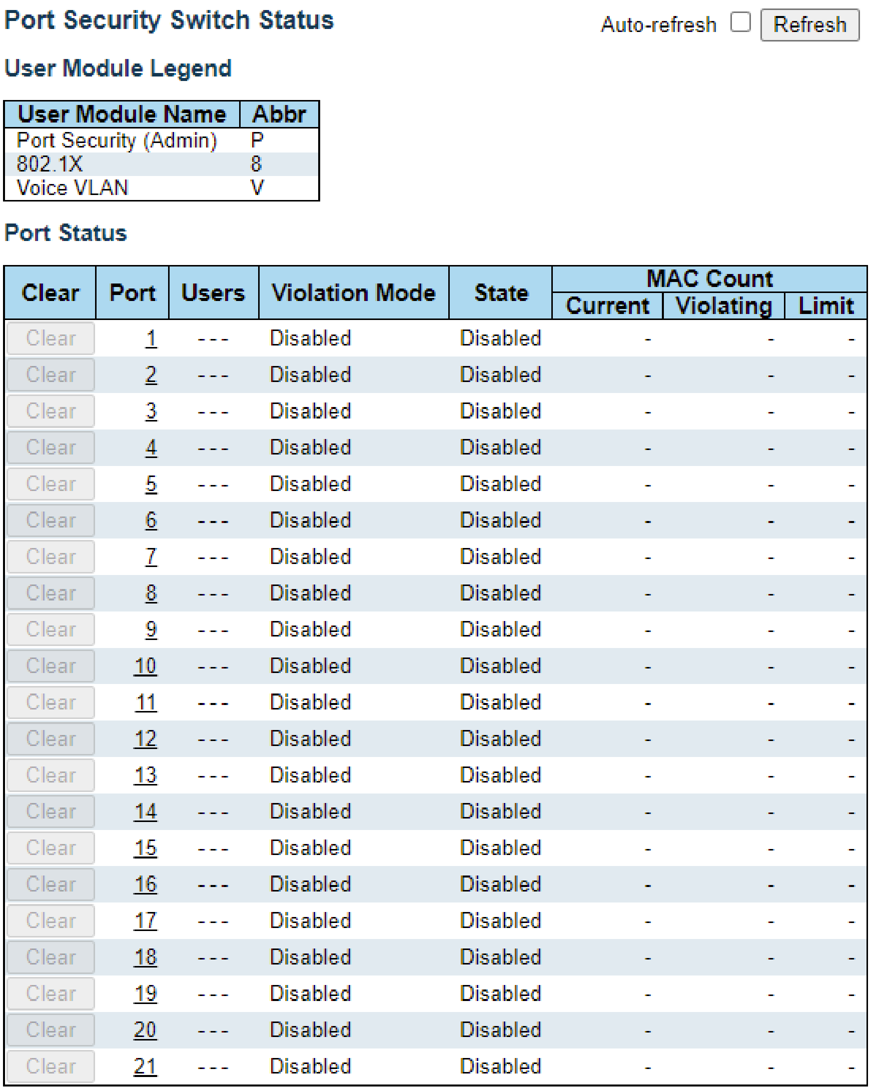
Re-open Button	If a port is shut down by this module, you may reopen it by clicking this button, which will only be enabled if this is the case. For other methods, refer to Shut down in the Action section. *Note that clicking the reopen button causes the page to be refreshed, so non-committed changes will be lost.*

4.8.2.2 Port Security Switch Status

This section shows the Port Security status. Port Security is a module with no direct configuration. Configuration comes indirectly from other modules - the user modules. When a user module has enabled port security on a port, the port is set-up for software-based learning. In this mode, frames from unknown MAC addresses are passed on to the port security module, which in turn asks all user modules whether to allow this new MAC address to forward or block it. For a MAC address to be set in the forwarding state, all enabled user modules must unanimously agree on allowing the MAC address to forward. If only one chooses to block it, it will be blocked until that user module decides otherwise.

The status page is divided into two sections - one with a legend of user modules and one with the actual port status.

Web GUI: Monitor > Security > Network > Port Security > Overview



Port Security Switch Status

User Module Legend

User Module Name	Abbr
Port Security (Admin)	P
802.1X	8
Voice VLAN	V

Port Status

Clear	Port	Users	Violation Mode	State	MAC Count		
					Current	Violating	Limit
Clear	1	---	Disabled	Disabled	-	-	-
Clear	2	---	Disabled	Disabled	-	-	-
Clear	3	---	Disabled	Disabled	-	-	-
Clear	4	---	Disabled	Disabled	-	-	-
Clear	5	---	Disabled	Disabled	-	-	-
Clear	6	---	Disabled	Disabled	-	-	-
Clear	7	---	Disabled	Disabled	-	-	-
Clear	8	---	Disabled	Disabled	-	-	-
Clear	9	---	Disabled	Disabled	-	-	-
Clear	10	---	Disabled	Disabled	-	-	-
Clear	11	---	Disabled	Disabled	-	-	-
Clear	12	---	Disabled	Disabled	-	-	-
Clear	13	---	Disabled	Disabled	-	-	-
Clear	14	---	Disabled	Disabled	-	-	-
Clear	15	---	Disabled	Disabled	-	-	-
Clear	16	---	Disabled	Disabled	-	-	-
Clear	17	---	Disabled	Disabled	-	-	-
Clear	18	---	Disabled	Disabled	-	-	-
Clear	19	---	Disabled	Disabled	-	-	-
Clear	20	---	Disabled	Disabled	-	-	-
Clear	21	---	Disabled	Disabled	-	-	-

Figure 4-72: Port Security Switch Status

Table 4-68: System and Port Configuration Parameters

User Module Legend	
User Module Name	The full name of a module that may request Port Security services.
Abbr	A one-letter abbreviation of the user module. This is used in the Users column in the port status table (see below).
Port Status	
The table has one row for each port on the selected switch and several columns.	
Clear	Click to remove all dynamic MAC addresses on all VLANs on this port. The button is only clickable if number of secured MAC addresses is non-zero.

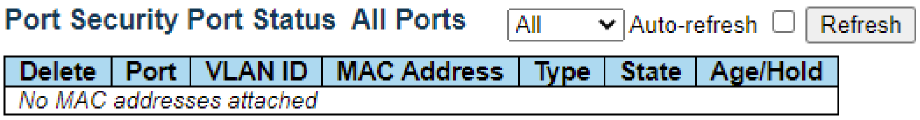
Port	The port number to which the configuration below applies. Click the port number to see the status for this port. Refer to next page.
Users	Each of the user modules has a column that shows whether that module has enabled Port Security or not. A '-' means that the corresponding user module is not enabled, whereas a letter indicates that the user module abbreviated by that letter (see Abbr above) has enabled port security.
Violation Mode	Shows the configured Violation Mode of the port. It can take one of four values: • **Disabled**: Port Security is not administratively enabled on this port. • **Protect**: Port Security is administratively enabled in Protect mode. • **Restrict**: Port Security is administratively enabled in Restrict mode. • **Shutdown**: Port Security is administratively enabled in Shutdown mode.
State	Shows the current state of the port. It can take one of four values: • **Disabled**: No user modules are currently using the Port Security service. • **Ready**: The Port Security service is in use by at least one user module and is awaiting the arrival of frames from unknown MAC addresses. • **Limit Reached**: The Port Security service is enabled by at least the Limit Control user module, and that module has indicated that the limit is reached, and no more MAC addresses should be taken in. • **Shutdown**: The Port Security service is enabled by at least the Limit Control user module, and that module has indicated that the limit is exceeded. No MAC addresses can be learned on the port until it is administratively re-opened on the Limit Control configuration Webpage.
Mac Count (Current, Violating Limit)	The three columns indicate the number of currently learned MAC addresses (forwarding as well as blocked), the number of violating MAC address (only counting in Restrict mode) and the maximum number of MAC addresses that can be learned on the port, respectively. If no user modules are enabled on the port, the Current column will show a dash (-). If Port Security is not administratively enabled on the port, the Violating and Limit columns will show a dash (-).

4.8.2.3 Port Security Port Status

This section shows the MAC addresses secured by the Port Security module. Port Security is a module with no direct configuration. Configuration comes indirectly from other modules - the user modules. When a user module has enabled port security on a port, the port is set-up for software-based learning. In this mode, frames from unknown MAC addresses are passed on to the port security module, which in turn asks all user modules whether to allow this new MAC address to forward or block it. For a MAC address to be set in the forwarding state, all enabled user modules must unanimously agree on allowing the MAC address to forward. If only one chooses to block it, it will be blocked until that user module decides otherwise.

Notice that if you have added static or sticky MAC addresses, they will show up on this page only if Port Security is enabled on the interface to which they pertain.

Web GUI: Monitor > Security > Network > Port Security > Details



Delete	Port	VLAN ID	MAC Address	Type	State	Age/Hold
No MAC addresses attached						

Figure 4-73: Port Security Port Status

Table 4-69: Port Security Port Status Parameters

Delete	Click to remove this particular MAC addresses from MAC address table. The button is only clickable if the entry type is Dynamic. Use the "Configuration→ Security→ Port Security→MAC Addresses" page to remove Static and Sticky entries.
Port	If all ports are shown (can be selected through the drop-down box on the top right), this one shows the port to which the MAC address is bound.
MAC Address & VLAN ID	The MAC address and VLAN ID that is seen on this port. If no MAC addresses are learned, a single row stating "No MAC addresses attached" is displayed.
Type	Indicates the type of entry. Takes one of three values: • **Dynamic**: The entry is learned through learn frames coming to the Port Security module while the port in question is not in sticky mode. • **Static**: The entry is entered by the end-user through management. Entry is not subject to aging. • **Sticky**: When the port is in sticky mode, all entries that would otherwise have been learned as dynamic are learned as sticky. • Sticky entries are part of the running-config and can therefore be saved to startup-config. An important aspect of sticky MAC addresses is that they survive link changes (in contrast to Dynamic, which will have to be learned again). They also survive reboots if running-config is saved to startup-config.
State	Indicates whether the corresponding MAC address is violating (administrative user has configured the interface in "Restrict" mode and the MAC address is blocked), blocked, or forwarding.
Time of Addition	Shows the date and time when this MAC address was first seen on the port.
Age/Hold	If at least one user module has decided to block this MAC address, it will stay in the blocked state until the hold time (measured in seconds) expires. If all user modules have decided to allow this MAC address to forward, and aging is enabled, the Port Security module will periodically check that this MAC address still forwards traffic. If the age period (measured in seconds) expires and no frames have been seen, the MAC address will be removed from the MAC table. Otherwise, a new age period will begin. If aging is disabled or a user module has decided to hold the MAC address indefinitely, a dash (-) will be shown.

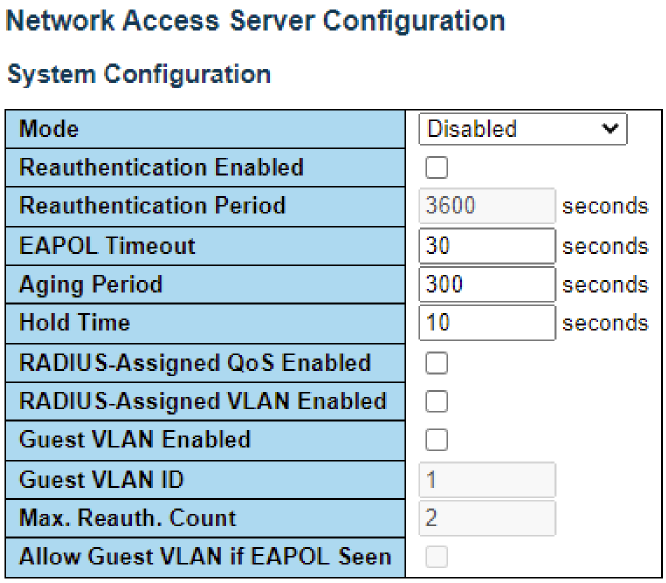
4.8.2.4 Network Access Server Configuration

This page allows you to configure the **IEEE 802.1X** and MAC-based authentication system and port settings.

The IEEE 802.1X standard defines a port-based access control procedure that prevents unauthorized access to a network by requiring users to first submit credentials for authentication. One or more central servers, the backend servers, determine whether the user is allowed access to the network. These backend (RADIUS) servers are configured on the "Configuration → Security → AAA" section. The IEEE802.1X standard defines port-based operation, but non-standard variants overcome security limitations as shall be explored below

MAC-based authentication allows for authentication of more than one user on the same port and does not require the user to have special 802.1X supplicant software installed on his system. The switch uses the user's MAC address to authenticate against the backend server. Intruders can create counterfeit MAC addresses, which makes MAC-based authentication less secure than 802.1 X authentications

The NAS configuration consists of two sections, System and Port Configurations.



Network Access Server Configuration

System Configuration

Mode	Disabled
Reauthentication Enabled	☐
Reauthentication Period	3600 seconds
EAPOL Timeout	30 seconds
Aging Period	300 seconds
Hold Time	10 seconds
RADIUS-Assigned QoS Enabled	☐
RADIUS-Assigned VLAN Enabled	☐
Guest VLAN Enabled	☐
Guest VLAN ID	1
Max. Reauth. Count	2
Allow Guest VLAN if EAPOL Seen	☐

Web GUI: Monitor > Security > Network > NAS

Figure 4-74: Network Access Server Configuration

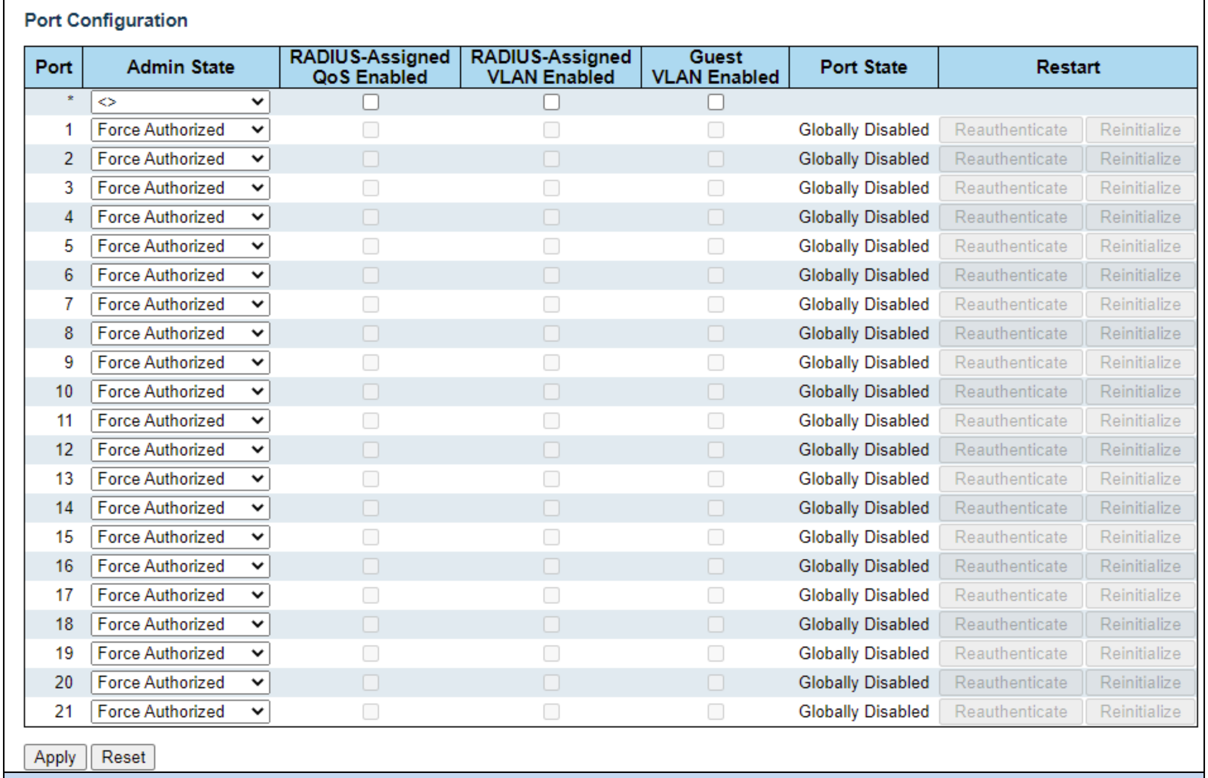
Table 4-70: Network Access Server Configuration Parameters

System Configuration	
Mode	Indicates if NAS is globally enabled or disabled on the switch If globally disabled, all ports are allowed forwarding of frames.
Reauthentication Enabled	If checked, successfully authenticated supplicants/clients are reauthenticated after the interval specified by the Reauthentication Period. Reauthentication for 802.1X-enabled ports can be used to detect if a new device is plugged into a switch port or if a supplicant is no longer attached.

	For MAC-based ports, reauthentication is only useful if the RADIUS server configuration has changed. It does not involve communication between the switch and the client, and therefore doesn't imply that a client is still present on a port (see **Aging Period** below)
Reauthentication Period	Determines the period, in seconds, after which a connected client must be reauthenticated. This is only active if the Reauthentication Enabled checkbox is checked. Valid values are in the range 1 to 3600 seconds.
EAPOL Timeout	Determines the time for retransmission of Request Identity EAPOL frames. Valid values are in the range 1 to 65535 seconds. This has no effect for MAC-based ports.
Aging Period	This setting applies to the following modes, i.e., modes using the Port Security functionality to secure MAC addresses: • Single 802.1X • Multi 802.1X • MAC-Based Auth. When the NAS module uses the Port Security module to secure MAC addresses, the Port Security module needs to check for activity on the MAC address in question at regular intervals and free resources if no activity is seen within a given period. This parameter controls exactly this period and can be set to a number between 10 and 1000000 seconds. If reauthentication is enabled and the port is in an 802.1X-based mode, this is not so critical, since supplicants that are no longer attached to the port will get removed upon the next reauthentication, which will fail. But if reauthentication is not enabled, the only way to free resources is by aging the entries. For ports in MAC-based Auth. mode, reauthentication does not cause direct communication between the switch and the client, so this will not detect whether the client is still attached or not, and the only way to free any resources is to age the entry.
Hold Time	This setting applies to the following modes, i.e., modes using the Port Security functionality to secure MAC addresses: • Single 802.1X • Multi 802.1X • MAC-Based Auth. If a client is denied access - either because the RADIUS server denies the client access or because the RADIUS server request times out (according to the timeout specified on the "**Configuration→Security→AAA**") the client is put on hold in the Unauthorized state. The hold timer does not count during an on-going authentication. In MAC-based Auth. mode, theswitch will ignore new frames coming from the client during the hold time. The Hold Time can be set to a number between 10 and 1000000 seconds.

RADIUS-Assigned QoS Enabled	RADIUS-assigned QoS provides a means to centrally control the traffic class to which traffic coming from a successfully authenticated supplicant is assigned on the switch. The RADIUS server must be configured to transmit special RADIUS attributes to take advantage of this feature (Refer to RADIUS-Assigned QoS Enabled within Port Configuration-see below) for a detailed description). The "RADIUS-Assigned QoS Enabled" checkbox provides a quick way to globally enable/disable RADIUS-server assigned QoS Class functionality. When checked, the individual ports' ditto setting determines whether RADIUS-assigned QoS Class is enabled on that port. When unchecked, RADIUS-server assigned QoS Class is disabled on all ports.
RADIUS-Assigned VLAN Enabled	RADIUS-assigned VLAN provides a means to centrally control the VLAN on which a successfully authenticated supplicant is placed on the switch. Incoming traffic will be classified to and switched on the RADIUS-assigned VLAN. The RADIUS server must be configured to transmit special RADIUS attributes to take advantage of this feature (see RADIUS-Assigned VLAN Enabled within Port Configuration below) for a detailed description. The "RADIUS-Assigned VLAN Enabled" checkbox provides a quick way to globally enable/disable RADIUS-server assigned VLAN functionality. When checked, the individual ports' ditto setting determines whether RADIUS-assigned VLAN is enabled on that port. When unchecked, RADIUS-server assigned VLAN is disabled on all ports.
Guest VLAN Enabled	A Guest VLAN is a special VLAN - typically with limited network access - on which 802.1X-unaware clients are placed after a network administrator-defined timeout. The switch follows a set of rules for entering and leaving the Guest VLAN as listed below. The "Guest VLAN Enabled" checkbox provides a quick way to globally enable/disable Guest VLAN functionality. When checked, the individual ports' ditto setting determines whether the port can be moved into Guest VLAN. When unchecked, the ability to move to the Guest VLAN is disabled on all ports.
Guest VLAN ID	This is the value that a port's Port VLAN ID is set to if a port is moved into the Guest VLAN. It is only changeable if the Guest VLAN option is globally enabled. Valid values are in the range [1; 4095].
Max. Reauth. Count	The number of times the switch transmits an EAPOL Request Identity frame without response before considering entering the Guest VLAN is adjusted with this setting. The value can only be changed if the Guest VLAN option is globally enabled. Valid values are in the range [1; 255].
Allow Guest VLAN if EAPOL Seen	The switch remembers if an EAPOL frame has been received on the port for the lifetime of the port. Once the switch considers whether to enter the Guest VLAN, it will first check if this option is enabled or disabled. If disabled (unchecked; default), the switch will only enter the Guest VLAN if an EAPOL frame has not been received on the port for the lifetime of the port. If enabled (checked), the switch will consider

	entering the Guest VLAN even if an EAPOL frame has been received on the port for the lifetime of the port. The value can only be changed if the Guest VLAN option is globally enabled.



Port Configuration

Port	Admin State	RADIUS-Assigned QoS Enabled	RADIUS-Assigned VLAN Enabled	Guest VLAN Enabled	Port State	Restart
*	<>	☐	☐	☐		
1	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
2	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
3	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
4	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
5	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
6	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
7	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
8	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
9	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
10	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
11	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
12	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
13	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
14	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
15	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
16	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
17	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
18	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
19	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
20	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize
21	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate Reinitialize

Port Configuration	
The table below has one row for each port on the switch several columns	
Port	The port number for which the configuration below applies.
Admin State	
If NAS is globally enabled, this selection controls the port's authentication mode. The following modes are available:	
Force Authorized	In this mode, the switch will send one EAPOL Success frame when the port link comes up, and any client on the port will be allowed network access without authentication
Force Unauthorized	In this mode, the switch will send one EAPOL Failure frame when the port link comes up, and any client on the port will be disallowed network access.
Port-based 802.1X	In the 802.1X-world, the user is called the supplicant, the switch is the authenticator, and the RADIUS server is the authentication server. The authenticator acts as the man-in-the-middle, forwarding requests and responses between the supplicant and the authentication server. Frames sent between the supplicant and the switch are special 802.1X frames, known as EAPOL (EAP Over LANs) frames. EAPOL frames encapsulate EAP PDUs (RFC3748). Frames sent between the switch and the RADIUS server are RADIUS packets. RADIUS packets also encapsulate EAP PDUs together with other attributes like the switch's

	IP address, name, and the supplicant's port number on the switch. EAP is very flexible, in that it allows for different authentication methods, likeMD5-Challenge,PEAP, and TLS. The important thing is that the authenticator (the switch) does not need to know which authentication method the supplicant and the authentication server are using, or how many information exchange frames are needed for a particular method. The switch simply encapsulates the EAP part of the frame into the relevant type (EAPOL or RADIUS) and forwards it. When authentication is complete, the RADIUS server sends a special packet containing a success or failure indication. Besides forwarding this decision to the supplicant, the switch uses it to open or block traffic on the switch port connected to the supplicant. *Note: Suppose two backend servers are enabled and that the server timeout is configured to X seconds (using the AAA configuration page) and suppose that the first server in the list is currently down (but not considered dead). Now, if the supplicant retransmits EAPOL Start frames at a rate faster than X seconds, then it will never get authenticated, because the switch will cancel on-going backend authentication server requests whenever it receives a new EAPOL Start frame from the supplicant. And since the server has not yet failed (because the X seconds have not expired), the same server will be contacted upon the next backend authentication server request from the switch. This scenario will loop forever. Therefore, the server timeout should be smaller than the supplicant's EAPOL Start frame retransmission rate.*
Single 802.1X	In port-based 802.1X authentication, once a supplicant is successfully authenticated on a port, the whole port is opened for network traffic. This allows other clients connected to the port (for instance through a hub) to piggy-back on the successfully authenticated client and get network access even though they really are not authenticated. To overcome this security breach, use the Single 802.1X variant. Single 802.1X is not an IEEE standard, but features many of the same characteristics as does port-based 802.1X. In Single 802.1X, at most one supplicant can get authenticated on the port at a time. Normal EAPOL frames are used in the communication between the supplicant and the switch. If more than one supplicant is connected to a port, the one that comes first when the port's link comes up will be the first one considered. If that supplicant does not provide valid credentials within a certain amount of time, another supplicant will get a chance. Once a supplicant is successfully authenticated, only that supplicant will be allowed access. This is the most secure of all the supported modes. In this mode, the Port Security module is used to secure a supplicant's MAC address once successfully authenticated

Multi 802.1X	Multi 802.1X is - like Single 802.1X - not an IEEE standard, but a variant that features many of the same characteristics. In Multi 802.1X, one or more supplicants can get authenticated on the same port at the same time. Each supplicant is authenticated individually and secured in the MAC table using the Port Security module. In Multi 802.1X it is not possible to use the multicast BPDU MAC address as destination MAC address for EAPOL frames sent from the switch towards the supplicant, since that would cause all supplicants attached to the port to reply to requests sent from the switch. Instead, the switch uses the supplicant's MAC address, which is obtained from the first EAPOL Start or EAPOL Response Identity frame sent by the supplicant. An exception to this is when no supplicants are attached. In this case, the switch sends EAPOL Request Identity frames using the BPDU multicast MAC address as destination - to wake up any supplicants that might be on the port. The maximum number of clients that can be attached to a port can be limited using the Port Security Limit Control functionality.
MAC-based Auth.	Unlike port-based 802.1X, MAC-based authentication is not a standard, but merely a best-practices method adopted by the industry. In MAC-based authentication, users are called clients, and the switch acts as the supplicant on behalf of clients. The initial frame (any kind of frame) sent by a client is snooped by the switch, which in turn uses the client's MAC address as both username and password in the subsequent EAP exchange with the RADIUS server. The 6-byte MAC address is converted to a string on the following form "xx-xx-xx-xx-xx-xx", that is, a dash (-) is used as separator between the lower-cased hexadecimal digits. The switch only supports the MD5-Challengeauthentication method, so the RADIUS server must be configured accordingly. When authentication is complete, the RADIUS server sends a success or failure indication, which in turn causes the switch to open up or block traffic for that particular client, using the Port Security module. Only then will frames from the client be forwarded on the switch. There are no EAPOL frames involved in this authentication, and therefore, MAC-based Authentication has nothing to do with the 802.1X standard. The advantage of MAC-based authentication over port-based 802.1X is that several clients can be connected to the same port (e.g., through a 3rd party switch or a hub) and still require individual authentication, and that the clients do not need special supplicant software to authenticate. The advantage of MAC-based authentication over 802.1X-based authentication is that the clients do not need special supplicant software to authenticate. The disadvantage is that MAC addresses can be spoofed by malicious users - equipment whose MAC address is a valid RADIUS user can be used by anyone. Also, only the MD5-Challenge method is supported.

	The maximum number of clients that can be attached to a port can be limited using the Port Security Limit Control functionality.
RADIUS-Assigned QoS Enabled	When RADIUS-Assigned QoS is both globally enabled and enabled (checked) on a given port, the switch reacts to QoS Class information carried in the RADIUS Access-Accept packet transmitted by the RADIUS server when a supplicant is successfully authenticated. If present and valid, traffic received on the supplicant's port will be classified to the given QoS Class. If (re-)authentication fails or the RADIUS Access-Accept packet no longer carries a QoS Class or it's invalid, or the supplicant is otherwise no longer present on the port, the port's QoS Class is immediately reverted to the original QoS Class (which may be changed by the administrator in the meanwhile without affecting the RADIUS-assigned). This option is only available for single-client modes, i.e., • Port-based 802.1X • Single 802.1X RADIUS attributes used in identifying a QoS Class: The User-Priority-Table attribute defined in RFC4675 forms the basis for identifying the QoS Class in an Access-Accept packet. Only the first occurrence of the attribute in the packet will be considered, and to be valid, it must follow this rule: • All 8 octets in the attribute's value must be identical and consist of ASCII characters in the range '0' - '7', which translates into the desired QoS Class in the range [0; 7].
RADIUS-Assigned VLAN Enabled	When RADIUS-Assigned VLAN is both globally enabled and enabled (checked) for a given port, the switch reacts to VLAN ID information carried in the RADIUS Access-Accept packet transmitted by the RADIUS server when a supplicant is successfully authenticated. If present and valid, the port's Port VLAN ID will be changed to this VLAN ID, the port will be set to be a member of that VLAN ID, and the port will be forced into VLAN unaware mode. Once assigned, all traffic arriving on the port will be classified and switched on the RADIUS-assigned VLAN ID. If (re-)authentication fails or the RADIUS Access-Accept packet no longer carries a VLAN ID or it's invalid, or the supplicant is otherwise no longer present on the port, the port's VLAN ID is immediately reverted to the original VLAN ID (which may be changed by the administrator in the meanwhile without affecting the RADIUS-assigned). This option is only available for single-client modes, i.e., • Port-based 802.1X • Single 802.1X For troubleshooting VLAN assignments, use the " VLANs→VLAN Membership Status and VLAN Port Status pages. These pages show which modules have (temporarily) overridden the current Port VLAN configuration.

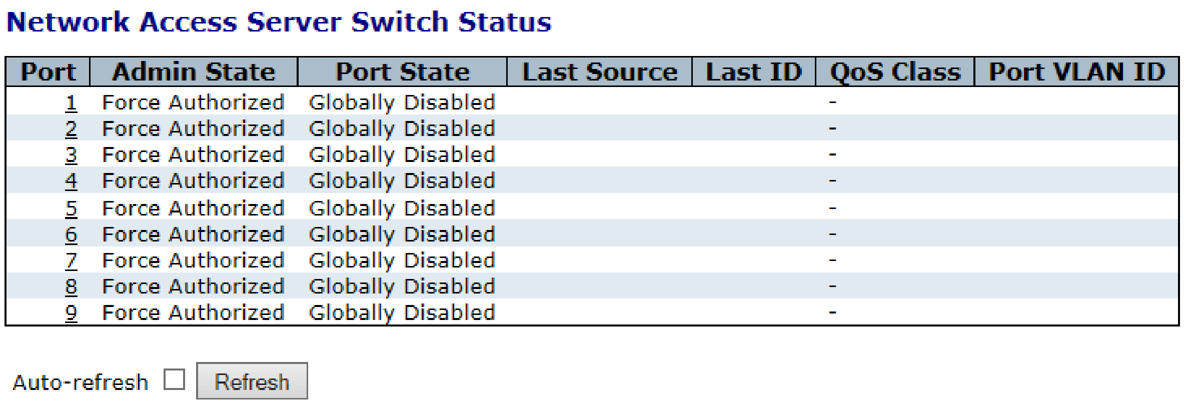
	RADIUS attributes used in identifying a VLAN ID: RFC2868 and RFC3580 form the basis for the attributes used in identifying a VLAN ID in an Access-Accept packet. The following criteria are used: The Tunnel-Medium-Type, Tunnel-Type, and Tunnel-Private-Group-IDattributes must all be present at least once in the Access-Accept packet. The switch looks for the first set of these attributes that have the same Tag value and fulfil the following requirements (if Tag == 0 is used, the Tunnel-Private-Group-ID does not need to include a Tag): - Value of Tunnel-Medium-Type must be set to "IEEE-802" (ordinal 6). - Value of Tunnel-Type must be set to "VLAN" (ordinal 13). - Value of Tunnel-Private-Group-ID must be a string of ASCII chars in the range '0' - '9', which is interpreted as a decimal string representing the VLAN ID. Leading '0's are discarded. The final value must be in the range [1; 4095].
Guest VLAN Enabled	When Guest VLAN is both globally enabled and enabled (checked) for a given port, the switch considers moving the port into the Guest VLAN according to the rules outlined below. This option is only available for EAPOL-based modes, i.e.: • Port-based 802.1X • Single 802.1X • Multi 802.1X For troubleshooting VLAN assignments, use the " → VLANs → VLAN Membership Status and VLAN Port Status" pages. These pages show which modules have (temporarily) overridden the current Port VLAN configuration. Guest VLAN Operation: When a Guest VLAN enabled port's link comes up, the switch starts transmitting EAPOL Request Identity frames. If the number of transmissions of such frames exceeds Max. Reauth. Count (refer to System Configuration above) and no EAPOL frames have been received in the meanwhile, the switch considers entering the Guest VLAN. The interval between transmission of EAPOL Request Identity frames is configured with EAPOL Timeout. If Allow Guest VLAN if EAPOL Seen (refer to System Configuration above) is enabled, the port will now be placed in the Guest VLAN. If disabled, the switch will first check its history to see if an EAPOL frame has previously been received on the port (this history is cleared if the port link goes down or the port's Admin State is changed -Refer to Port Configuration), and if not, the port will be placed in the Guest VLAN. Otherwise, it will not move to the Guest VLAN, but continue transmitting EAPOL Request Identity frames at the rate given by EAPOL Timeout. Once in the Guest VLAN, the port is considered authenticated, and all attached clients on the port are allowed access on this VLAN. The switch will not transmit an EAPOL Success frame when entering the Guest VLAN.

	While in the Guest VLAN, the switch monitors the link for EAPOL frames, and if one such frame is received, the switch immediately takes the port out of the Guest VLAN and starts authenticating the supplicant according to the port mode. If an EAPOL frame is received, the port will never be able to go back into the Guest VLAN if the "Allow Guest VLAN if EAPOL Seen" is disabled.
Port State	The current state of the port. It can undertake one of the following values: • **Globally Disabled**: NAS is globally disabled. Link Down: NAS is globally enabled, but there is no link on the port. • **Authorized**: The port is in Force Authorized (Refer to Port Configuration above) or a single-supplicant mode and the supplicant is authorized. • **Unauthorized**: The port is in Force Unauthorized ((Refer to Port Configuration above) or a single-supplicant mode and the supplicant is not successfully authorized by the RADIUS server. • **X Auth/Y Unauth**: The port is in a multi-supplicant mode. Currently X clients are authorized, and Y are unauthorized.
Restart	Two buttons are available for each row. The buttons are only enabled when authentication is globally enabled and the port's Admin State (Refer to beginning of Port Configuration above) is in an EAPOL-based or MAC-based mode (Refer to f Port Configuration above). Clicking these buttons will not cause settings changed on the page to take effect. • **Reauthenticate**: Schedules a reauthentication whenever the quiet-period of the port runs out (EAPOL-based authentication). For MAC-based authentication, reauthentication will be attempted immediately. The button only has effect for successfully authenticated clients on the port and will not cause the clients to get temporarily unauthorized. • **Reinitialize**: Forces a reinitialization of the clients on the port and thereby a reauthentication immediately. The clients will transfer to the unauthorized state while the reauthentication is in progress.

4.8.2.5 Network Access Server Switch Status

This section provides an overview of the current NAS port states for the selected switch.

Web GUI: Monitor > Security > Network > NAS



Network Access Server Switch Status

Port	Admin State	Port State	Last Source	Last ID	QoS Class	Port VLAN ID
1	Force Authorized	Globally Disabled			-	
2	Force Authorized	Globally Disabled			-	
3	Force Authorized	Globally Disabled			-	
4	Force Authorized	Globally Disabled			-	
5	Force Authorized	Globally Disabled			-	
6	Force Authorized	Globally Disabled			-	
7	Force Authorized	Globally Disabled			-	
8	Force Authorized	Globally Disabled			-	
9	Force Authorized	Globally Disabled			-	

Figure 4-75: Network Access Server Switch Status

Table 4-71: Network Access Server Switch Status Parameters

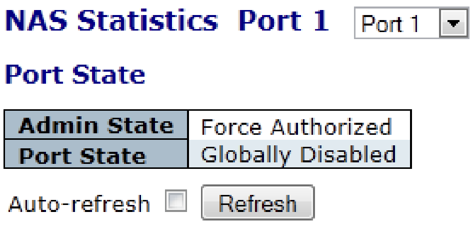
Port	The switch port number. Click to navigate to detailed NAS statistics for this port. Refer to next section.
Admin State	The port's current administrative state. Refer to NAS **Admin State** for a description of possible values Network Access Server Configuration.
Port State	The current state of the port. Refer to NAS **Port State** for a description of the individual states. Network Access Server Configuration.
Last Source	The source MAC address carried in the most recently received EAPOL frame for EAPOL-based authentication, and the most recently received frame from a new client for MAC-based authentication.
Last ID	The username (supplicant identity) carried in the most recently received Response Identity EAPOL frame for EAPOL-based authentication, and the source MAC address from the most recently received frame from a new client for MAC-based authentication.
QoS Class	QoS Class assigned to the port by the RADIUS server if enabled.
Port VLAN ID	The VLAN ID that NAS has put the port in. The field is blank, if the Port VLAN ID is not overridden by NAS. If the VLAN ID is assigned by the RADIUS server, "(RADIUS-assigned)" is appended to the VLAN ID. (Read more about RADIUS-assigned VLANs at previous section. System Configuration). If the port is moved to the Guest VLAN, "(Guest)" is appended to the VLAN ID. Read more about Guest VLANs (previous section System Configuration).

4.8.2.6 NAS Port Statistics

This section provides detailed NAS statistics for a specific switch port running EAPOL-based IEEE 802.1X authentication. For MAC-based ports, it shows selected backend server (RADIUS Authentication Server) statistics only.

Use the port select box to select which port details to be displayed.

Web GUI: Monitor > Security > Network > NAS > Port



NAS Statistics Port 1

Port State

Admin State	Force Authorized
Port State	Globally Disabled

Auto-refresh ☐

Figure 4-76: NAS Port Statistics

Table 4-72: NAS Port Parameters

Port State	
Admin State	The port's current administrative state. Refer to **NAS Admin State** for a description of possible values.
Port State	The current state of the port. Refer to **NAS Port State** for a description of the individual states.
QoS Class	QoS Class assigned to the port by the RADIUS server. The field is blank if no QoS class is assigned.
Port VLAN ID	The VLAN ID that NAS has put the port in. The field is blank, if the Port VLAN ID is not overridden by NAS. If the VLAN ID is assigned by the RADIUS server, "(RADIUS-assigned)" is appended to the VLAN ID. Read more about RADIUS-assigned VLANs at previous section System Configuration. If the port is moved to the Guest VLAN, "(Guest)" is appended to the VLAN ID. Read more about Guest VLANs previous .System Configuration).
Port Counters	
EAPOL Counters	These supplicant frame counters are available for the following administrative states: • Force Authorized • Force Unauthorized • Port-based 802.1X • Single 802.1X • Multi 802.1X

EAPOL Counters			
Direction	Name	IEEE Name	Description
Rx	Total	dot1xAuthEapolFramesRx	The number of valid EAPOL frames of any type that have been received by the switch.
Rx	Response ID	dot1xAuthEapolRespIdFramesRx	The number of valid EAPOL Response Identity frames that have been received by the switch.

Rx	Responses	dot1xAuthEapolRespFramesRx	The number of valid EAPOL response frames (other than Response Identity frames) that have been received by the switch.
Rx	Start	dot1xAuthEapolStartFramesRx	The number of EAPOL Start frames that have been received by the switch.
Rx	Logoff	dot1xAuthEapolLogoffFramesRx	The number of valid EAPOL Logoff frames that have been received by the switch.
Rx	Invalid Type	dot1xAuthInvalidEapolFramesRx	The number of EAPOL frames that have been received by the switch in which the frame type is not recognized.
Rx	Invalid Length	dot1xAuthEapLengthErrorFramesRx	The number of EAPOL frames that have been received by the switch in which the Packet Body Length field is invalid.
Tx	Total	dot1xAuthEapolFramesTx	The number of EAPOL frames of any type that have been transmitted by the switch.
Tx	Request ID	dot1xAuthEapolReqIdFramesTx	The number of EAPOL Request Identity frames that have been transmitted by the switch.
Tx	Requests	dot1xAuthEapolReqFramesTx	The number of valid EAPOL Request frames (other than Request Identity frames) that have been transmitted by the switch.

Backend Server Counters

This backend (RADIUS) frame counters are available for the following administrative states:

- Port-based 802.1X
- Single 802.1X
- Multi 802.1X
- MAC-based Auth

Backend Server Counters

Direction	Name	IEEE Name	Description
Rx	Access Challenges	dot1xAuthBackendAccessChallenges	**802.1X-based**: Counts the number of times that the switch receives the first request from the backend server following the first response from the supplicant. Indicates that the backend server has communication with the switch. **MAC-based**:

			Counts all Access Challenges received from the backend server for this port (left-most table) or client (right-most table).
Rx	Other Requests	dot1xAuthBackendOtherRequestsToSupplicant	**802.1X-based**: Counts the number of times that the switch sends an EAP Request packet following the first to the supplicant. Indicates that the backend server chose an EAP-method. **MAC-based**: Not applicable.
Rx	Auth. Successes	dot1xAuthBackendAuthSuccesses	**802.1X- and MAC-based**: Counts the number of times that the switch receives a success indication. Indicates that the supplicant/client has successfully authenticated to the backend server.
Rx	Auth. Failures	dot1xAuthBackendAuthFails	**802.1X- and MAC-based**: Counts the number of times that the switch receives a failure message. This indicates that the supplicant/client has not authenticated to the backend server.
Tx	Responses	dot1xAuthBackendResponses	**802.1X-based:** Counts the number of times that the switch attempts to send a supplicant's first response packet to the backend server. Indicates the switch attempted communication with the backend server. Possible retransmissions are not counted. **MAC-based:** Counts all the backend server packets sent from the switch towards the backend server for a given port (left-most table) or client (right-most table). Possible retransmissions are not counted.

Last Supplicant/ Client Info
Last Supplicant/Client Info Information about the last supplicant/client that attempted to authenticate. This information is available for the following administrative states: (Refer to section 4.9.2.2 Port Configuration) • Port-based 802.1X • Single 802.1X • Multi 802.1X • MAC-based Auth

Last Supplicant/Client Info		
Name	**IEEE Name**	**Description**
MAC Address	dot1xAuthLastEapolFrameSource	The MAC address of the last supplicant/client.
VLAN ID	-	The VLAN ID on which the last frame from the last supplicant/client was received.
Version	dot1xAuthLastEapolFrameVersion	**802.1X-based**: The protocol version number carried in the most recently received EAPOL frame. **MAC-based**: Not applicable.
Identity	-	**802.1X-based**: The username (supplicant identity) carried in the most recently received Response Identity EAPOL frame. **MAC-based**: Not applicable.

Selected Counters

The Selected Counters table is visible when the port is in one of the following administrative states:

- Multi 802.1X
- MAC-based Auth.

The table is identical to and is placed next to the above Port Counters table and will be empty if no MAC address is currently selected. To populate the table, select one of the **attached MAC Addresses** from the table below.

Attached MAC Addresses	
Identity	Shows the identity of the supplicant, as received in the Response Identity EAPOL frame. Clicking the link causes the supplicant's EAPOL and Backend Server counters to be shown in the Selected Counters table. If no supplicants are attached, it shows No supplicants attached. This column is not available for MAC-based Auth.
MAC Address	For Multi 802.1X, this column holds the MAC address of the attached supplicant. For MAC-based Auth., this column holds the MAC address of the attached client. Clicking the link causes the client's Backend Server counters to be shown in the Selected Counters table. If no clients are attached, it shows No clients attached.
VLAN ID	This column holds the VLAN ID that the corresponding client is currently secured through the Port Security module

State	The client can either be authenticated or unauthenticated. In the authenticated state, it is allowed to forward frames on the port, and in the unauthenticated state, it is blocked. If the backend server has not successfully authenticated the client, it is unauthenticated. If an authentication fails for one or the other reason, the client will remain in the unauthenticated state for **Hold Time** seconds.
Last Authentication	Shows the date and time of the last authentication of the client (successful as well as unsuccessful).
Buttons	The port select box determines which port is affected when clicking the buttons. **Clear**: This button is available in the following modes: • Force Authorized • Force Unauthorized • Port-based 802.1X • Single 802.1X **Clear All**: This button is available in the following modes: • Multi 802.1X • MAC-based Auth.X Click to clear the counters for the selected port. **Clear this**: This button is available in the following modes: • Multi 802.1X • MAC-based Auth.X

4.8.2.7 ACL Ports Configuration

Configure the ACL Parameters (ACE) of each switch port. These Parameters will affect frames received on a port unless the frame matches a specific ACE.

Note: For a detailed explanation of ACL and ACE terms, refer to the Glossary of Terms at the end of this manual

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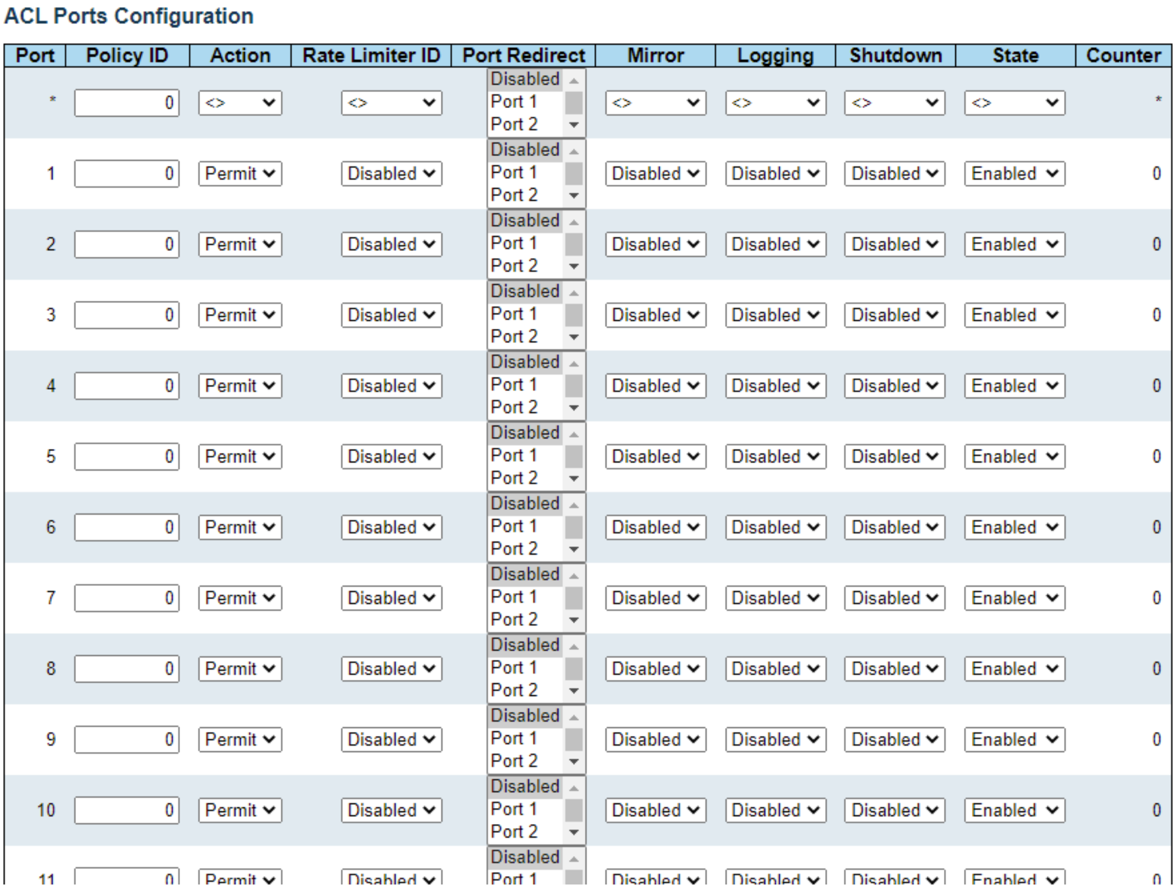
Web GUI: Configuration > Security > Network > ACL > Ports



ACL Ports Configuration

Port	Policy ID	Action	Rate Limiter ID	Port Redirect	Mirror	Logging	Shutdown	State	Counter
*	0	<>	<>	Disabled Port 1 Port 2	<>	<>	<>	<>	*
1	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
2	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
3	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
4	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
5	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
6	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
7	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
8	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
9	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
10	0	Permit	Disabled	Disabled Port 1 Port 2	Disabled	Disabled	Disabled	Enabled	0
11	0	Permit	Disabled	Disabled Port 1	Disabled	Disabled	Disabled	Enabled	0

Figure 4-77: ACL Port Configuration

Table 4-73: ACL Port Configuration Parameters

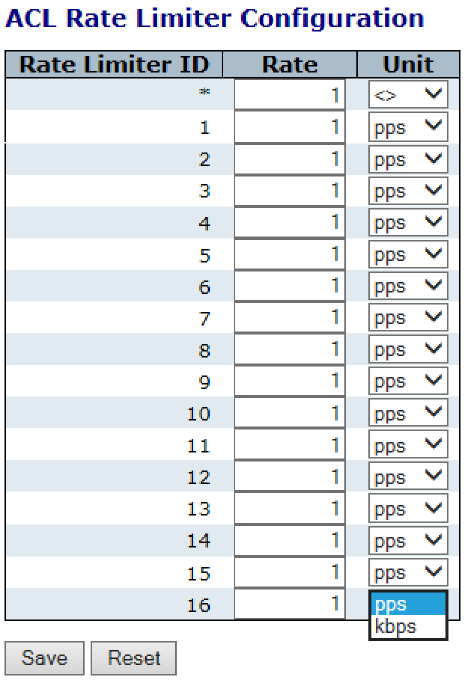
Port	The logical port for the settings contained in the same row.
Policy ID	Select the policy to apply to this port. The allowed values are 0 through 255. The default value is 0.
Action	Select whether forwarding is permitted ("Permit") or denied ("Deny"). The default value is **Permit**.
Rate Limiter ID	Select which rate limiter to apply on this port. The allowed values are Disabled or the values **1** through **16**. The default value is **Disabled**.
Port Redirect	Select which port frames are redirected on. The allowed values are Disabled or a specific port number. The default value is **Disabled**.
Mirror	Specify the mirror operation of this port. The allowed values are: • **Enabled**: Frames received on the port are mirrored. • **Disabled**: Frames received on the port are not mirrored. The default value is **Disabled**.
Logging	Specify the logging operation of this port. The allowed values are: • **Enabled**: Frames received on the port are stored in the System Log. • **Disabled**: Frames received on the port are not logged. The default value is "Disabled". Please note that the System Log memory size and logging rate is limited.

Shutdown	Specify the port shut down operation of this port. The allowed values are: • **Enabled**: If a frame is received on the port, the port will be disabled. • **Disabled**: Port shut down is disabled. The default value is **Disabled**. *Note: The shutdown feature only works when the packet length is less than 1518(without VLAN tags).*
State	Specify the port state of this port. The allowed values are: • **Enabled**: To reopen ports by changing the volatile port configuration of the ACL user module. • **Disabled**: To close ports by changing the volatile port configuration of the ACL user module. The default value is **Enabled**.
Counter	Counts the number of frames that match this ACE.

4.8.2.8 Configuration

Configure the rate limiter for the ACL of the switch.

Web GUI: Monitor > Security > Network > ACL > Rate Limiters



ACL Rate Limiter Configuration

Rate Limiter ID	Rate	Unit
*	1	<>
1	1	pps
2	1	pps
3	1	pps
4	1	pps
5	1	pps
6	1	pps
7	1	pps
8	1	pps
9	1	pps
10	1	pps
11	1	pps
12	1	pps
13	1	pps
14	1	pps
15	1	pps
16	1	pps

Figure 4-78: ACL Rate Limiter Configuration

Table 4-74: ACL Rate Limiter Parameters

Rate Limiter ID	The rate limiter ID for the settings contained in the same row. and its range is **1** to **16**.
Rate	The allowed values are: **0-3276700** in PPS, or **0**, **100**, **200**, **300**, ..., **1000000** in KBPS.

Unit	Specify the rate unit. The allowed values are: • **PPS**: packets per second. • **LBPS**: Kbits per second.

4.8.2.9 Access Control List Configuration

This section shows the Access Control List (ACL), which is made up of the ACEs defined on this switch. Each row describes the ACE that is defined. The maximum number of ACEs is 256 on each switch.

Click on the lowest plus sign to add a new ACE to the list. The reserved ACEs used for internal protocol, cannot be edited or deleted, the order sequence cannot be changed, and the priority is highest.

Web GUI: Monitor > Security > Network > ACL > Access Control List

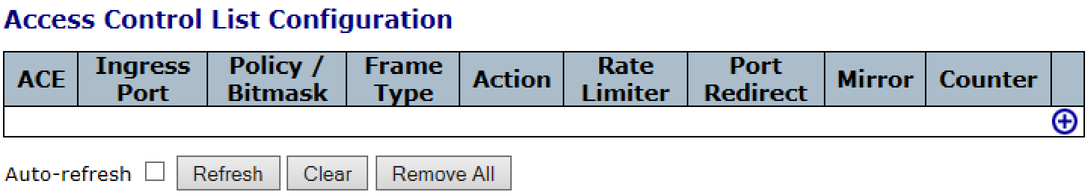


Figure 4-79: Access Control List Configuration

Table 4-75: ACL Configuration Parameters

ACE	Indicates the ACE ID.
Ingress Port	Indicates the ingress port of the ACE. Possible values are: • **All**: The ACE will match all ingress port. • **Port**: The ACE will match a specific ingress port.
Policy / Bitmask	Indicates the policy number and bitmask of the ACE.
Frame Type	Indicates the frame type of the ACE. Possible values are: • **Any**: The ACE will match any frame type. • **EType:** The ACE will match Ethernet Type frames. Note that an Ethernet Type based ACE will not get matched by IP and ARP frames. • **ARP**: The ACE will match ARP/RARP frames • **IPv4:** The ACE will match all IPv4 frames. • **IPv4/ICMP**: The ACE will match IPv4 frames with ICMP protocol. • **IPv4/UDP:** The ACE will match IPv4 frames with UDP protocol. • **IPv4/TCP:** The ACE will match IPv4 frames with TCP protocol. • **IPv4/Other**: The ACE will match IPv4 frames, which are not ICMP/UDP/TCP. • **IPv6:** The ACE will match all IPv6 standard frames.
Action	Indicates the forwarding action of the ACE. • **Permit**: Frames matching the ACE may be forwarded and learned. • **Deny**: Frames matching the ACE are dropped. • **Filter**: Frames matching the ACE are filtered.
Rate Limiter	Indicates the rate limiter number of the ACE. The allowed range is **1** to **16**. When **Disabled** is displayed, the rate limiter operation is disabled.

Port Redirect	Indicates the port redirect operation of the ACE. Frames matching the ACE are redirected to the port number. The allowed values are **Disabled** or a specific port number. When **Disabled** is displayed, the port redirect operation is disabled.
Mirror	Specify the mirror operation of this port. Frames matching the ACE are mirrored to the destination mirror port. The allowed values are: • **Enabled**: Frames received on the port are mirrored. • **Disabled**: Frames received on the port are not mirrored. The default value is "Disabled.
Counter	The counter indicates the number of times the ACE was hit by a frame.
Modification Button	⊕: The lowest plus sign adds a new entry at the bottom of the ACE listings. By checking this box, you access additional displays (ACE configuration, VLAN Parameters).

Note: Refer to the Alphabetic Glossary of Terms for explanation of all underlined terms in the above section.

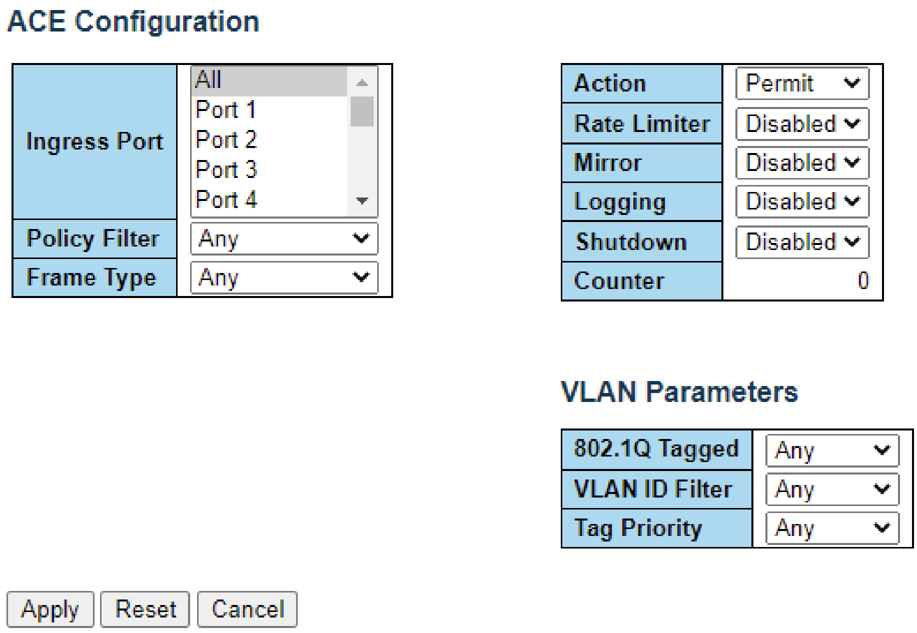
By clicking on the ⊕: The lowest plus sign adds a new entry at the bottom of the ACE listings. Refer to next page.

4.8.2.10 ACE Configuration

Configure an ACE (Access Control Entry) on this section. An ACE consists of several parameters. These parameters vary according to the frame type that you select. First select the ingress port for the ACE, and then select the frame type. Different parameter options are displayed depending on the frame type selected.

A frame that hits this ACE matches the configuration that is defined here.

Web GUI: Configuration > Security > Network > ACL > Access Control List



ACE Configuration

Ingress Port	All Port 1 Port 2 Port 3 Port 4
Policy Filter	Any
Frame Type	Any

Action	Permit
Rate Limiter	Disabled
Mirror	Disabled
Logging	Disabled
Shutdown	Disabled
Counter	0

VLAN Parameters

802.1Q Tagged	Any
VLAN ID Filter	Any
Tag Priority	Any

Figure 4-80: ACE Configuration displays

Table 4-76: ACL Configuration Parameters

ACE Configuration	
Second Lookup	Specify the second lookup operation of the ACE.
Ingress Port	Select the ingress port for which this ACE applies. • **All**: The ACE applies to all port. • **Port**: The ACE applies to this port number, where *n* is the number of the switch port.
Policy Filter	Specify the policy number filter for this ACE. • **Any**: No policy filter is specified. (Policy filter status is "don't-care".) • **Specific**: If you want to filter a specific policy with this ACE, choose this value. Two field for entering a policy value and bitmask appears.
Frame Type	Select the frame type for this ACE. These frames are mutually exclusive: • **Any**: Any frame can match this ACE. • **Ethernet Type**: Only Ethernet Type frames can match this ACE. The IEEE 802.3 describes the value of Length/Type Field specifications to be greater than or equal to 1536 decimal (equal to 0600 hexadecimal) and the value should not be equal to 0x800(IPv4), 0x806(ARP) or 0x86DD(IPv6). • **ARP**: Only ARP frames can match this ACE. Notice the ARP frames will not match the ACE with ethernet type. • **IPv4:** Only IPv4 frames can match this ACE. Notice the IPv4 frames will not match the ACE with ethernet type. • **IPv6:** Only IPv6 frames can match this ACE. Notice the IPv6 frames will not match the ACE with Ethernet type.

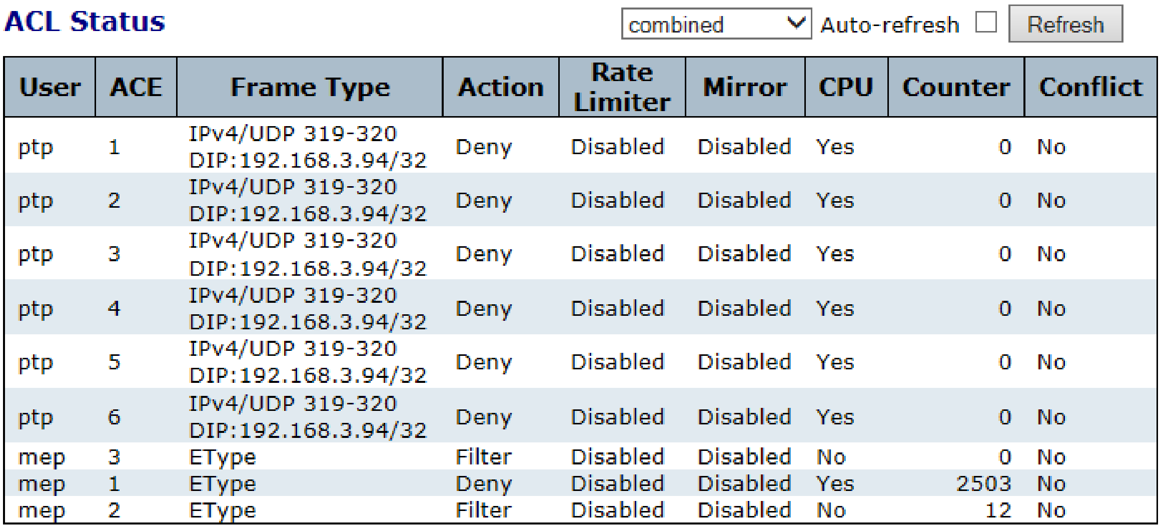
Action	Specify the action to take with a frame that hits this ACE. • **Permit**: The frame that hits this ACE is granted permission for the ACE operation. • **Deny**: The frame that hits this ACE is dropped. • **Filter**: Frames matching the ACE are filtered.
Rate Limiter	Select whether the rate limiter in number of base units. The allowed range is **1** to **16**. **Disabled** indicates that, the rate limiter operation is disabled
EVC Policer	Select whether EVC policer is enabled or disabled. The default value is **Disabled**. Note that the ACL rate limiter and EVC policer cannot both be enabled.
Mirror	Specify the mirror operation of this port. Frames matching the ACE are mirrored to the destination mirror port. The rate limiter will not affect frames on the mirror port. The allowed values are: • **Enabled**: Frames received on the port are mirrored. • **Disabled**: Frames received on the port are not mirrored. The default value is "Disabled".
Logging	Specify the logging operation of the ACE. Notice that the logging message does not include the 4 bytes CRC information. The allowed values are: • **Enabled**: Frames matching the ACE are stored in the System Log. • **Disabled**: Frames matching the ACE are not logged. *Note: The logging feature only works when the packet length is less than 1518(without VLAN tags) and the System Log memory size and logging rate is limited*
Shutdown	Specify the port shut down operation of the ACE. The allowed values are: • **Enabled**: If a frame matches the ACE, the ingress port will be disabled. • **Disabled**: Port shut down is disabled for the ACE. *Note: The shutdown feature only works when the packet length is less than 1518(without VLAN tags).*
Counter	The counter indicates the number of times the ACE was hit by a frame.

VLAN Parameters	
802.1Q Tagged	Specify whether frames can hit the action according to the 802.1Q tagged. The allowed values are: • **Any**: Any value is allowed ("don't-care"). • **Enabled**: Tagged frame only. • **Disabled**: Untagged frame only. The default value is "Any".
VLAN ID Filter	Specify the VLAN ID filter for this ACE. • **Any**: No VLAN ID filter is specified. (VLAN ID filter status is "don't-care".) • **Specific**: If you want to filter a specific VLAN ID with this ACE, choose this value. A field for entering a VLAN ID number appears.
Tag Priority	Specify the tag priority for this ACE. A frame that hits this ACE matches this tag priority. The allowed number range is **0** to **7** or range **0-1**, **2-3**, **4-5**, **6-7**, **0-3** and **4-7**. The value **Any** means that no tag priority is specified (tag priority is "don't-care".)

4.8.2.11 ACL Status

This section shows the ACL status by different ACL users. Each row describes the ACE that is defined. It is a conflict if a specific ACE is not applied to the hardware due to hardware limitations. The maximum number of ACEs is 256 on each switch.

Web GUI: Monitor > Security > Network > ACL Status

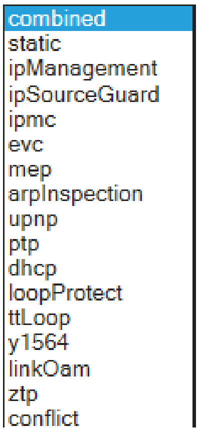


User	ACE	Frame Type	Action	Rate Limiter	Mirror	CPU	Counter	Conflict
ptp	1	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
ptp	2	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
ptp	3	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
ptp	4	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
ptp	5	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
ptp	6	IPv4/UDP 319-320 DIP:192.168.3.94/32	Deny	Disabled	Disabled	Yes	0	No
mep	3	EType	Filter	Disabled	Disabled	No	0	No
mep	1	EType	Deny	Disabled	Disabled	Yes	2503	No
mep	2	EType	Filter	Disabled	Disabled	No	12	No

Figure 4-81: ACL Status

Table 4-77: ACL Status Parameters

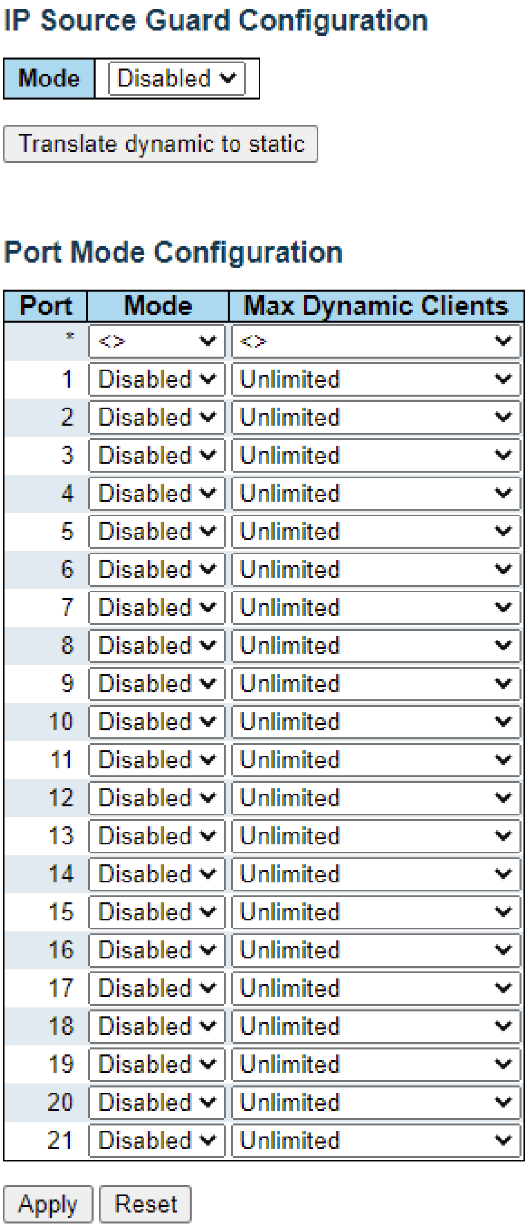
User	Indicates the ACL user.
ACE	Indicates the ACE ID on local switch.

Frame Type	Indicates the frame type of the ACE. Possible values are: • **Any**: The ACE will match any frame type. • **EType:** The ACE will match Ethernet Type frames. **Note that an Ethernet Type based ACE will not get matched by IP and ARP frames.** • **ARP**: The ACE will match ARP/RARP frames. • **IPv4:** The ACE will match all IPv4 frames. • **IPv4/ICMP**: The ACE will match IPv4 frames with ICMP protocol. • **IPv4/UDP:** The ACE will match IPv4 frames with UDP protocol. • **IPv4/TCP:** The ACE will match IPv4 frames with TCP protocol. • **IPv4/Other**: The ACE will match IPv4 frames, which are not ICMP/UDP/TCP. • **IPv6:** The ACE will match all IPv6 standard frames.
Action	Indicates the forwarding action of the ACE. • **Permit**: Frames matching the ACE may be forwarded and learned. • **Deny**: Frames matching the ACE are dropped**.** • **Filter**: Frames matching the ACE are filtered.
Rate Limiter	Indicates the rate limiter number of the ACE. The allowed range is **1** to **16**. When **Disabled** is displayed, the rate limiter operation is disabled.
Mirror	Specify the mirror operation of this port. Frames matching the ACE are mirrored to the destination mirror port. The allowed values are: • **Enabled**: Frames received on the port are mirrored. • **Disabled**: Frames received on the port are not mirrored. The default value is "Disabled.
CPU	Forward packet that matched the specific ACE to CPU.
Counter	The counter indicates the number of times the ACE was hit by a frame.
Conflict	Indicates the hardware status of the specific ACE. The specific ACE is not applied to the hardware due to hardware limitations.
Buttons	The select box determines which ACL user is affected by clicking the buttons**.** Combined  combined static ipManagement ipSourceGuard ipmc evc mep arpInspection upnp ptp dhcp loopProtect ttLoop y1564 linkOam ztp conflict

4.8.2.12 IP Source Guard Configuration

IP Source Guard is a secure feature used to restrict IP traffic on DHCP snooping untrusted ports by filtering traffic based on the DHCP Snooping Table or manually configured IP Source Bindings. It helps prevent IP spoofing attacks when a host tries to spoof and use the IP address of another host. This section provides the related IP Source Guard configurations

Web GUI: Configuration > Security > Network > IP Source Guard/Configuration



IP Source Guard Configuration

Mode: Disabled

Port Mode Configuration

Port	Mode	Max Dynamic Clients
*	<>	<>
1	Disabled	Unlimited
2	Disabled	Unlimited
3	Disabled	Unlimited
4	Disabled	Unlimited
5	Disabled	Unlimited
6	Disabled	Unlimited
7	Disabled	Unlimited
8	Disabled	Unlimited
9	Disabled	Unlimited
10	Disabled	Unlimited
11	Disabled	Unlimited
12	Disabled	Unlimited
13	Disabled	Unlimited
14	Disabled	Unlimited
15	Disabled	Unlimited
16	Disabled	Unlimited
17	Disabled	Unlimited
18	Disabled	Unlimited
19	Disabled	Unlimited
20	Disabled	Unlimited
21	Disabled	Unlimited

Figure 4-82: IP Source Guard Configuration

Table 4-78: IP Source Guard Configuration Parameters

Mode of IP Source Guard Configuration	Enable the Global IP Source Guard or disable the Global IP Source Guard. All configured ACEs will be lost when the mode is enabled.
Port Mode Configuration	Specify IP Source Guard is enabled on which ports. Only when both Global Mode and Port Mode on a given port are enabled, IP Source Guard is enabled on this given port.

Max Dynamic Clients	Specify the maximum number of dynamic clients that can be learned on given port. This value can be 0, 1, 2 or unlimited. If the port mode is enabled and the value of max dynamic client is equal to 0, it means only allow the IP packets forwarding that are matched in static entries on the specific port.
Buttons	**Translate dynamic to static**: Click to translate all dynamic entries to static entries.

4.8.2.13 Static IP Source Guard Table

Web GUI: Configuration > Security > Network > IP Source Guard/Static Table

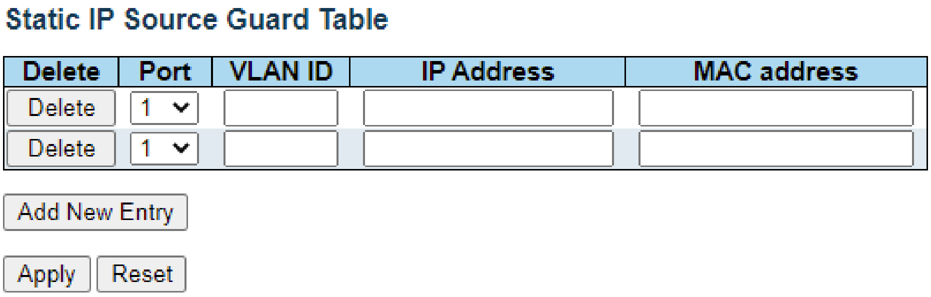


Figure 4-83: Static IP Source Guard Table

Table 4-79: IP Source Guard Table Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
Port	The logical port for the settings.
VLAN ID	The VLAN ID for the settings.
IP Address	Allowed Source IP address
MAC address	Allowed Source MAC address
Buttons	**Add New Entry:** Click to add a new entry to the Static IP Source Guard table.

4.8.2.14 Dynamic IP Source Guard Table

Entries in the Dynamic IP Source Guard Table are shown on this page. The Dynamic IP Source Guard Table is sorted first by port, then by VLAN ID, then by IP address, and then by MAC address

Navigating the IP Source Guard Table

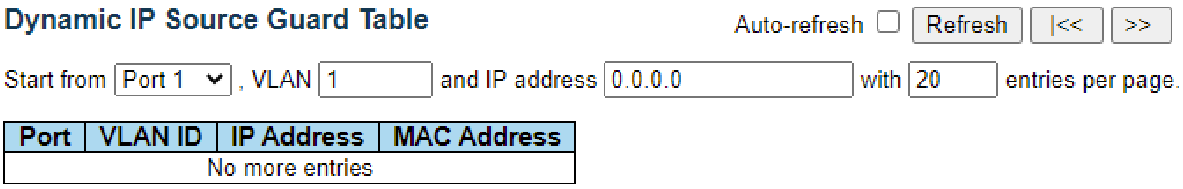
Each page shows up to 99 entries from the Dynamic IP Source Guard table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the Dynamic IP Source Guard Table.

The "Start from port address", "VLAN" and "IP address" input fields allow the user to select the starting point in the Dynamic IP Source Guard Table.

Clicking the **Refresh** button will update the displayed table starting from that or the closest next Dynamic IP Source Guard Table match. In addition, the two input fields will - upon a **Refresh** button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

The will >> use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the << button to start over.

Web GUI: Monitor > Security > Network > IP Source Guard



Start from Port 1, VLAN 1 and IP address 0.0.0.0 with 20 entries per page.

Port	VLAN ID	IP Address	MAC Address
No more entries			

Figure 4-84: Dynamic IP Source Guard Table

Table 4-80: Dynamic IP Source Guard Table Parameters

Port	Switch Port Number for which the entries are displayed.
VLAN ID	VLAN-ID in which the IP traffic is permitted.
IP Address	User IP address of the entry.
MAC address	Source MAC address.
Buttons	**<<:** Updates the table starting from the first entry in the Dynamic IP Source Guard Table. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

4.8.3 Address Resolution Protocol

ARP is an acronym for **A**ddress **R**esolution **P**rotocol. It is a protocol that used to convert an IP address into a physical address, such as an Ethernet address. ARP allows a host to communicate with other hosts when only the Internet address of its neighbors is known. Before using IP, the host sends a broadcast ARP request containing the Internet address of the desired destination system.

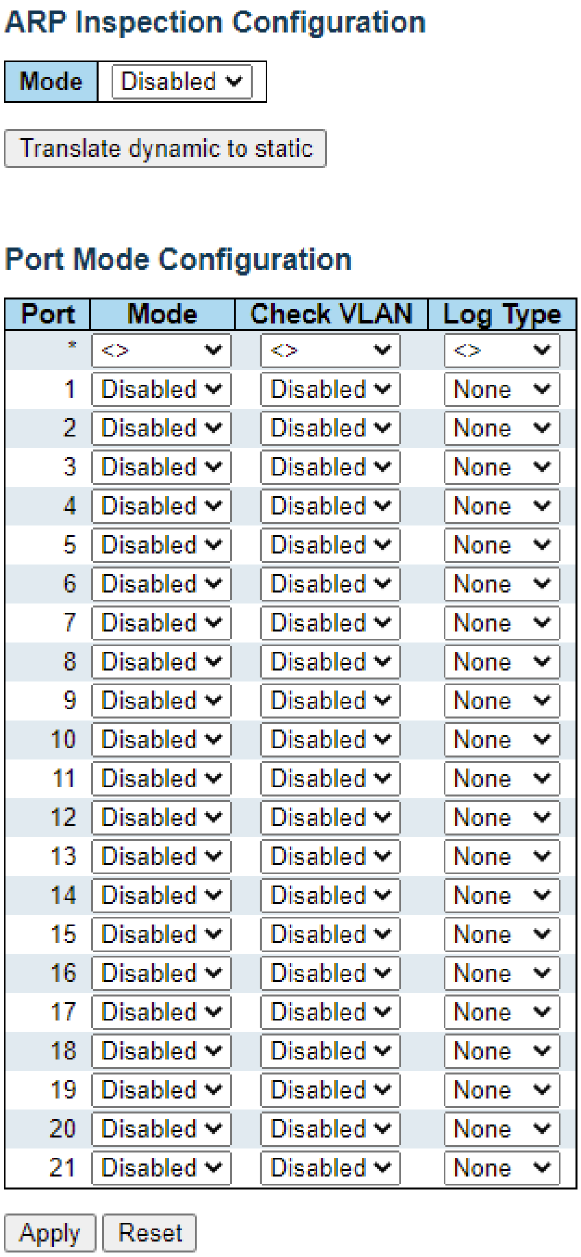
The ARP subject is covered by the following displays:

- ARP Inspection Configuration
- Port Mode Configuration
- VLAN Mode Configuration
- Static ARP Inspection Table
- Dynamic ARP Inspection Table

4.8.3.1 ARP Inspection Configuration

This section provides ARP Inspection related configuration.

ARP Inspection is a secure feature. Several types of attacks can be launched against a host or devices connected to Layer 2 networks by "poisoning" the ARP caches. This feature is used to block such attacks. Only valid ARP requests and responses can go through the switch device.



ARP Inspection Configuration

Mode: Disabled

Port Mode Configuration

Port	Mode	Check VLAN	Log Type
*	<>	<>	<>
1	Disabled	Disabled	None
2	Disabled	Disabled	None
3	Disabled	Disabled	None
4	Disabled	Disabled	None
5	Disabled	Disabled	None
6	Disabled	Disabled	None
7	Disabled	Disabled	None
8	Disabled	Disabled	None
9	Disabled	Disabled	None
10	Disabled	Disabled	None
11	Disabled	Disabled	None
12	Disabled	Disabled	None
13	Disabled	Disabled	None
14	Disabled	Disabled	None
15	Disabled	Disabled	None
16	Disabled	Disabled	None
17	Disabled	Disabled	None
18	Disabled	Disabled	None
19	Disabled	Disabled	None
20	Disabled	Disabled	None
21	Disabled	Disabled	None

Web GUI: Monitor > Security > Network > ARP Inspection > Port Configuration

Figure 4-85: ARP Configurations displays

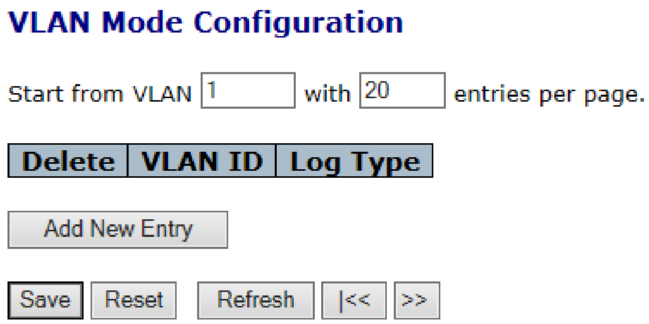
Table 4-81: ARP Configuration displays Parameters

ARP Inspection Configuration	
Mode of ARP Inspection Configuration	Enable the Global ARP Inspection or disable the Global ARP Inspection
Port Mode Configuration	
Port Mode Configuration	Specify ARP Inspection is enabled on which ports. Only when both Global Mode and Port Mode on a given port are enabled, ARP Inspection is enabled on this given port. Possible modes are: • **Enabled**: Enable ARP Inspection operation.

	• **Disabled**: Disable ARP Inspection operation. If you want to inspect the VLAN configuration, you must enable the setting of "Check VLAN". The default setting of "Check VLAN" is disabled. When the setting of "Check VLAN" is disabled, the log type of ARP Inspection will refer to the port setting. And if the setting of "Check VLAN" is enabled; the log type of ARP Inspection will refer to the VLAN setting. Possible setting of "Check VLAN" are: • **Enabled**: Enable check VLAN operation. • **Disabled**: Disable check VLAN operation. Only if the Global Mode and Port Mode on a given port are enabled, and the setting of "Check VLAN" is disabled, the log type of ARP Inspection will refer to the port setting. There are four Log Type and possible types are: • **None**: Log nothing. • **Deny**: Log denied entries. • **Permit**: Log permitted entries. • **ALL**: Log all entries.
Buttons	**Translate dynamic to static**: Click to translate all dynamic entries to static entries.

4.8.3.2 VLAN Mode Configuration

This section provides ARP enabled on which VLAN.



VLAN Mode Configuration

Start from VLAN 1 with 20 entries per page.

Delete	VLAN ID	Log Type

Figure 4-86: VLAN Mode Configurations display

Table 4-82: VLAN Mode Configuration Parameters

VLAN Mode Configuration	
Specify ARP Inspection is enabled on which VLANs. First, you must enable the port setting on Port mode configuration web page. Only when both Global Mode and Port Mode on a given port are enabled, ARP Inspection is enabled on this given port. Second, you can specify which VLAN will be inspected on VLAN mode configuration web page. The log type also can be configured on per VLAN setting. Possible types are: • **None**: Log nothing. • **Deny**: Log denied entries. • **Permit**: Log permitted entries. • **All**: Log all entries	
Buttons	**Add New Entry**: Click to add a new VLAN to the ARP Inspection VLAN table.
Navigating the VLAN Configuration	
Each page shows up to 9999 entries from the VLAN table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the VLAN Table. The first displayed will be the one with the lowest VLAN ID found in the VLAN Table. The "VLAN" input fields allow the user to select the starting point in the VLAN Table. Clicking **Refresh** the button will update the displayed table starting from that or the closest next VLAN Table match. The >> will use the next entry of the currently displayed VLAN entry as a basis for the next lookup. When the end is reached the warning, message is shown in the displayed table. Use the << button to start over.	

4.8.3.3 Static ARP Inspection Table

This page shows the static ARP Inspection rules. The maximum number of rules is **256** on the switch.

Web GUI: Monitor > Security > Network > ARP Inspection > Static Table

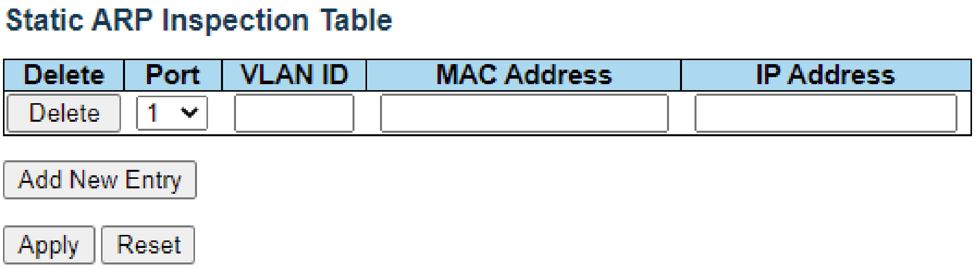


Figure 4-87: Static ARP Inspection Table display

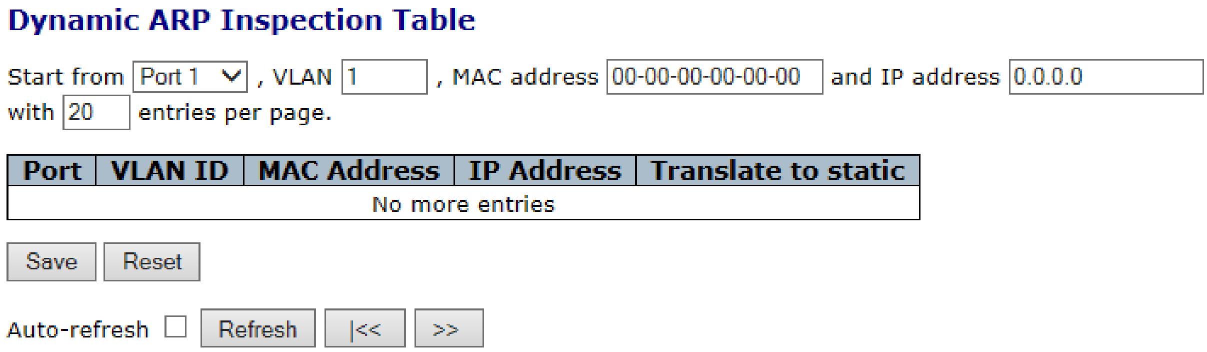
Table 4-83: Static ARP Inspection Table parameters

Static ARP Inspection Table	
Delete	Check to delete the entry. It will be deleted during the next save
Port	The logical port for the settings.
VLAN ID	The VLAN ID for the settings.

MAC Address	Allowed Source MAC address in ARP request packets
IP Address	Allowed Source IP address in ARP request packets
Buttons	**Add New Entry**: Click to add a new entry to the Static ARP Inspection table.

4.8.3.4 Dynamic ARP Inspection Table

Web GUI: Monitor > Security > Network > ARP Inspection > Dynamic Table



Dynamic ARP Inspection Table

Start from Port 1, VLAN 1, MAC address 00-00-00-00-00-00 and IP address 0.0.0.0 with 20 entries per page.

Port	VLAN ID	MAC Address	IP Address	Translate to static
No more entries				

Auto-refresh ☐

Entries in the Dynamic ARP Inspection Table are shown on this page. The Dynamic ARP Inspection Table contains up to 256 entries, and is sorted first by port, then by VLAN ID, then by MAC address, and then by IP address. All dynamic entries are learning from DHCP Snooping.

Figure 4-88: Dynamic ARP Inspection Table display

Table 4-84: Dynamic ARP Inspection Table parameters

Dynamic ARP Inspection Table	
Port	Switch Port Number for which the entries are displayed
VLAN ID	VLAN-ID in which the ARP traffic is permitted.
MAC Address	User MAC address of the entry
IP Address	User IP address of the entry.

Navigating the ARP Inspection Table
Each page shows up to 99 entries from the Dynamic ARP Inspection table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the Dynamic ARP Inspection Table. The "Start from port address", "VLAN", "MAC address" and "IP address" input fields allow the user to select the starting point in the Dynamic ARP Inspection Table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next Dynamic ARP Inspection Table match. In addition, the two input fields will - upon a **Refresh** button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address. The >> will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text. No more entries" is shown in the displayed table. Use the << button to start over.

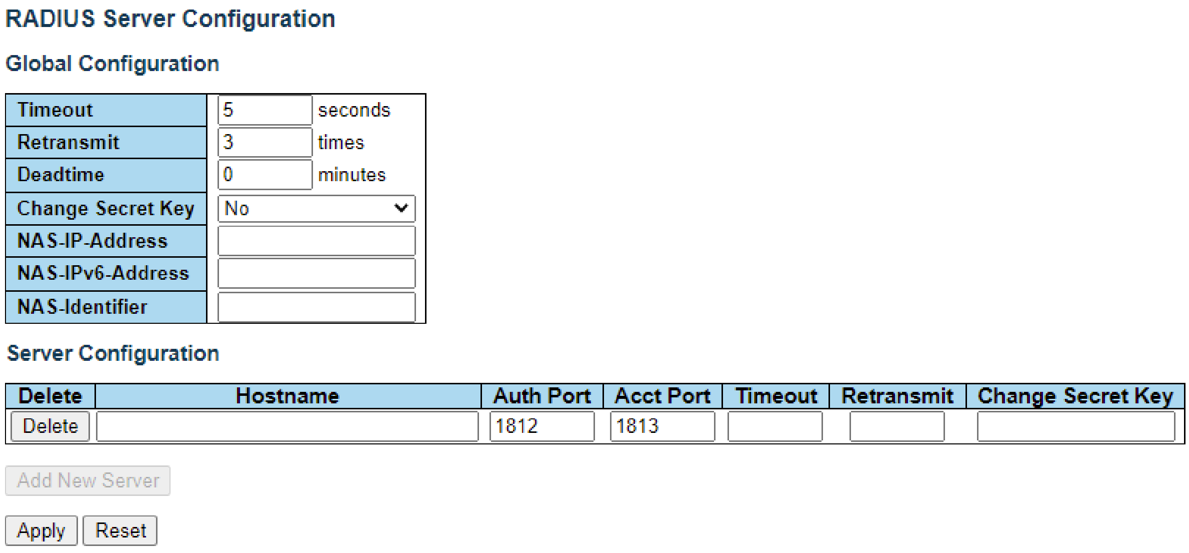
4.8.4 Authentication Server Configuration (AAA)

This section allows to configure the various Authentication Servers.

4.8.4.1 Radius Server Configuration

This section allows you to configure the RADIUS servers.

Web GUI: Monitor > Security > AAA > Radius



RADIUS Server Configuration

Global Configuration

Timeout	5 seconds
Retransmit	3 times
Deadtime	0 minutes
Change Secret Key	No
NAS-IP-Address	
NAS-IPv6-Address	
NAS-Identifier	

Server Configuration

Delete	Hostname	Auth Port	Acct Port	Timeout	Retransmit	Change Secret Key
Delete		1812	1813			

Figure 4-89: Radius: Server Configuration

Table 4-85: Radius: Server Configuration Parameters

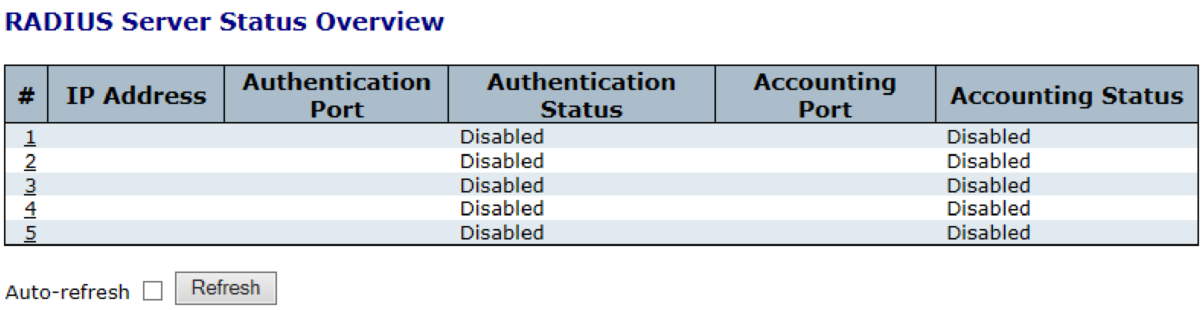
Global Configuration	
Timeout	Timeout is the number of seconds, in the range 1 to 1000, to wait for a reply from a RADIUS server before retransmitting the request.
Retransmit	Retransmit is the number of times, in the range 1 to 1000, a RADIUS request is retransmitted to a server that is not responding. If the server has not responded after the last retransmit it is dead.
Deadtime	Deadtime, which can be set to a number between 0 to 1440 minutes, is the period during which the switch will not send new requests to a server that has failed to respond to a previous request. This will stop the switch from continually trying to contact a server that it has already determined as dead. Setting the Deadtime to a value greater than 0 (zero) will enable this feature, but only if more than one server has been configured
Change Secret Key	Specify to change the secret key or not. When "Yes" is selected for the option, you can change the secret key - up to 63 characters long - shared between the RADIUS server and the switch.
NAS IP Address (Attribute 4)	The IPv4 address to be used as attribute 4 in RADIUS Access-Request packets. If this field is left blank, the IP address of the outgoing interface is used.
NAS IPv6 Address (Attribute 95)	The IPv6 address to be used as attribute 95 in RADIUS Access-Request packets. If this field is left blank, the IP address of the outgoing interface is used.
NAS Identifier (Attribute32)	The identifier - up to 253 characters long - to be used as attribute 32 in RADIUS Access-Request packets. If this field is left blank, the IP address of the outgoing interface is used.
Server Configuration	
The table has one row for each RADIUS Server and several columns listed below.	
Delete	To delete a RADIUS server entry, check this box. The entry will be deleted during the next Save.
Hostname	The IP address or hostname of the RADIUS server.
Auth Port	The UDP port to use on the RADIUS server for authentication. Set to 0 to disable authentication.
Acct Port	The UDP port to use on the RADIUS server for accounting. Set to 0 to disable accounting.
Timeout	This optional setting overrides the global timeout value. Leaving it blank will use the global timeout value.
Retransmit	This optional setting overrides the global retransmit value. Leaving it blank will use the global retransmit value.
Change Secret Key	Specify to change the secret key or not. When the checkbox is checked, you can change the setting overrides the global key. Leaving it blank will use the global key.

Adding a New Server
Click **Add New Server** to add a new RADIUS server. An empty row is added to the table, and the RADIUS server can be configured as needed. Up to 5 servers are supported. The **Delete** button can be used to undo the addition of the new server.

4.8.4.2 Radius Server Status Overview

This page provides an overview of the status of the RADIUS servers configurable on the Global and Server configurations

Web GUI: Monitor > Security > AAA > RADIUS Overview



RADIUS Server Status Overview

#	IP Address	Authentication Port	Authentication Status	Accounting Port	Accounting Status
1			Disabled		Disabled
2			Disabled		Disabled
3			Disabled		Disabled
4			Disabled		Disabled
5			Disabled		Disabled

Figure 4-90: RADIUS: Server Status Overview

Table 4-86: RADIUS: Server Status Overview parameters

RADIUS Servers	
#	The RADIUS server number. Click to navigate to detailed statistics for this server.
IP Address	The IP address of the server
Authentication Port	UDP port number for authentication
Authentication Status	The current status of the server. This field takes one of the following values: • **Disabled**: The server is disabled. • **Not Ready**: The server is enabled, but IP communication is not yet up and running. • **Ready**: The server is enabled, IP communication is up and running, and the RADIUS module is ready to accept access attempts. • **Dead (X seconds left)**: Access attempts were made to this server, but it did not reply within the configured timeout. The server has temporarily been disabled but will get re-enabled when the dead-time expires. The number of seconds left before this occurs is displayed in parentheses. This state is only reachable when more than one server is enabled.
Accounting Port	UDP port for accounting
Accounting Status	The status of the server. This field takes one of the following values: • **Disabled**: The server is disabled.

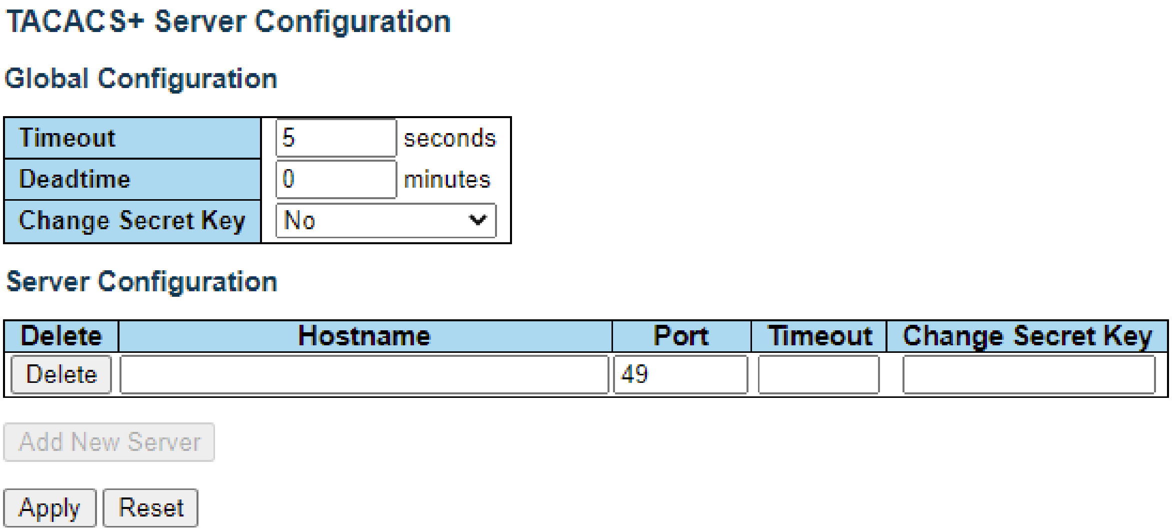
	• **Not Ready**: The server is enabled, but IP communication is not yet up and running. • **Ready**: The server is enabled, IP communication is up and running, and the RADIUS module is ready to accept access attempts. • **Dead (X seconds left)**: Access attempts were made to this server, but it did not reply within the configured timeout. The server has temporarily been disabled but will get re-enabled when the dead-time expires. The number of seconds left before this occurs is displayed in parentheses. This state is only reachable when more than one server is enabled.

4.8.4.3 TACACS+ Sever Configuration

This page allows you to configure the TACACS+ servers.

TACACS+ is an acronym for Terminal Access Controller Access Control System Plus. It is a networking protocol which provides access control for routers, network access servers and other networked computing devices via one or more centralized servers. TACACS+ provides separate authentication, authorization and accounting services.

Web GUI: Monitor > Security > AAA > TACACA+


TACACS+ Server Configuration

Global Configuration

Timeout	5	seconds
Deadtime	0	minutes
Change Secret Key	No	

Server Configuration

Delete	Hostname	Port	Timeout	Change Secret Key
Delete		49		

Figure 4-91: TACACS+ Server Configuration

Table 4-87: TACACS+ Server Configuration Parameters

Global Configuration	
Timeout	Timeout is the number of seconds, in the range 1 to 1000, to wait for a reply from a TACACS+ server before it is dead.
Deadtime	Deadtime, which can be set to a number between 0 to 1440 minutes, is the period during which the switch will not send new requests to a server that has failed to respond to a previous request. This will stop the switch from continually trying to contact a server that it has already determined as dead. Setting the Deadtime to a value greater than 0 (zero) will enable this feature, but only if more than one server has been configured

Change Secret Key	Specify to change the secret key or not. When **Yes** is selected for the option, you can change the secret key - up to 63 characters long - shared between the TACACS+ server and the switch.
Server Configuration	
The table has one row for each TACACS+ Server and several columns listed below.	
Delete	To delete a TACACS+ server entry, check this box. The entry will be deleted during the next Save.
Hostname	The IP address or hostname of the TACACS+ server.
Port	The UDP port to use on the TACACS+ server for authentication.
Timeout	This optional setting overrides the global timeout value. Leaving it blank will use the global timeout value.
Change Secret Key	Specify to change the secret key or not. When the checkbox is checked, you can change the setting overrides the global key. Leaving it blank will use the global key.
Adding a New Server	
Click **Add New Server** to add a new TACACS+ server. An empty row is added to the table, and the TACACS+ server can be configured as needed. Up to 5 servers are supported. The **Delete** button can be used to undo the addition of the new server	

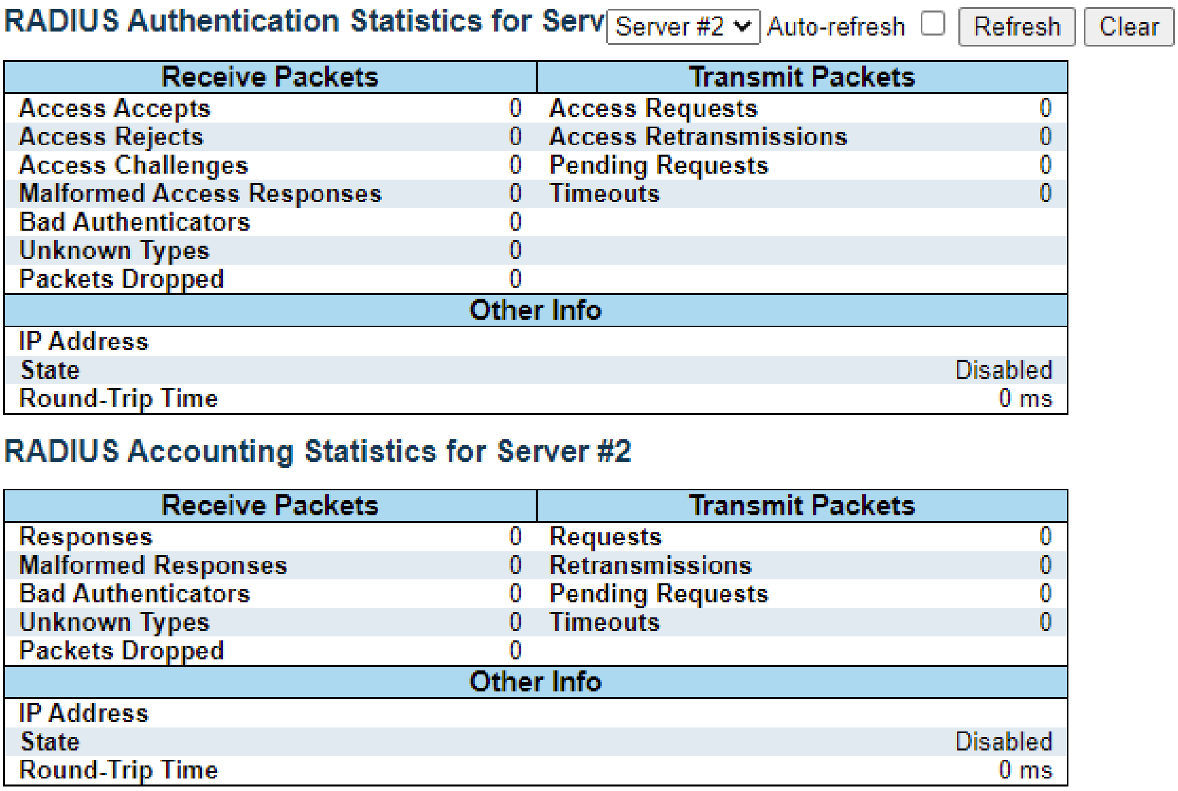
1.1.1.1 RADIUS Auth.Statistics for Server

This section provides detailed statistics for a particular RADIUS server.

The statistics map closely to those specified in RFC4668 - RADIUS Authentication Client MIB.

Use the server select box to switch between the backend servers to show details for.

Web GUI: Monitor > Security > AAA > Radius Overview



RADIUS Authentication Statistics for Serv

Receive Packets		Transmit Packets	
Access Accepts	0	Access Requests	0
Access Rejects	0	Access Retransmissions	0
Access Challenges	0	Pending Requests	0
Malformed Access Responses	0	Timeouts	0
Bad Authenticators	0		
Unknown Types	0		
Packets Dropped	0		

Other Info	
IP Address	
State	Disabled
Round-Trip Time	0 ms

RADIUS Accounting Statistics for Server #2

Receive Packets		Transmit Packets	
Responses	0	Requests	0
Malformed Responses	0	Retransmissions	0
Bad Authenticators	0	Pending Requests	0
Unknown Types	0	Timeouts	0
Packets Dropped	0		

Other Info	
IP Address	
State	Disabled
Round-Trip Time	0 ms

Figure 4-92: RADIUS Statistics for Server

Table 4-88: RADIUS Statistics for Server Parameters

RADIUS Authentication Statistics			
The statistics map closely to those specified in RFC4668 - RADIUS Authentication Client MIB. Use the server select box to switch between the backend servers to show details for.			
Packet Counters	RADIUS authentication server packet counter. There are seven receive and four transmit counters		
Direction	**Name**	**RFC4668 Name**	**Description**
Rx	Access Accepts	radiusAuthClientExtAccessAccepts	The number of RADIUS Access-Accept packets (valid or invalid) received from the server.
Rx	Access Rejects	radiusAuthClientExtAccessRejects	The number of RADIUS Access-Reject packets (valid or invalid) received from the server.
Rx	Access Challenges	radiusAuthClientExtAccessChallenges	The number of RADIUS Access-Challenge packets (valid or invalid) received from the server.
Rx	Malformed Access Responses	radiusAuthClientExtMalformed AccessResponses	The number of malformed RADIUS Access-Response packets received from the server. Malformed packets include packets with an invalid length. Bad authenticators or Message Authenticator attributes or unknown types are not included as malformed access responses.

Rx	Bad Authenticators	radiusAuthClientExtBadAuthenticators	The number of RADIUS Access-Response packets containing invalid authenticators or Message Authenticator attributes received from the server.
Rx	Unknown Types	radiusAuthClientExtUnknownTypes	The number of RADIUS packets that were received with unknown types from the server on the authentication port and dropped.
Rx	Packets Dropped	radiusAuthClientExtPacketsDropped	The number of RADIUS packets that were received from the server on the authentication port and dropped for some other reason.
Tx	Access Requests	radiusAuthClientExtAccessRequests	The number of RADIUS Access-Request packets sent to the server. This does not include retransmissions.
Tx	Access Retransmissions	radiusAuthClientExtAccess Retransmissions	The number of RADIUS Access-Request packets retransmitted to the RADIUS authentication server.
Tx	Pending Requests	radiusAuthClientExtPendingRequests	The number of RADIUS Access-Request packets destined for the server that have not yet timed out or received a response. This variable is incremented when an Access-Request is sent and decremented due to receipt of an Access-Accept, Access-Reject, Access-Challenge, timeout, or retransmission.
Tx	Timeouts	radiusAuthClientExtTimeouts	The number of authentication timeouts to the server. After a timeout, the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as a Request as well as a timeout

Other Info		This section contains information about the state of the server and the latest round-trip time.
Name	**RFC4668 Name**	**Description**
IP Address	-	IP address and UDP port for the authentication server in question.
State	-	Shows the state of the server. It takes one of the following values: **Disabled**: The selected server is disabled. **Not Ready**: The server is enabled, but IP communication is not yet up and running. **Ready**: The server is enabled, IP communication is up and running, and the RADIUS module is ready to accept access attempts.

		Dead (X seconds left): Access attempts were made to this server, but it did not reply within the configured timeout. The server has temporarily been disabled but will get re-enabled when the dead-time expires. The number of seconds left before this occurs is displayed in parentheses. This state is only reachable when more than one server is enabled.
Round-Trip Time	Rad+iusAuthClientExtRoundTripTime	The time interval (measured in milliseconds) between the most recent Access-Reply/Access-Challenge and the Access-Request that matched it from the RADIUS authentication server. The granularity of this measurement is 100 ms. A value of 0 ms indicates that there has not been round-trip communication with the server yet.
RADIUS Accounting Statistics		
The statistics map closely to those specified in RFC4670 - RADIUS Accounting Client MIB. Use the server select box to switch between the backend servers to show details for.		
Packet Counters		RADIUS accounting server packet counter. There are five receive and four transmit counters

Direction	Name	RFC4670 Name	Description
Rx	Responses	radiusAccClientExtResponses	The number of RADIUS packets (valid or invalid) received from the server.
Rx	Malformed Responses	radiusAccClientExtMalformedResponses	The number of malformed RADIUS packets received from the server. Malformed packets include packets with an invalid length. Bad authenticators or unknown types are not included as malformed access responses.
Rx	Bad Authenticators	radiusAcctClientExtBadAuthenticators	The number of RADIUS packets containing invalid authenticators received from the server.
Rx	Unknown Types	radiusAccClientExtUnknownTypes	The number of RADIUS packets of unknown types that were received from the server on the accounting port.
Rx	Packets Dropped	radiusAccClientExtPacketsDropped	The number of RADIUS packets that were received from the server on the accounting port and dropped for some other reason.
Tx	Requests	radiusAccClientExtRequests	The number of RADIUS packets sent to the server. This does not include retransmissions.
Tx	Retransmissions	radiusAccClientExtRetransmissions	The number of RADIUS packets retransmitted to the RADIUS accounting server.
Tx	Pending Requests	radiusAccClientExtPendingRequests	The number of RADIUS packets destined for the server that have not yet timed out or received a response. This variable is incremented when a

			Request is sent and decremented due to receipt of a Response, timeout, or retransmission.
Tx	Timeouts	radiusAccClientExtTimeouts	The number of accounting timeouts to the server. After a timeout, the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as a Request as well as a timeout.

Other Info	This section contains information about the state of the server and the latest round-trip time.	
Name	**RFC4670 Name**	**Description**
IP Address	-	IP address and UDP port for the accounting server in question.
State	-	Shows the state of the server. It takes one of the following values: **Disabled**: The selected server is disabled. **Not Ready**: The server is enabled, but IP communication is not yet up and running. **Ready**: The server is enabled, IP communication is up and running, and the RADIUS module is ready to accept accounting attempts. **Dead (X seconds left)**: Accounting attempts were made to this server, but it did not reply within the configured timeout. The server has temporarily been disabled but will get re-enabled when the dead-time expires. The number of seconds left before this occurs is displayed in parentheses. This state is only reachable when more than one server is enabled.
Round-Trip Time	radiusAccClientExtRoundTripTime	The time interval (measured in milliseconds) between the most recent Response and the Request that matched it from the RADIUS accounting server. The granularity of this measurement is 100 ms. A value of 0 ms indicates that there has not been round-trip communication with the server yet.

4.9 SyncCenter Configuration

4.9.1 Overview

SyncCenter is a unique feature developed by Fibrolan, which clearly visualizes the system's clocks and timing flows. It allows the high-level configuration and monitoring of inputs, outputs and behavior.

Each one of the different inputs and outputs (e.g. PTP, SyncE) is configured and monitored in their own respective detailed pages, but the overall control and relationship between them is handled by SyncCenter.

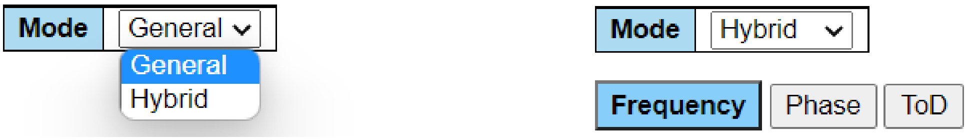
Furthermore, SyncCenter allows both General and Hybrid modes. In General mode all clocking domains (frequency, phase and ToD) are control by the same input(s) (e.g. GNSS), while the Hybrid mode allows each domain to operate independently of the others (e.g. as a BC, with both PTP and SyncE).

4.9.2 Mode Configuration

This section enables the configuration of the device's clocking system, with sync reference sources, outputs and overall state.

The possible clock reference inputs (sync source) to the SyncCenter are: SyncE, PTP, NTP, GNSS, ToD, TDM and External (1PPS and 10MHz). The SyncCenter will output the required sync clock according to reference quality and priority.

Web GUI: Configuration > Timing > SyncCenter



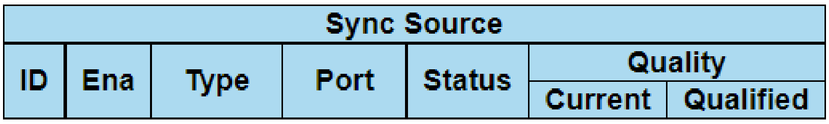
Mode: General

Mode: Hybrid

Figure 4-93: Mode selection

When SyncCenter mode is set to Hybrid split clocking domain option appears

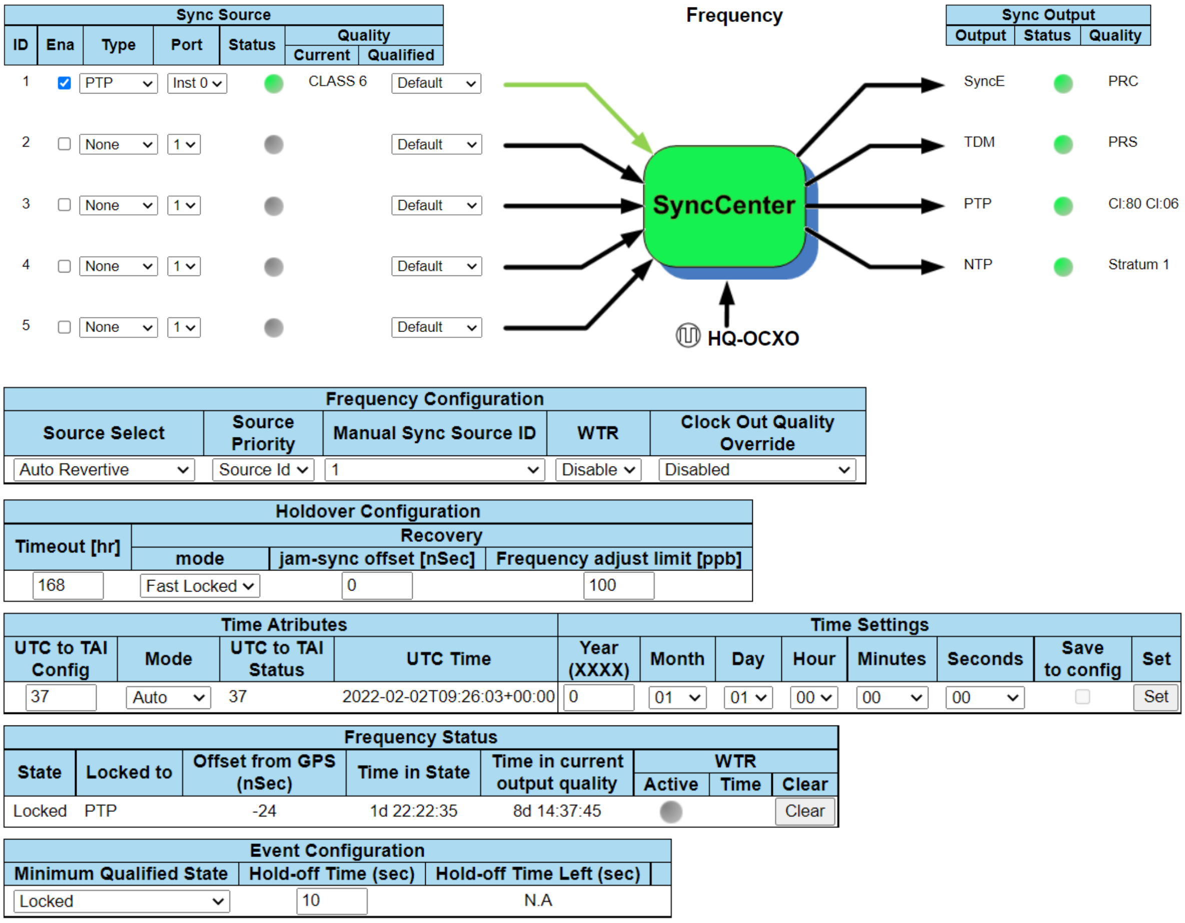
4.9.3 Sync Source Configuration



Sync Source						
ID	Ena	Type	Port	Status	Quality	
					Current	Qualified

Figure 4-94: Sync Source display

Up to 5 different Sync sources cab be configured including SyncE, PTP, NTP, GNSS, ToD, TDM and External. Source priority can be set according to ID (default) of quality level.



Sync Source						
ID	Ena	Type	Port	Status	Quality Current	Quality Qualified
1	☑	PTP	Inst 0	●	CLASS 6	Default
2	☐	None	1	●		Default
3	☐	None	1	●		Default
4	☐	None	1	●		Default
5	☐	None	1	●		Default

Sync Output		
Output	Status	Quality
SyncE	●	PRC
TDM	●	PRS
PTP	●	Cl:80 Cl:06
NTP	●	Stratum 1

Frequency Configuration				
Source Select	Source Priority	Manual Sync Source ID	WTR	Clock Out Quality Override
Auto Revertive	Source Id	1	Disable	Disabled

Holdover Configuration			
Timeout [hr]	Recovery		
	mode	jam-sync offset [nSec]	Frequency adjust limit [ppb]
168	Fast Locked	0	100

Time Atributes				Time Settings							
UTC to TAI Config	Mode	UTC to TAI Status	UTC Time	Year (XXXX)	Month	Day	Hour	Minutes	Seconds	Save to config	Set
37	Auto	37	2022-02-02T09:26:03+00:00	0	01	01	00	00	00	☐	Set

Frequency Status							
State	Locked to	Offset from GPS (nSec)	Time in State	Time in current output quality	WTR		
					Active	Time	Clear
Locked	PTP	-24	1d 22:22:35	8d 14:37:45	●		Clear

Event Configuration		
Minimum Qualified State	Hold-off Time (sec)	Hold-off Time Left (sec)
Locked	10	N.A

Figure 4-95: SyncCenter configuration page

Table 4-89: Sync Source parameters

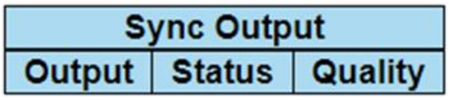
Sync Source	
ID	Indicates the sync source identification number.
Ena	Enable or disable the sync source.
Type	Select the type of sync source. Available options depend on model and may include: SyncE, PTP, GNSS, TDM and External.
Port	Select the port or instance of the selected sync source type. For example: for SyncE this will be Ethernet port numbers, for PTP the clock instance number, etc.
State	The status of the sync source. This indicator displays the following states: • **Green** - The source provides a valid reference clock. • **Red** – indicates failure of the source. • **Orange** – Source quality is unqualified • **Grey** - When a source is disabled or not applicable, indicator will be. The indicator is also a hyperlink to the detailed source's page.
Quality (Current)	Indicates the sync source's current (clock) quality (QL) as received from the source (e.g., via SSM). When there is no quality indication received from the source, a default quality value is shown with parentheses.
Quality (Qualified)	select the threshold quality, for which the source will be qualified as valid.

4.9.4 SyncCenter Visual Indicators

Table 4-90: Sync Center parameters

SyncCenter	
Input arrows	Visualization of sources feeding the system. A **green** arrow indicates the source is currently selected.
SyncCenter	Provides a visual indication of the current system clock status: • **Green** - system is locked to a sync source. • **Blue** - indicates the system is in Holdover state. • **Yellow** - indicates Free running (internal clock) state. • **Green/Yellow** (blinking) - Lock Acquisition. • **Blue/Green** (blinking) - Holdover Recovery.
Output arrows	Visualization of outputs (distributed from the system clock).

4.9.5 Sync Output



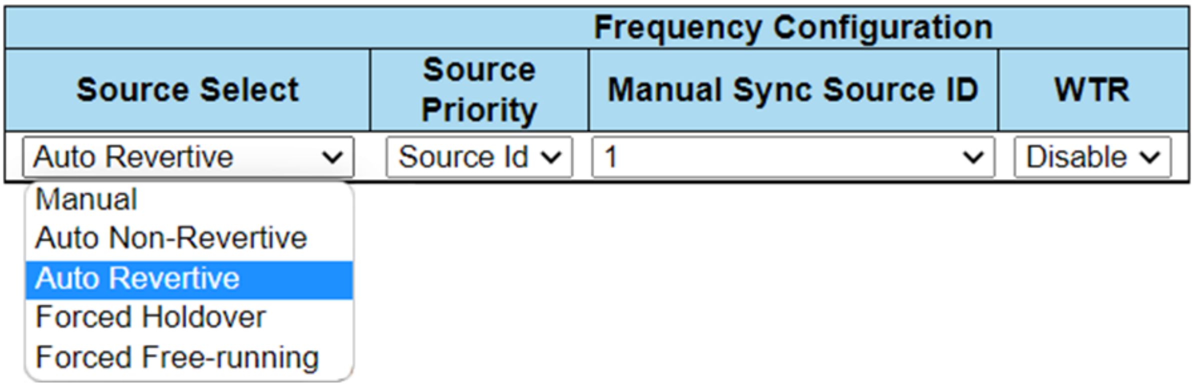
Sync Output		
Output	Status	Quality

Figure 4-96: Sync Output

Table 4-91: Sync Output parameters

Sync Output	
Output	Indicates the type of output (e.g., SyncE, PTP, BITS, etc.).
Status	Indicates the clock output is active
Quality	Indicates the clock quality distributed on this type of output.

4.9.6 Source Select Configuration



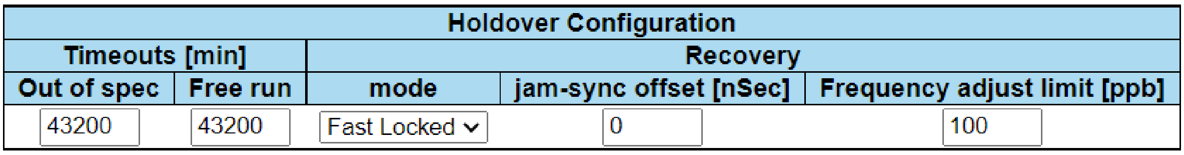
Frequency Configuration			
Source Select	Source Priority	Manual Sync Source ID	WTR
Auto Revertive	Source Id	1	Disable

Figure 4-97: SyncCenter Configuration

Table 4-92: Configuration parameters

General/Frequency/Phase/ToD Configuration	
Mode	Allow selection of the required system's synchronization mode Available modes are: • **Manual:** source will the one configured in the manual source configuration fields, regardless of its state. • **Auto Revertive (default mode).:** clock source is automatically selected based on priority and state. When higher priority source that previously failed, is valid again, switchover will take place. This is the default mode and the most commonly used one. • **Auto Non-Revertive:** clock source is automatically selected based on priority and state. When higher priority source that previously failed, is valid again, no switchover will take place. • **Forced HoldOver:** the system will be synchronized to the last selected source but will go into holdover mode and ignore this source. • **Forced Free running:** the system will be synchronized to the local clock, ignoring all sync sources.
Priority Select Mode	The source will be selected based on its ID (the lower it is the higher its priority) or based on its Quality.
Manual Sync Source ID	Manually configure the sync source. Applicable only in Manual mode.
WTR	Configure the Wait To Restore (WTR) timer or disable its operation (applicable when in Auto-Revertive mode).

4.9.7 Holdover Configuration



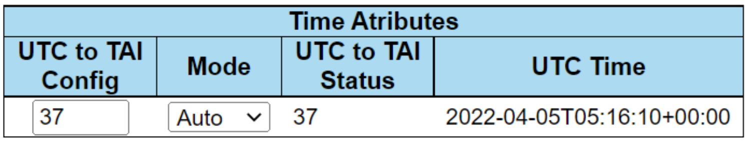
Holdover Configuration				
Timeouts [min]		Recovery		
Out of spec	Free run	mode	jam-sync offset [nSec]	Frequency adjust limit [ppb]
43200	43200	Fast Locked	0	100

Figure 4-98: Holdover Configuration

Table 4-93: Holdover Configuration parameters

Holdover Configuration	
Timeout [min]	Set the SyncCenter holdover duration in minutes for available states: • In-spec timer, when expired system mode changes to Out-of-spec • Out-of-spec timer, when expired system mode changes to Free-running
Mode	Three options supported: Fast Locked, Keep offset, Freq adjust.
jam-sync offset	Default setting is 0
Frequency adjust limit [	Default setting is 100 ppb

4.9.8 Time Attributes Configuration



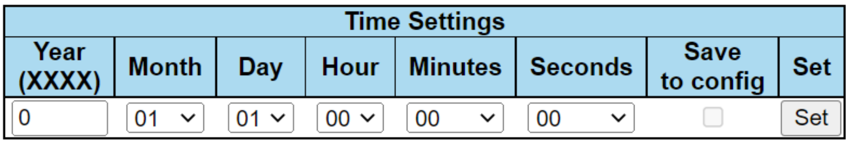
Time Atributes			
UTC to TAI Config	Mode	UTC to TAI Status	UTC Time
37	Auto	37	2022-04-05T05:16:10+00:00

Figure 4-99: Time Attributes Configuration

Table 4-94: Time Attributes Configuration parameters

Holdover Configuration	
UTC to TAI	Value in seconds of difference between UTC and TAI
Mode	Options supported: Manual, Auto.
UTC Time	Display the current UTC time of the SyncCenter

4.9.9 Time Settings Configuration



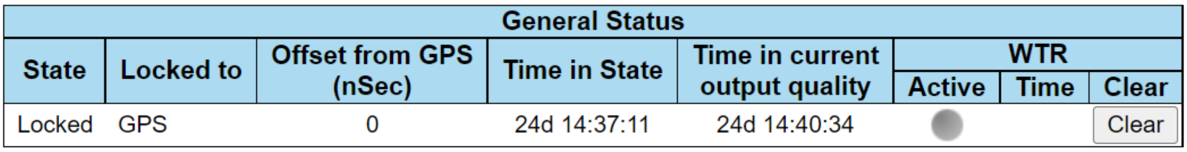
Time Settings							
Year (XXXX)	Month	Day	Hour	Minutes	Seconds	Save to config	Set
0	01	01	00	00	00	☐	Set

Figure 4-100: Time Settings Configuration

Table 4-95: Time Settings Configuration parameters

Holdover Configuration	
Time Settings	Allows to set the system date and time manually
Save to config	Option to save the manual settings to running configuration file
Set	Set the selected date and time values. This will not Apply nor Save the values to configuration. These actions are done separately.

4.9.10 SyncCenter General/Frequency/Phase/ToD Status



General Status							
State	Locked to	Offset from GPS (nSec)	Time in State	Time in current output quality	WTR		
					Active	Time	Clear
Locked	GPS	0	24d 14:37:11	24d 14:40:34	●		Clear

Figure 4-101: SyncCenter Status

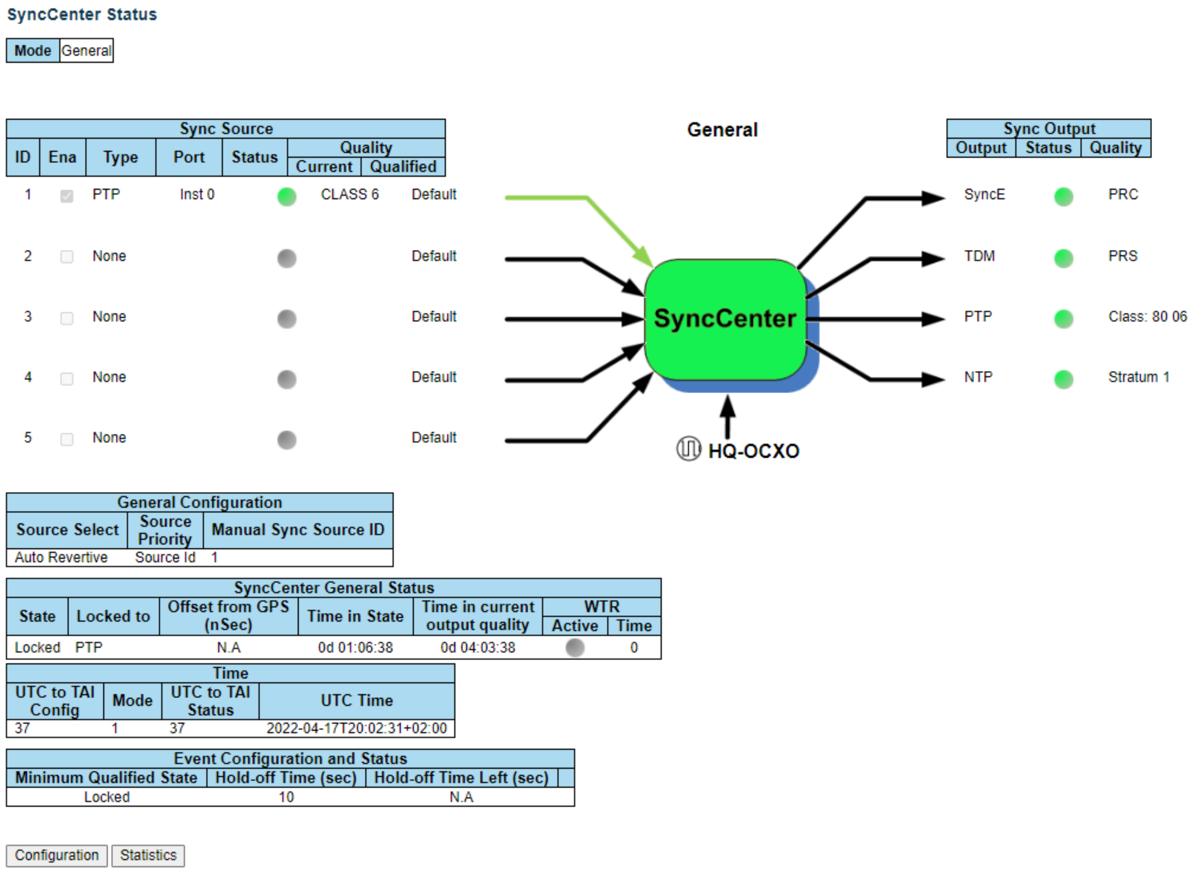
Table 4-96: SyncCenter Status parameters

SyncCenter Status	
State	Shows the current SyncCenter state, which includes: • **Free Run -** indicates Free running (internal clock) state. • **Lock Acquisition -** indicates the system locking on selected reference. • **Locked –** indicates the system locked to selected reference. • **Holdover -** reference was lost, system is maintaining clocked output. • **Holdover Recovery -** reference rediscovered, system resyncs.
Locked to	Indicates the sync source (type and port/instance) the system is currently locked to (e.g., PTP, GPS, etc.).
Offset from GNSS (nSec)	N/A
Time in State	The time that has passed since the last system sync state change.
Time in current output quality	The time that has passed since the last output QL change.
WTR Active	Indicates the current active status of the WTR timer. **Green** means timer is not running (i.e., system stable), **Amber** means timer is currently running, and **Grey** indicates WTR is disabled.
WTR Time	Indicates the time left before the WTR timer expires (when running).
Clear button	Allows resetting of the WTR timer when running (i.e., skip the WTR period).
Buttons	**Monitor** Direct link to the Sync Center monitoring page. **Other Buttons**: Direct link to relevant pages.

4.10 SyncCenter Monitoring

This page allows us to monitor and view the status of the SyncCenter. The page automatically update in order to display the actual status.

Web GUI: Monitor > Timing > SyncCenter > Status



SyncCenter Status

Mode	General

Sync Source						
ID	Ena	Type	Port	Status	Quality Current	 Qualified
1	☑	PTP	Inst 0	🟢	CLASS 6	Default
2	☐	None		●		Default
3	☐	None		●		Default
4	☐	None		●		Default
5	☐	None		●		Default

Sync Output		
Output	Status	Quality
SyncE	🟢	PRC
TDM	🟢	PRS
PTP	🟢	Class: 80 06
NTP	🟢	Stratum 1

General Configuration		
Source Select	Source Priority	Manual Sync Source ID
Auto Revertive	Source Id	1

SyncCenter General Status						
State	Locked to	Offset from GPS (nSec)	Time in State	Time in current output quality	WTR Active	 Time
Locked	PTP	N.A	0d 01:06:38	0d 04:03:38	●	0

Time			
UTC to TAI Config	Mode	UTC to TAI Status	UTC Time
37	1	37	2022-04-17T20:02:31+02:00

Event Configuration and Status		
Minimum Qualified State	Hold-off Time (sec)	Hold-off Time Left (sec)
Locked	10	N.A

Figure 4-102: Monitoring SyncCenter Status displays

The following displays allow us to monitor the SyncCenter status and activity.

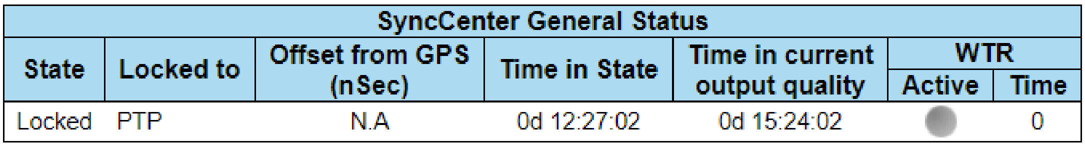
4.10.1 Sync Sources and Visual Indicators

For details refer to Table 4-89 and Table 4-90

4.10.2 SyncCenter Source Status

The status table display the current state of the system in reference to the selected Timing source.

Figure 4-103: General Status

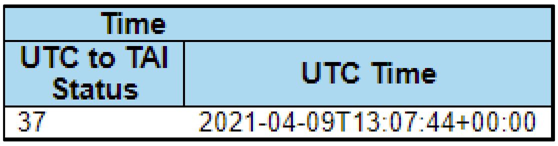


SyncCenter General Status						
State	Locked to	Offset from GPS (nSec)	Time in State	Time in current output quality	WTR Active	 Time
Locked	PTP	N.A	0d 12:27:02	0d 15:24:02	●	0

Table 4-97: General Status parameters

State	Shows the current system's overall synchronization state (e.g., Locked). The state is also evident in the color of the SyncCenter main block diagram as described in Table 4-90 and Table 4-96
Locked to	Indicates the sync source (type and port/instance) the system is currently locked to (e.g., SyncE 2).
Offset from GNSS (nSec)	Currently N/A.
Time in State	The time that has passed since the last system sync state change.
Time in current output quality	The time that has passed since the last output QL change.
WTR Active	Indicates the active status of the WTR timer. **Green** means timer is not running (i.e., system stable), **Amber** means timer is currently running, and **Grey** indicates WTR is disabled.
WTR Time	Indicates the time left before the WTR timer expires (when running).
Clear button	Allows resetting of the WTR timer when running (i.e., skip the WTR period).

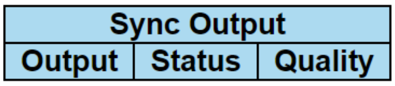
4.10.3 Time



Time	
UTC to TAI Status	UTC Time
37	2021-04-09T13:07:44+00:00

UTC to TAI Status	Value in seconds of difference between UTC and TAI
UTC Time	Display the current UTC time of the SyncCenter

4.10.4 Sync Output



Sync Output		
Output	Status	Quality

Figure 4-104: Sync Output Status

Table 4-98: Sync Output parameters

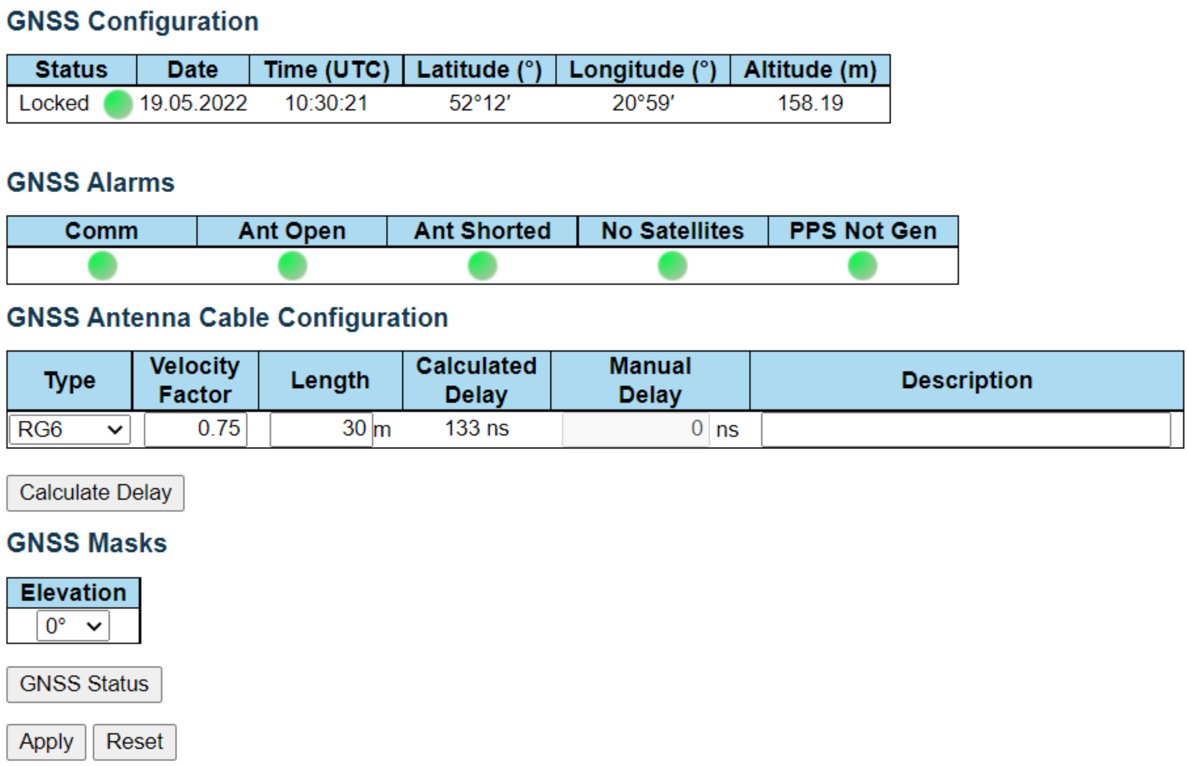
Sync Output	
Output	Indicates the type of output (e.g., SyncE, PTP or TDM).
Status	Indicates the clock output which is used to synchronize the functional block in 'Output'.
Quality	Indicates the clock quality distributed on this type of output.
Buttons	**Configuration:** Direct link to the SyncCenter configuration page. **Statistics:** Direct link to the Sync Center Statistics page

4.11 GNSS Receiver

This section shows the various GNSS displays and their functionality receiver GNSS Configuration. This section displays the configuration and status info of the GNSS receiver.

4.11.1 GNSS Antenna Cable Configuration

Web GUI: Configuration > Timing > GNSS



GNSS Configuration

Status	Date	Time (UTC)	Latitude (°)	Longitude (°)	Altitude (m)
Locked ●	19.05.2022	10:30:21	52°12′	20°59′	158.19

GNSS Alarms

Comm	Ant Open	Ant Shorted	No Satellites	PPS Not Gen
●	●	●	●	●

GNSS Antenna Cable Configuration

Type	Velocity Factor	Length	Calculated Delay	Manual Delay	Description
RG6	0.75	30 m	133 ns	0 ns	

GNSS Masks

Elevation
0°

Figure 4-105: GNSS Configuration

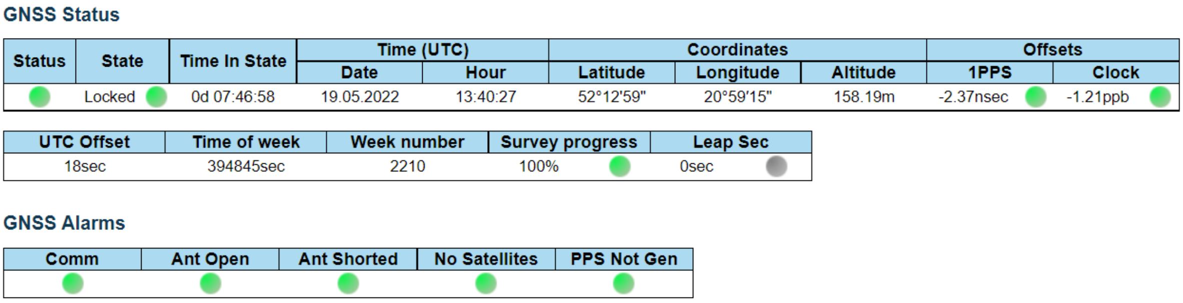
Table 4-99: GNSS Antenna Cable Configuration parameters

Type	Set the type of cable being used for the GNSS antenna. When Manual is selected, it is possible to directly configure the cable delay.
Velocity Factor	Set the Velocity Factor (VF) of the antenna cable.
Length	Set the length of the antenna cable in meters.
Calculated Delay	Indicates the cable delay in nsec as calculated based on VF and length.
Manual Delay	Set the cable delay in nsec manually (applicable when Type is **Manual**).
Description	Set a free text description of the cable (up to 63 characters).
Buttons	**Calculate Delay:** Click to calculate the cable delay based on current parameters.

4.11.2 GNSS Status and Alarms

This section displays the status and Alarms of the GNSS receiver.

Web GUI: Monitor > Timing > GNSS > Status



GNSS Status

Status	State	Time In State	Time (UTC)		Coordinates			Offsets	
			Date	Hour	Latitude	Longitude	Altitude	1PPS	Clock
●	Locked ●	0d 07:46:58	19.05.2022	13:40:27	52°12'59"	20°59'15"	158.19m	-2.37nsec ●	-1.21ppb ●

UTC Offset	Time of week	Week number	Survey progress	Leap Sec
18sec	394845sec	2210	100% ●	0sec ●

GNSS Alarms

Comm	Ant Open	Ant Shorted	No Satellites	PPS Not Gen
●	●	●	●	●

Figure 4-106: Monitoring GNSS Status and Alarms

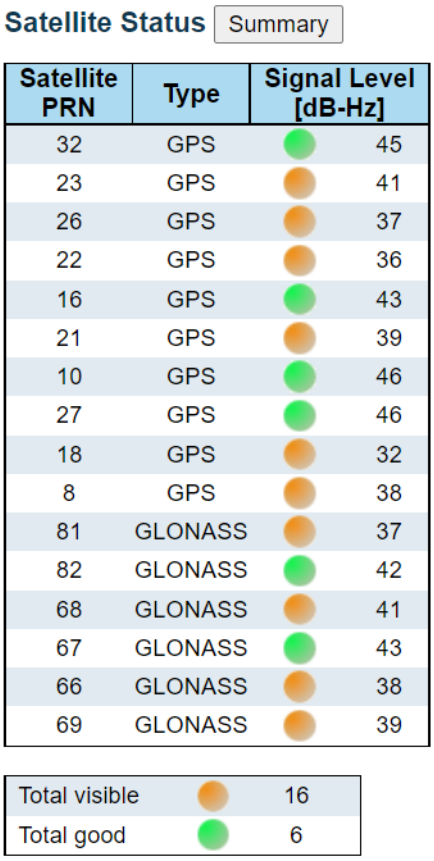
Table 4-100: GNSS Status parameters

GNSS Status	
Status	Indicates the overall status of the GNSS receiver (e.g., Doing Fixes).
Date	Indicates the current date as received by the GNSS.
Time	Indicates the current time of day as received by the GNSS.
Latitude	Indicates the current latitude as received by the GNSS in degrees.
Longitude	Indicates the current longitude as received by the GNSS in degrees.
Altitude	Indicates the current altitude as received by the GNSS in meters.
Offsets-1PPS	Indicates the current estimated 1PPS time error the GNSS is generating, in nsec.
Offsets-Clock	Indicates the current estimated frequency error the GNSS is generating, in ppb.
UTC Offset	Indicates the time offset from UTC time in seconds
Time of week	Indicates the current week time in seconds (passed seconds since 1970-01-01)
Week number	Indicates the current week number (passed weeks since 1970-01-01)
Survey progress	Indicates the GNSS receiver satellite survey progress in %
Leap Sec	Indicates is if Leap Second event is expected

Table 4-101: GNSS Alarm parameters

GNSS Alarms	
Comm	Display status of communication with built-in GNSS receiver
Ant Open	Signal weather the GNSS antenna is detected (green) by the receiver or not (red)
Ant Shorted	Signal weather a short circuit is detected (red) by the receiver or not (green)
No Satellites	When it lights red the GNSS can see no satellites.
PPS Not Gen	When it lights red the GNSS cannot generate 1PPS signal.

4.11.3 Satellite Status



Satellite PRN	Type	Signal Level [dB-Hz]	
32	GPS	🟢	45
23	GPS	🟠	41
26	GPS	🟠	37
22	GPS	🟠	36
16	GPS	🟢	43
21	GPS	🟠	39
10	GPS	🟢	46
27	GPS	🟢	46
18	GPS	🟠	32
8	GPS	🟠	38
81	GLONASS	🟠	37
82	GLONASS	🟢	42
68	GLONASS	🟠	41
67	GLONASS	🟢	43
66	GLONASS	🟠	38
69	GLONASS	🟠	39

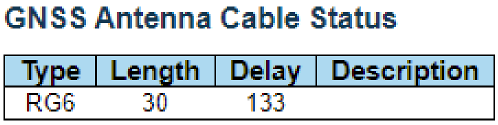
Total visible	🟠	16
Total good	🟢	6

Figure 4-107: Satellite Status

Table 4-102: Satellite Status parameters

Satellite PNR	The PRN (satellite number) of the tracked satellites.
Type	Cons
Signal Level	The satellite's received signal level in terms of Carrier to Noise ratio [dB-Hz]. The accompanying LED indicates whether the satellite receive level is good (**green**) or fair (**orange)**.
Summary Table	Shows the number of total tracked satellites and good satellites.
Details/Summary Button	Toggle detailed satellite table on/off

4.11.4 GNSS Antenna Cable Status



GNSS Antenna Cable Status

Type	Length	Delay	Description
RG6	30	133	

Figure 4-108: GNSS Antenna Cable Status

Table 4-103: GNSS Antenna Cable parameters

Type	The type of cable being used for the GNSS antenna.
Length	The length of the antenna cable in meters.
Delay	Indicates the cable delay in nsec.
Description	A textual description of the cable.
Common Buttons:	GNSS Config. Sky View. Sat Counts are direct links to the respective pages.

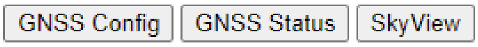
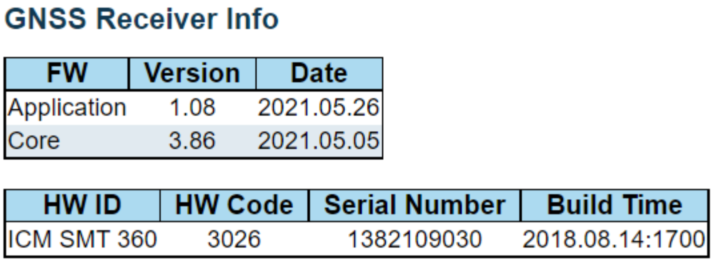


Figure 4-109: Common buttons of GNSS webpages

4.11.5 GNSS Receiver Info



GNSS Receiver Info

FW	Version	Date
Application	1.08	2021.05.26
Core	3.86	2021.05.05

HW ID	HW Code	Serial Number	Build Time
ICM SMT 360	3026	1382109030	2018.08.14:1700

Figure 4-110: GNSS Antenna Cable Status

Table 4-104: GNSS Antenna Cable parameters

FW	Display GNSS module’s FW type: Application, Core
Version	Display GNSS module’s FW versions
Date	Display GNSS module’s FW date
HW ID	Display GNSS module’s HW ID
HW Code	Display GNSS module’s HW Code
Serial Number	Display GNSS module’s serial number
Build Time	Display GNSS module’s HW build time

4.11.6 Sky View

This section displays the current sky map of the GNSS receiver tracked satellites.

Web GUI: Monitor > Timing > GNSS > SkyView

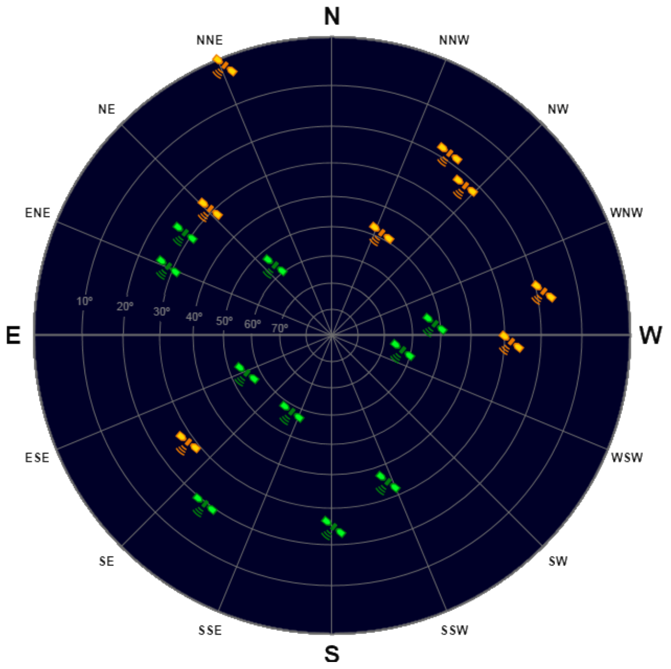


Figure 4-111: Sky view display

Table 4-105: Sky View parameters

Displays the sky view of the tracked satellites. The azimuth angle is the angle between the North ('N') and radial on which the satellite is displayed. The elevation angle is represented by the distance from the center (90 degrees) to the edge of the sky map circle (0 degrees). Each satellite icon is positioned according to status and displayed in green (strong receive signa) or orange (fair signal). When pointing on a satellite a text box balloon will automatically open, showing satellite info highlights.

4.11.7 Satellite Count

This section displays a graph of the tracked satellites count.

Web GUI: Monitor > Timing > GNSS > SkyView

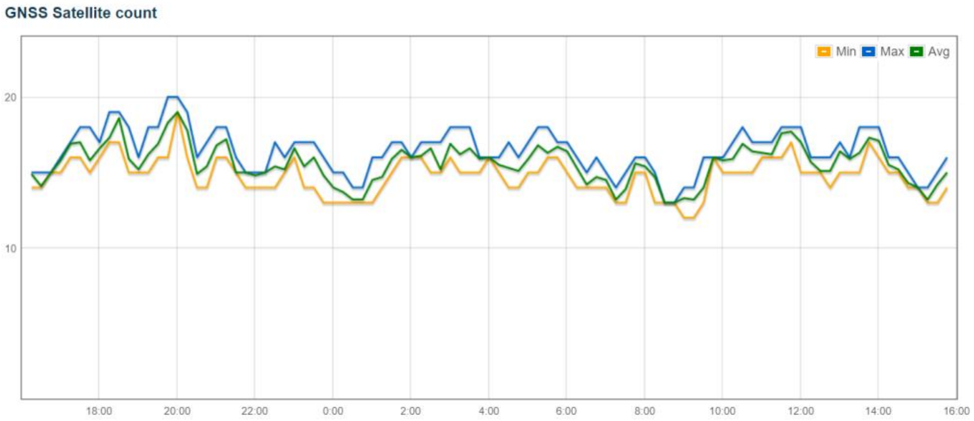


Figure 4-112: Satellite Count display

Table 4-106 Satellite Count parameters

Satellite Count	The type of cable being used for the GNSS antenna.
Graph type	Selection of type of graph to show: Time axis duration can be 15 minutes (1 minute resolution) or 24 hours (15 minutes resolution- Show only good (above threshold) satellites or all visible (tracked)ones.
Common Buttons	**Send Report**: send report to your computer if you have set the required parameter in the Falcon report Configuration. **Other Buttons**: GNSS Config. Sky View. Sat Counts are direct links to the respective pages.

4.12 IEEE1588 Precision Time Protocol

PTP is an acronym for **P**recision **T**ime **P**rotocol, a network protocol for synchronizing the clocks of Network systems. Regarding Ethernet Backhaul, PTP is considered the technology of choice to deliver clock synchronization to remote telecom base stations. PTP defines synchronization message used between a Master and Slave clock. The Master provides the time, and the slave synchronizes to the Master

Multiple slaves can synchronize to a single Master. The Master clock provides synchronization message that the slaves use to correct their local clocks. This section allows the user to configure and inspect the current PTP Clock settings. In Synchronous mode of operation, the Synchronous Ethernet interface processes the SSM (**Synchronization Status Messages)** and recovers the clock quality level information. The ESMC channel is a logical communication channel which transmits SSM information that is the quality level of the transmitting synchronous Ethernet equipment clock.

When a Synchronous Ethernet port is selected, the SSM are transmitted through this port, indicating the quality level of the clock it can drive. The messages are received (if the other remote unit supports SyncE) with the quality level of the transmitting clock. The remote end unit receiving the messages on its configured Synchronous Ethernet port extracts the clock quality level and transmits it to the Clock Master Unit. The Clock Master Unit receives the SSM data from many Synchronous Ethernet ports and establishes the clock sources. The device internal state logic (clock selector) monitors all reference clocks and automatically selects the best available reference clock based on configured priority and revertive priorities. There are different synchronization methods as described below

The Auto-Revertive is the default mode of operation. This mode includes two functions: automatic reference clock selection (the highest priority qualified clock is selected) and the occurrence of the Revertive function when needed.

The clock selection process supports revertive and non-revertive modes of operation. If the Auto-revertive mode is enabled: when the clock selection process has selected -a primary clock, and the active primary clock source has failed o degraded over a certain period and then is later recovered, this primary clock source becomes again the active clock source. If Auto non-revertive mode is selected and a secondary clock source is active (due to a previous degradation of the primary clock source), the primary clock source is not reactivated even after its quality has been improved.

Methods of Operation

Note: the following modes of operation can be selected under SyncCenter Configuration.

Auto Revertive: In this mode, the highest priority qualified reference clock is selected. If this selected clock fails or it is degraded, the next priority qualified clock is selected, and the lock acquisition will begin. If the previous primary clock is restored and qualified, then the revertive function will compel the previous primary clock to become again the active clock source.

Auto Non Revertive: Clock Selection of the best clock source is only done when the selected clock fails. The primary clock source is not reactivated in this case.

Free-Run mode: The free-run mode occurs immediately, after a reset, or when the timing synchronization logic has not yet been synchronized to a reference clock input. In this mode the frequency accuracy of the clock outputs is equal to the frequency accuracy of the input master clock.

Manual: The user may select the clock source (None, SyncE, PTP, TDM, External) If this manually selected clock source is failing, the clock selector will go into holdover state.

Normal (Locked mode): The input clock references are monitored for frequency accuracy and phase correctness. If at least one is of the clock reference inputs is qualified, then the logic will start the lock acquisition of that clock input. And the device logic will enter the normal locked mode. During the normal locked operation, the time synchronization logic phase locks to the qualified reference clock and generates output clocks and frame pulses with a frequency accuracy equal to the frequency accuracy of the input reference clock. The generated clock and frames pulse outputs comply with specifications as described in Telcordia and ITU-T Telecommunication standard.

Holdover state: When the timing synchronization logic loses its reference input clock or becomes degraded, and no other qualified clock references are available, it will enter in holdover mode and continue to create output clocks based on the reference frequency data collected during the synchronization process.

PTP Messages

PTP defines the following messages for synchronization and control between devices:

Event message (timing message): Types of event messages: Sync, Delay_Req, Pdelay_Req, Pdelay_Req.

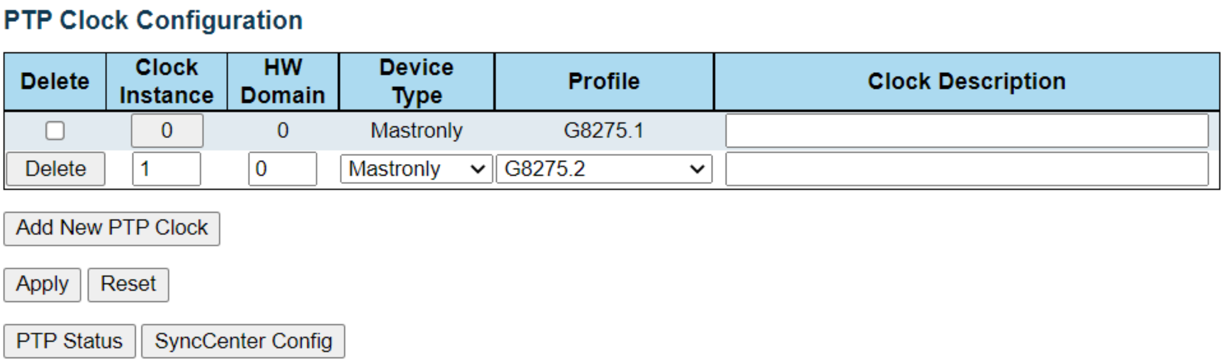
General messages: Announce, Follow-Up. Delay_Resp, Pdelay_Resp_Follow_Up, Management, Signaling. (Pdelay=Peer delay)

4.12.1 PTP Clock Configuration

This section allows the user to configure the PTP clock configuration settings.

Note: By clicking on PTP Config "Add New PTP Clock" you get the following additional display

Web GUI: Configuration > Timing > PTP



PTP Clock Configuration

Delete	Clock Instance	HW Domain	Device Type	Profile	Clock Description
☐	0	0	Mastronly	G8275.1	
Delete	1	0	Mastronly	G8275.2	

Figure 4-113: PTP Clock Configuration

Note: After applying the Clock configuration hit the button with the clock instance number to continue to the instance detailed configuration

---

Table 4-107: PTP Clock Configuration Parameters (for both above displays)

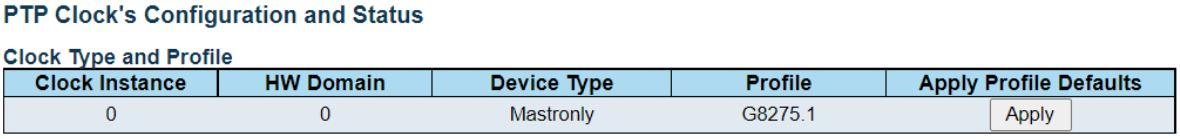
Delete	Check this box and click on **Save** to delete the clock instance.
Clock Instance	Indicates the Instance of a particular Clock Instance [0…3]. Click on the Clock Instance number to edit the Clock details.
HW Domain	Indicates the HW clock domain used by the clock.
Device Type	Indicates the Type of the Clock Instance. There are five Device Types. 1. Ord-Bound – clock's Device Type is Ordinary-Boundary Clock. 2. P2p Transp – clock's Device Type is Peer to Peer Transparent Clock. 3. E2e Transp – clock's Device Type is End to End Transparent Clock. 4. Master Only – clock's Device Type is Master Only. 5. Slave Only – clock's Device Type is Slave Only. **Definitions:** **Master & Slave clock**: has only one physical port to the network and can be implemented as a master or slave clock. The OC sends and receive PTP messages. It supports the synchronization mechanism. **Boundary clock**: has multiple physical ports to the network and can be used as an intermediate stage/device. The BC performs the functionality of the Ordinary clock and can be connected to multiple sub-networks: normally it is synchronized to one Master reference clock and provides synchronization to various clients. **End to End Transparent clock**: there are multiple ports and do not behave or perform a Master and slave relationship. These ports forward all PTP messages and correct the timing. **Peer to peer Transparent clock:** there are multiple ports and do not behave or perform a Master and slave relationship. Each port supports the Pdelay mechanism
Profile	Indicates the profile used by the clock.
Clock Description	User defined free text (64 characters)
Buttons	**Add New PTP Clock**: Hit to add a PTP clock instance entry to the table. **Apply**: Hit to apply the clock instance settings to the running-config. **Reset**: Hit to reset the new clock instance parameters to previous values. **PTP Status**: Click on it to go to PTP Status display. **Sync Center config**: Click on it to go to SyncCenter config. display

4.12.2 PTP Clock's Configuration and Status

This page allows the user to inspect and configure the current PTP clock settings. It contains the following configuration and status tables:

Web GUI: Configuration > Timing > PTP > (Hit Clock Inst. Number)

4.12.2.1 Clock Type and Profile



PTP Clock's Configuration and Status

Clock Type and Profile

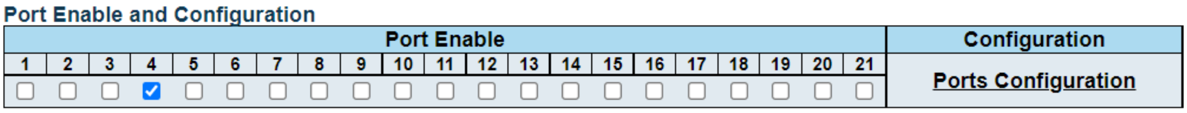
Clock Instance	HW Domain	Device Type	Profile	Apply Profile Defaults
0	0	Mastronly	G8275.1	Apply

Figure 4-114: Clock Type and Profile

Table 4-108: Clock Type and Profile

Clock Instance	Indicates the Instance of a particular Clock Instance [0…3].
HW Domain	Indicates the HW clock domain used by the clock.
Device Type	Indicates the Type of the Clock Instance. There are five Device Types. 1. Ord-Bound – clock's Device Type is Ordinary-Boundary Clock. 2. P2p Transp – clock's Device Type is Peer to Peer Transparent Clock. 3. E2e Transp – clock's Device Type is End to End Transparent Clock. 4. Master Only – clock's Device Type is Master Only. 5. Slave Only – clock's Device Type is Slave Only.
Profile	Indicates the profile used by the clock.
Apply Profile Defaults	If the clock has been configured to use a profile, clicking the 'Apply' button will reset configured values to profile defaults.

4.12.2.2 Port Enable and Configuration



Port Enable and Configuration

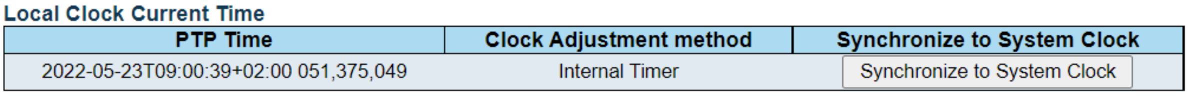
Port Enable																					Configuration
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Ports Configuration
☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Figure 4-115: Port Enable and Configuration

Table 4-109: Port Enable and Configuration

Port Enable	Set check mark for each port configured for this Clock Instance.
Configuration	Click 'Ports Configuration' to edit the port data set for the ports assigned to this clock instance.

4.12.2.3 Local Clock Current Time



Local Clock Current Time

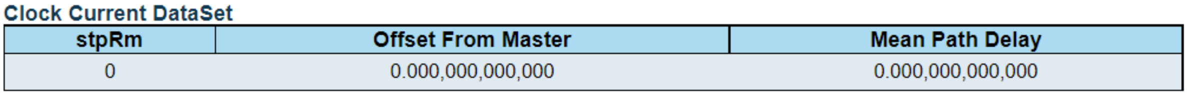
PTP Time	Clock Adjustment method	Synchronize to System Clock
2022-05-23T09:00:39+02:00 051,375,049	Internal Timer	Synchronize to System Clock

Figure 4-116: Local Clock Current time

Table 4-110: Local Clock Current time

PTP Time	Shows the actual PTP time with nanosecond resolution.
Clock Adjustment Method	Shows the actual clock adjustment method. The method depends on the available hardware.
Synchronize to System Clock	Activate this button to synchronize the System Clock to PTP Time.

4.12.2.4 Clock Current DataSet



Clock Current DataSet

stpRm	Offset From Master	Mean Path Delay
0	0.000,000,000,000	0.000,000,000,000

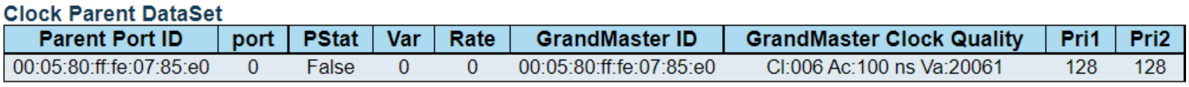
Figure 4-117: Clock Type and Profile

Table 4-111: Clock Type and Profile

stpRm	Steps Removed: It is the number of PTP clocks traversed from the grandmaster to the local slave clock.
Offset From Master	Time difference between the master clock and the local slave clock, measured in ns.
Mean Path Delay	The mean propagation time for the link between the master and the local slave.

4.12.2.5 Clock Parent Data Set

The clock parent data set is defined in the IEEE 1588 standard. The parent data set is dynamic.



Clock Parent DataSet

Parent Port ID	port	PStat	Var	Rate	GrandMaster ID	GrandMaster Clock Quality	Pri1	Pri2
00:05:80:ff:fe:07:85:e0	0	False	0	0	00:05:80:ff:fe:07:85:e0	Cl:006 Ac:100 ns Va:20061	128	128

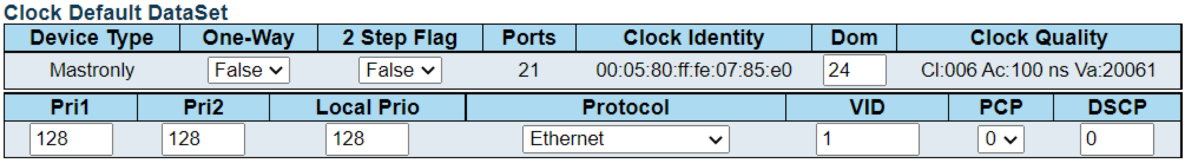
Figure 4-118: Clock Type and Profile

Table 4-112: Clock Type and Profile

Parent Port ID	Clock identity for the parent clock, if the local clock is not a slave, the value is the clocks own id.
Port	Port Id for the parent master port.
PStat	Parents Stats (always false).
Var	It is observed parent offset scaled log variance.
Rate	Observed Parent Clock Phase Change Rate. i.e., the slave clocks rate offset compared to the master. (unit = ns per s).
Grand Master ID	Clock identity for the grand master clock, if the local clock is not a slave, the value is the clocks own id.
Grand Master Clock Quality	The clock quality announced by the grand master (See description of Clock Default DataSet:Clock Quality)
Pri1	Clock priority 1 announced by the grand master.
Pri2	Clock priority 2 announced by the grand master.

4.12.2.6 Clock Default DataSet

The clock default data set is defined in the IEEE 1588 Standard. It holds three groups of data: the static members defined at clock creation time, the Dynamic members defined by the system, and the configurable members which can be set here.



Clock Default DataSet

Device Type	One-Way	2 Step Flag	Ports	Clock Identity	Dom	Clock Quality
Mastronly	False	False	21	00:05:80:ff:fe:07:85:e0	24	Cl:006 Ac:100 ns Va:20061

Pri1	Pri2	Local Prio	Protocol	VID	PCP	DSCP
128	128	128	Ethernet	1	0	0

Figure 4-119: Clock Default DataSet

Table 4-113: Clock Default DataSet

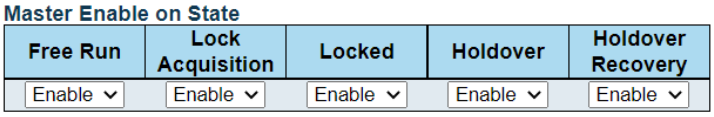
Device Type	Indicates the Type of the Clock Instance. There are five Device Types. 1. Ord-Bound – clock's Device Type is Ordinary-Boundary Clock. 2. P2p Transp – clock's Device Type is Peer to Peer Transparent Clock. 3. E2e Transp – clock's Device Type is End to End Transparent Clock. 4. Master Only – clock's Device Type is Master Only. 5. Slave Only – clock's Device Type is Slave Only.
One-Way	If true, one way measurements are used. This parameter applies only to a slave. In one-way mode no delay measurements are performed, i.e. this is applicable only if frequency synchronization is needed. The master always responds to delay requests.
2 Step Flag	True if two-step Sync events and Pdelay_Resp events are used.
Ports	The total number of physical ports in the node.
Clock Identity	It shows unique clock identifier.
Dom	Clock domain [0..127].
Clock Quality	The clock quality is determined by the system, and holds 3 parts: Clock Class, Clock Accuracy and OffsetScaledLog Variance as defined in IEEE1588. The Clock Accuracy values are defined in IEEE1588 table 6 (Currently the clock Accuracy is set to 'Unknown' as default).
Pri1	Clock priority 1 [0..255] used by the BMC master select algorithm.
Pri2	Clock priority 2 [0..255] used by the BMC master select algorithm.
Local Prio	Priority [1..255] used in the 8275.1 BMCA.
Protocol	Transport protocol used by the PTP protocol engine Ethernet PTP over Ethernet multicast EthernetMixed PTP using a combination of Ethernet multicast and unicast IPv4Multi PTP over IPv4 multicast IPv4Mixed PTP using a combination of IPv4 multicast and unicast IPv4Uni PTP over IPv4 unicast IPv6Mixed PTP using a combination of IPv6 multicast and unicast. Currently, this is supported for only One step E2E Transparent clock. EthIPv4IPv6Combo PTP using any one of Ethernet, IPv4 or IPv6. This is supported for only one step E2E Transparent clocks.

VID	VLAN Identifier used for tagging the VLAN packets.
PCP	Priority Code Point value used for PTP frames.
DSCP	DSCP value used when transmitting IPv4 encapsulated packets.

4.12.2.7 Master Enable on State

The Master Enable on State allow the user to control the PTP instance message transmission based on the SyncCenter operational state. PTP transmission can be set to one of the following modes per SyncCenter state:

- Disabled – PTP transmission deactivated
- Enabled - PTP transmission activated
- Rule 0 - PTP transmission activation is conditioned to Instance 0 state


Master Enable on State

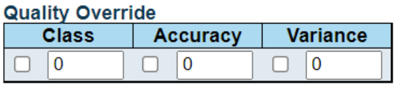
Free Run	Lock Acquisition	Locked	Holdover	Holdover Recovery
Enable	Enable	Enable	Enable	Enable

Figure 4-120: Master Enable on State

Table 4-114: Master Enable on State

Free Run	In Free Run state PTP can be set to: Disable, Enable, Rule 0.
Lock Acquisition	In Lock Acquisition state PTP can be set to: Disable, Enable, Rule 0.
Locked	In Locked state PTP can be set to: Disable, Enable, Rule 0.
Holdover	In Holdover state PTP can be set to: Disable, Enable, Rule 0.
Holdover Recovery	In Holdover Recovery state PTP can be set to: Disable, Enable, Rule 0.

4.12.2.8 Quality Override


Quality Override

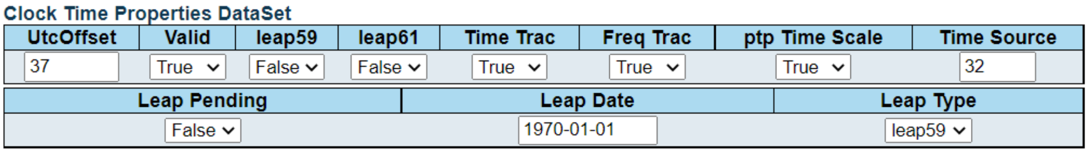
Class	Accuracy	Variance
☐ 0	☐ 0	☐ 0

Figure 4-121: Quality Override

Class	Tick checkbox to enable Clock Class override, then set the desired value.
Accuracy	Tick checkbox to enable Accuracy override, then set the desired value.
Variance	Tick checkbox to enable Variance override, then set the desired value.

Table 4-115: Quality Override

4.12.2.9 Clock Default DataSet


Clock Time Properties DataSet

UtcOffset	Valid	leap59	leap61	Time Trac	Freq Trac	ptp Time Scale	Time Source
37	True	False	False	True	True	True	32

Leap Pending	Leap Date	Leap Type
False	1970-01-01	leap59

Figure 4-122: Clock Type and Profile

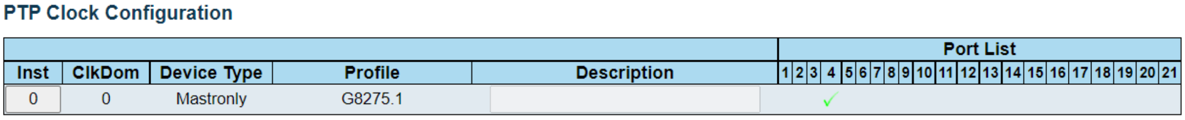
Table 4-116: Clock Type and Profile

UtcOffset	In systems whose epoch is UTC, it is the offset between TAI and UTC
Valid	When true, the value of currentUtcOffset is valid
leap59	When true, this field indicates that last minute of the current UTC day has only 59 seconds.
leap61	When true, this field indicates that last minute of the current UTC day has 61 seconds.
Time Trac	True if the timescale and the value of currentUtcOffset are traceable to a primary reference.
ptp Time Scale	True if the clock timescale of the grandmaster clock and false otherwise.
Time Source	The source of time used by the grandmaster clock.
Leap Pending	When true, there is a leap event pending at the date defined by leapDate.
Leap Date	The date for which the leap will occur at the end of its last minute. Date is represented as the number of days after 1970-01-01 (the latter represented as 0).
Leap Type	The type of leap event i.e. leap59 or leap61.
Buttons	**Apply**: Hit to apply the clock instance settings to the running-config. **Reset**: Hit to reset the new clock instance parameters to previous values. **PTP Global**: Hit to return to PTP Global configuration screen. **PTP Clock Status**: Click on it to go to PTP Clock Status screen.

4.12.3 PTP Monitoring

This section allows the user to inspect the current PTP clock settings

Web GUI: Monitor > Timing > PTP > Clocks



PTP Clock Configuration

					Port List																				
Inst	ClkDom	Device Type	Profile	Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
0	0	Mastronly	G8275.1					✓																	

Figure 4-123: PTP Clock Status

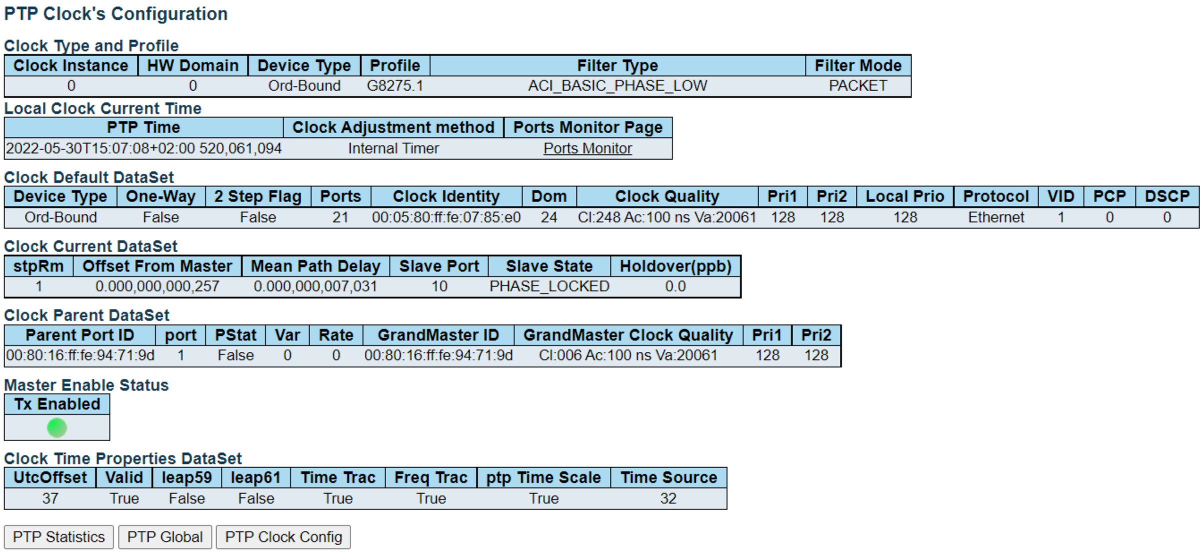
Table 4-117: PTP Clock Status Parameters

Inst	Indicates the Instance of a particular Clock Instance [0...3]. Click on the Clock Instance number to monitor the Clock details.
ClkDom	Refers to Clock HW Domain
Device Type	Indicates the Type of the Clock Instance. There are five Clock Types: • **Boundary** – clock's Type is Ordinary-Boundary Clock. • **Transparent (P2P)** – Clock's Type is Peer to Peer Transparent Clock. • **Transparent (E2E)** – Clock's Type is End to End Transparent Clock • **Master Only** - Clock's e Type is Master Only. • **Slave Only** - Clock's Type is Slave Only.
Profile	Indicates the profile used by the clock.

Description	User defined free text (64 characters)
Port List	It shows the configured ports for the specified Clock Instance.
Buttons	**Instance number:** Hit to access detailed Clock Instance Status page **PTP Config**: Click on it to go to PTP Configuration display. **Sync Center config**: Click on it to go to SyncCenter config. display

4.12.3.1 PTP Clock Instance Status

Web GUI: Monitor > Timing > PTP > Clocks > (Hit Clock Inst. Number)



PTP Clock's Configuration

Clock Type and Profile

Clock Instance	HW Domain	Device Type	Profile	Filter Type	Filter Mode
0	0	Ord-Bound	G8275.1	ACI_BASIC_PHASE_LOW	PACKET

Local Clock Current Time

PTP Time	Clock Adjustment method	Ports Monitor Page
2022-05-30T15:07:08+02:00 520,061,094	Internal Timer	Ports Monitor

Clock Default DataSet

Device Type	One-Way	2 Step Flag	Ports	Clock Identity	Dom	Clock Quality	Pri1	Pri2	Local Prio	Protocol	VID	PCP	DSCP
Ord-Bound	False	False	21	00:05:80:ff:fe:07:85:e0	24	Cl:248 Ac:100 ns Va:20061	128	128	128	Ethernet	1	0	0

Clock Current DataSet

stpRm	Offset From Master	Mean Path Delay	Slave Port	Slave State	Holdover(ppb)
1	0.000,000,000,257	0.000,000,007,031	10	PHASE_LOCKED	0.0

Clock Parent DataSet

Parent Port ID	port	PStat	Var	Rate	GrandMaster ID	GrandMaster Clock Quality	Pri1	Pri2
00:80:16:ff:fe:94:71:9d	1	False	0	0	00:80:16:ff:fe:94:71:9d	Cl:006 Ac:100 ns Va:20061	128	128

Master Enable Status

Tx Enabled
●

Clock Time Properties DataSet

UtcOffset	Valid	leap59	leap61	Time Trac	Freq Trac	ptp Time Scale	Time Source
37	True	False	False	True	True	True	32

Figure 4-124: PTP Clock Instance Status

Table 4-118: PTP Clock Instance Status Parameters

Clock Instance	Indicates the Instance of a particular Clock Instance [0...3]
ClkDom HW Domain	Refers to Clock HW Domain
Device Type	Indicates the Type of the Clock Instance. There are five Clock Types: • **Boundary** – clock's Type is Ordinary-Boundary Clock. • **Transparent (P2P)** – Clock's Type is Peer to Peer Transparent Clock. • **Transparent (E2E)** – Clock's Type is End to End Transparent Clock • **Master Only** - Clock's e Type is Master Only. • **Slave Only** - Clock's Type is Slave Only.
Profile	Indicates the profile used by the clock.
PTP Time	Shows the actual PTP time with nanosecond resolution.
Clock Adjust. Method	Shows the actual clock adjustment method. The method depends on the available hardware.
Ports Monitor Page	Click to monitor the port data set for the ports assigned to this clock instance.

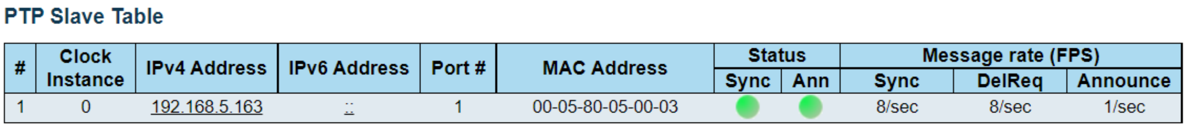
One-Way	If true, one-way measurements are used. This parameter applies only to a slave. In one-way mode no delay measurements are performed, i.e. this is applicable only if frequency synchronization is needed. The master always responds to delay requests.
2 Step Flag	True if two-step Sync events and Pdelay_Resp events are used.
Ports	The total number of physical ports in the node.
Clock Identity	It shows unique clock identifier.
Dom	Clock domain [0..127].
Clock Quality	The clock quality is determined by the system, and holds 3 parts: Clock Class, Clock Accuracy and OffsetScaledLog Variance as defined in IEEE1588. The Clock Accuracy values are defined in IEEE1588 table 6 (Currently the clock Accuracy is set to 'Unknown' as default).
Pri1	Clock priority 1 [0..255] used by the BMC master select algorithm.
Pri2	Clock priority 2 [0..255] used by the BMC master select algorithm.
Local Prio	Local priority for G8275.1 BMC algorithm (1 is highest priority).
Protocol	• Transport protocol used by the PTP protocol engine • Ethernet PTP over Ethernet multicast • ip4multi PTP over IPv4 multicast • ip4uni PTP over IPv4 unicast
VID	VLAN Identifier used for tagging the PTP frames. Note: Packets are tagged if the port is configured for vlan tagging for the configured VID.
PCP	Priority Code Point value used for PTP frames.
DSCP	Priority Code Point value used for PTP frames.
stpRm	Steps Removed: It is the number of PTP clocks traversed from the grandmaster to the local slave clock.
Offset From Master	Time difference between the master clock and the local slave clock, measured in ns.
Mean Path Delay	The mean propagation time for the link between the master and the local slave.
Slave Port	Shows which port is in slave mode. The value is 0 if no ports are in slave mode.
Slave State	Shows synchronization state of the slave (Slave only/Boundary): FREERUN, FREQ_LOCKING, PHASE_LOCKING, PHASE_LOCKED, HOLDOVER.
Holdover(pbb)	After the slave has been in Locked mode during the stabilization period, this value shows the actual clock offset between the free run and the actual holdover frequency, the value is shown in parts pr billion (ppb). During the stabilization period, the value is shown as N.A. The stabilization period is 60 sec as default, it can be changed from the CLI interface.

Parent Port ID	Clock identity for the parent clock, if the local clock is not a slave, the value is the clocks own id.
Port	Port Id for the parent master port.
PStat	Parents Stats (always false).
Var	It is observed parent offset scaled log variance.
Rate	Observed Parent Clock Phase Change Rate. i.e. the slave clocks rate offset compared to the master. (unit = ns per s).
GrandMaster ID	Clock identity for the grand master clock, if the local clock is not a slave, the value is the clocks own id.
GrandMaster Clock Quality	The clock quality announced by the grand master (See description of Clock Default DataSet:Clock Quality).
Pri1	Clock priority 1 announced by the grand master.
Pri2	Clock priority 2 announced by the grand master.
Tx Enabled	Green – Indicates Master is enabled for PTP transmission. Red – Indicates Master is NOT enabled for PTP transmission.
UtcOffset	In systems whose epoch is UTC, it is the offset between TAI and UTC.
Valid	When true, the value of currentUtcOffset is valid.
leap59	When true, this field indicates that last minute of the current UTC day has only 59 seconds.
leap61	When true, this field indicates that last minute of the current UTC day has 61 seconds.
Time Trac	True if the timescale and the value of currentUtcOffset are traceable to a primary reference.
Freq Trac	True if the frequency determining the timescale is traceable to a primary reference.
ptp Time Scale	True if the clock timescale of the grandmaster clock and false otherwise.
Time Source	The source of time used by the grandmaster clock.
Buttons	**PTP Config**: Click on it to go to PTP Configuration display. **Sync Center config**: Click on it to go to SyncCenter config. Display.

4.12.4 PTP Slave Table

This section shows the PTP Slave Table (Relevant for Unicast profiles only).

Web GUI: Monitor > Timing > PTP > Slave Table



PTP Slave Table

#	Clock Instance	IPv4 Address	IPv6 Address	Port #	MAC Address	Status		Message rate (FPS)		
						Sync	Ann	Sync	DelReq	Announce
1	0	192.168.5.163	::	1	00-05-80-05-00-03	●	●	8/sec	8/sec	1/sec

Figure 4-125: PTP Slave Table

Table 4-119: PTP Slave Table

#	Index of slave (has no functional impact).
Clock Instance	The master's clock instance.
IP Address	The slave's IP address.
Port #	The master's port number.
MAC Address	The MAC address of the slave (or the gateway's).
Status	**Sync** - Indicates Sync messages are transmitted to the slave. **Ann** - Indicates Announce messages are transmitted to the slave.
Message rate (FPS)	**Sync** - The current rate of Sync messages to the slave (as negotiated with the master). **DelReq** - The current rate of Delay Request messages from the slave (as negotiated with the master). **Announce** - The current rate of Announce messages to the slave (as negotiated with the master)

The slave device must collect 4 timestamps when PTP Sync and Del.Req messages are transmitted and received in order to calculate the offset from master clock.

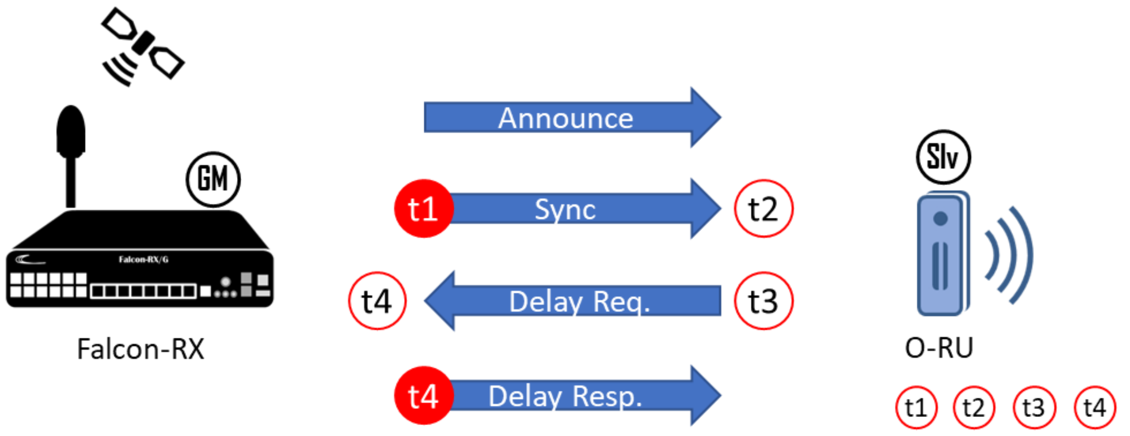


Figure 4-126: Basic working principle of IEEE 1588v2

4.13 Synchronous Ethernet (SyncE)

4.13.1 Overview

This section allows the user to inspect and configure the current SyncE port settings. SyncE is used to make an Ethernet network 'clock frequency' synchronized. Mobile network operators have started to deploy 4G/LTE networks. Ethernet has become the logical choice for mobile backhaul. These operators would like to deploy voice over Ethernet. Ethernet networks must provide timing and synchronization to enable proper operation of the mobile services. **The Falcon-RX devices** are offered with complete precision timing support based on Synchronous Ethernet and 1588-2008 (PTP) for LTE mobile backhaul applications.

The aim of Synchronous Ethernet is to provide a synchronous signal to network resources that may need such frequency synchronization signal. SyncE was standardized by the ITU-T and supports the following recommendations:

ITU-T G8261 standard that defines aspects regarding the architecture and performance of SyncE networks.

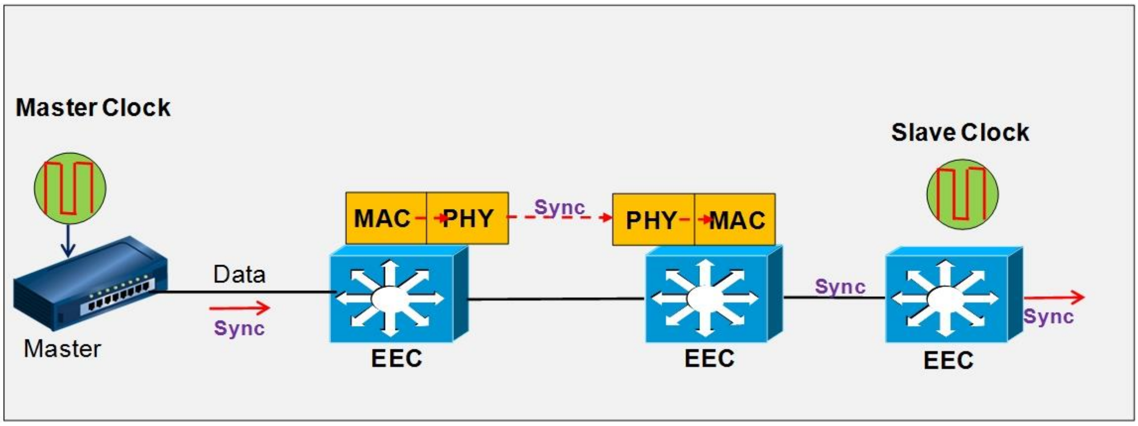
ITU-T G8262 standard which specifies SyncE slave clocks.

ITU-T G8264 standard that describes the specifications of Ethernet Synchronization Messaging Channel (ESMC)

In Synchronous mode of operation, the Synchronous Ethernet interface processes the SSM (**Synchronization Status Messages)** and recovers the clock quality level information. The ESMC channel is a logical communication channel which transmits SSM information, that is the quality level of the transmitting synchronous Ethernet equipment clock.

When a Synchronous Ethernet port is selected, the SSM are transmitted through this port, indicating the quality level of the clock it can drive. The messages are received (if the other remote unit supports SyncE) with the quality level of the transmitting clock. The remote end unit receiving the messages on its configured Synchronous Ethernet port extracts the clock quality level and transmits it to the Clock Master Unit. The Clock Master Unit receives the SSM data from many Synchronous Ethernet ports and establishes the clock sources. The device internal state logic (clock selector) monitors all reference clocks and automatically selects the best available reference clock based on configured priority and revertive priorities.

SyncE Basic mechanism



The master switch receives the external clock which is a high precision clock. In a synchronous Ethernet network, Ethernet data is carried over layer 2 whereas the sync timing signals over physical layer 1. All internal clocks should be synchronized by the external reference clock.

The Ethernet interfaces are designed with an internal clock which is synchronized by the master external clock. SyncE enables the transport of slave synchronization signals within the entire network.

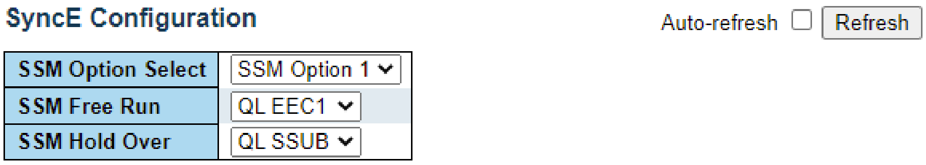
The EEC devices are defined as Ethernet Equipment Slave clocks. Ethernet interfaces are also able to generate their own synchronization clock in case they lose the master reference clock (this situation is defined as holdover state**).**

The SyncE Configuration procedure for the R Class series es includes the following display:

4.13.2 SyncE Port Configuration

This section displays and allows configuration of the SyncE configuration of the applicable Ethernet ports.

Web GUI: Configuration > Timing > SyncE



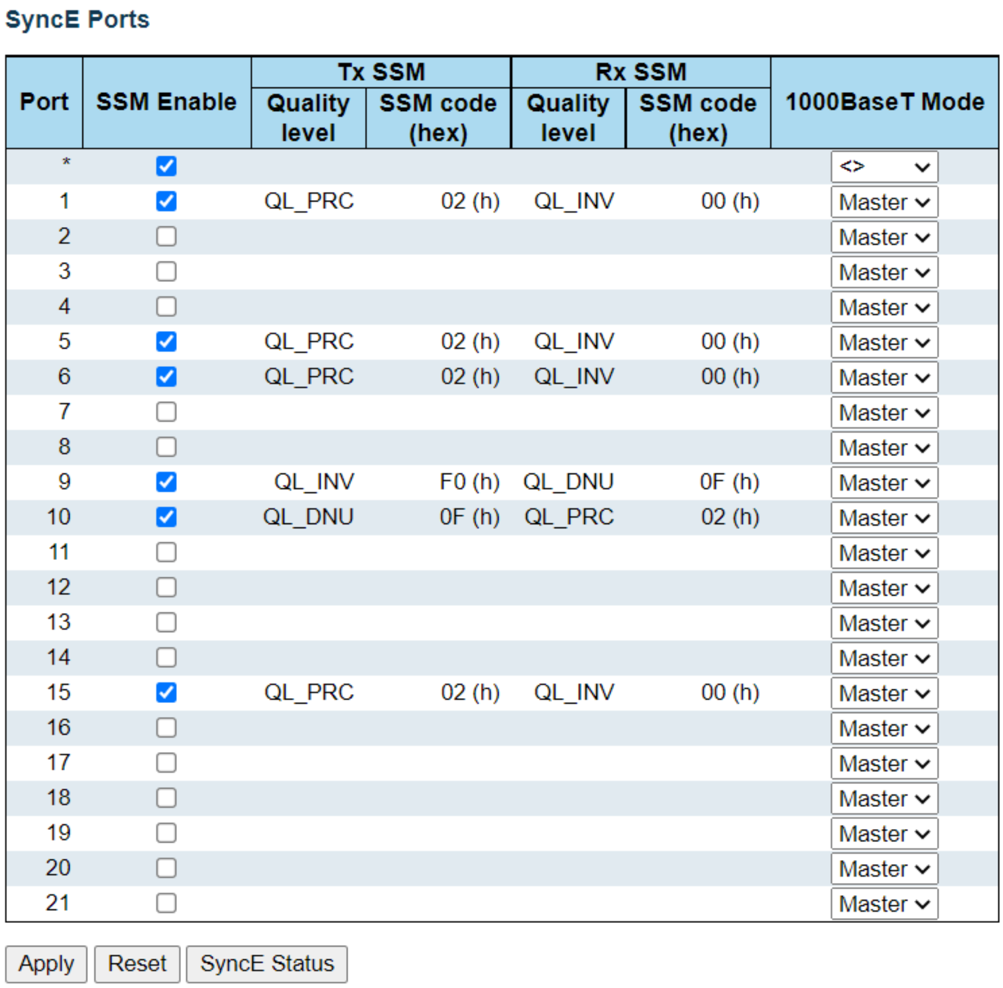
SyncE Configuration

SSM Option Select	SSM Option 1
SSM Free Run	QL EEC1
SSM Hold Over	QL SSUB

Figure 4-127: SyncE SSM Configuration

Table 4-120: SyncE configuration

SyncE Configuration	
SSM Option Select	Select the system network region option: • SSM Option 1 - refers to synchronization networks designed for Europe. • SSM Option 2 - refers to synchronization networks designed for US.
SSM Free Run	Set the SSM output quality level in Free Run state: PRC, SSUB, SSUA, EEC1, DNU
SSM Holdover	Set the SSM output quality level in Holdover state: PRC, SSUB, SSUA, EEC1, DNU



SyncE Ports

Port	SSM Enable	Tx SSM		Rx SSM		1000BaseT Mode
		Quality level	SSM code (hex)	Quality level	SSM code (hex)	
*	☑					<>
1	☑	QL_PRC	02 (h)	QL_INV	00 (h)	Master
2	☐					Master
3	☐					Master
4	☐					Master
5	☑	QL_PRC	02 (h)	QL_INV	00 (h)	Master
6	☑	QL_PRC	02 (h)	QL_INV	00 (h)	Master
7	☐					Master
8	☐					Master
9	☑	QL_INV	F0 (h)	QL_DNU	0F (h)	Master
10	☑	QL_DNU	0F (h)	QL_PRC	02 (h)	Master
11	☐					Master
12	☐					Master
13	☐					Master
14	☐					Master
15	☑	QL_PRC	02 (h)	QL_INV	00 (h)	Master
16	☐					Master
17	☐					Master
18	☐					Master
19	☐					Master
20	☐					Master
21	☐					Master

Figure 4-128: SyncE Port Configuration

Table 4-121: SyncE Port Configuration Parameters

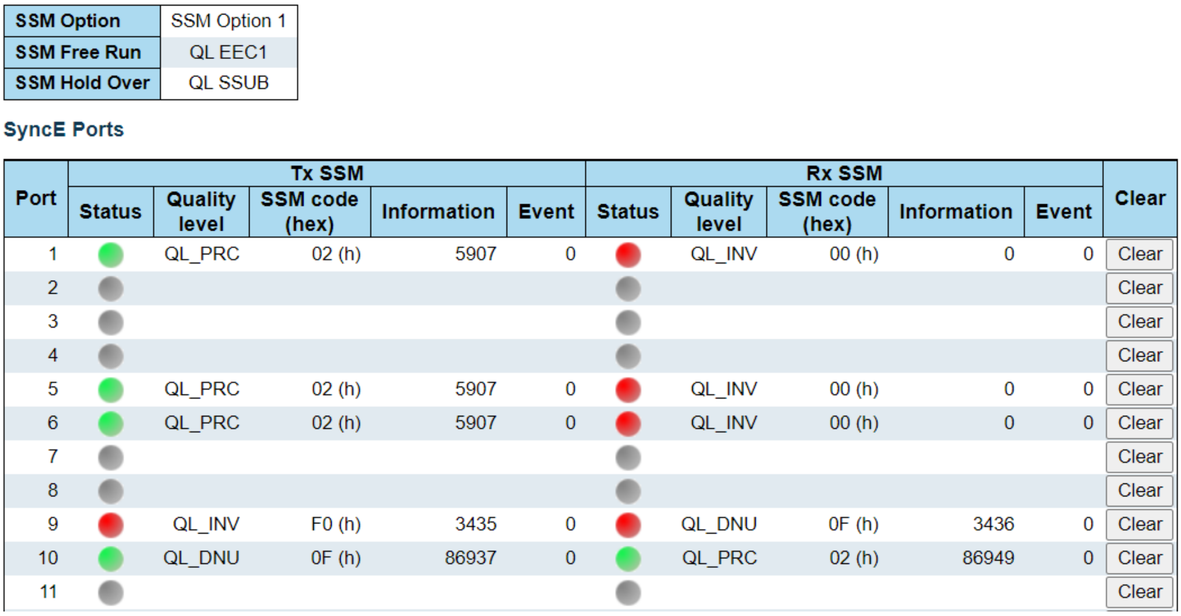
SyncE Ports	
Port	The port number to configure.
SSM Enable	Enable and disable of SSM functionality on this port.
Tx SSM: Quality Level	Monitoring of the transmitted SSM QL on this port. Transmitted QL should be the Quality Level of the clock generated by this node. This means the QL of the clock source this node is locked to.
Tx SSM: SSM code (hex)	Displaying the actual hex code used to indicate the transmitted Quality.

Rx SSM: Quality Level	Monitoring of the received SSM QL on this port. If link is down on port, QL_LINK is indicated. If no SSM is received, QL_FAIL is indicated.
Rx SSM: SSM code (hex)	
1000BaseT Mode	If PHY is in 1000BaseT Mode then this is monitoring the master/slave mode. In order to receive clock on a port, it has to be in slave mode. In order to transmit clock on a port, it has to be in master mode.

4.13.3 SyncE Port Monitoring

This section displays and allows configuration of the SyncE configuration of the applicable Ethernet ports.

Web GUI: Monitor > Timing > SyncE



SSM Option	SSM Option 1
SSM Free Run	QL EEC1
SSM Hold Over	QL SSUB

SyncE Ports

Port	Tx SSM					Rx SSM					Clear
	Status	Quality level	SSM code (hex)	Information	Event	Status	Quality level	SSM code (hex)	Information	Event	
1	🟢	QL_PRC	02 (h)	5907	0	🔴	QL_INV	00 (h)	0	0	Clear
2	●					●					Clear
3	●					●					Clear
4	●					●					Clear
5	🟢	QL_PRC	02 (h)	5907	0	🔴	QL_INV	00 (h)	0	0	Clear
6	🟢	QL_PRC	02 (h)	5907	0	🔴	QL_INV	00 (h)	0	0	Clear
7	●					●					Clear
8	●					●					Clear
9	🔴	QL_INV	F0 (h)	3435	0	🔴	QL_DNU	0F (h)	3436	0	Clear
10	🟢	QL_DNU	0F (h)	86937	0	🟢	QL_PRC	02 (h)	86949	0	Clear
11	●					●					Clear

Figure 4-129: SyncE Status

Table 4-122: SyncE Status Parameters

SyncE Status	
SSM Option Select	Display the system network region option: • SSM Option 1 - refers to synchronization networks designed for Europe. • SSM Option 2 - refers to synchronization networks designed for US.
SSM Free Run	Display SSM output quality level in Free Run state: PRC, SSUB, SSUA, EEC1, DNU
SSM Holdover	Display SSM output quality level in Holdover state: PRC, SSUB, SSUA, EEC1, DNU

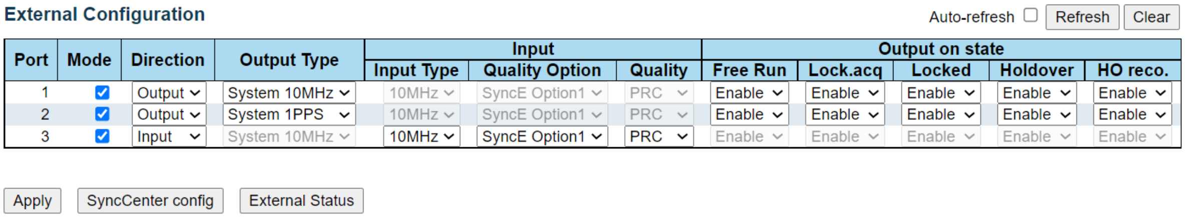
Table 4-123: SyncE Port Status Parameters

SyncE Ports Status	
Port	The port number to configure.
Tx SSM: Status	Idicate and disable of SSM functionality on this port.

Tx SSM: Quality Level	Monitoring of the transmitted SSM QL on this port. Transmitted QL should be the Quality Level of the clock generated by this node. This means the QL of the clock source this node is locked to
Tx SSM: code (hex)	Displaying the actual hex code used to indicate the transmitted Quality
Tx SSM: Information	Counter displaying the number of transmitted SSM Information messages
Tx SSM: Event	Counter displaying the number of transmitted SSM Event messages
Rx SSM: Status	Enable and disable of SSM functionality on this port.
Rx SSM: Quality Level	Monitoring of the received SSM QL on this port.
Rx SSM: code (hex)	Displaying the actual hex code indicating the received Quality per port
Rx SSM: Information	Counter displaying the number of received SSM Information messages
Rx SSM: Event	Counter displaying the number of received SSM Event messages
Clear	Hit **Clear** button to reset counters per port
Buttons	**SyncE Config**: Click on it to go to PTP Configuration display. **Clear All**: Click to reset all ports counters

4.14 External Sync Ports Configuration

Web GUI: Configuration > Timing > External



External Configuration

Auto-refresh ☐ Refresh Clear

Port	Mode	Direction	Output Type	Input			Output on state				
				Input Type	Quality Option	Quality	Free Run	Lock.acq	Locked	Holdover	HO reco.
1	☑	Output	System 10MHz	10MHz	SyncE Option1	PRC	Enable	Enable	Enable	Enable	Enable
2	☑	Output	System 1PPS	10MHz	SyncE Option1	PRC	Enable	Enable	Enable	Enable	Enable
3	☑	Input	System 10MHz	10MHz	SyncE Option1	PRC	Enable	Enable	Enable	Enable	Enable

Apply SyncCenter config External Status

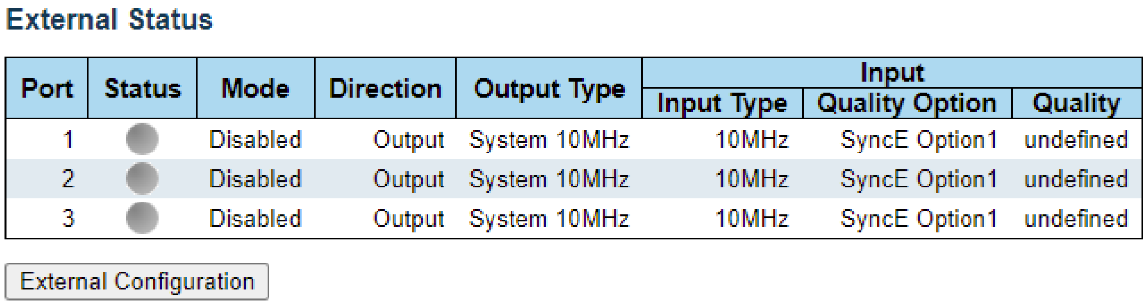
Figure 4-130: External Clock Configuration

Table 4-124: External Clock Configuration parameters

Port	Indicates sync port number.
Mode	Enable or disable the sync port.
Direction	Set the port to either input or output.
Output Type	Set the port's output type and frequency. Applicable when the port is set to **Output**
Input Type	Set the port's input type and frequency. Applicable when the port is set to **Input**
Quality Option	Set the input signal Quality Option
Quality	Set the input signal Quality level
Buttons	**Sync Center config:** click to go to SyncCenter Configuration page. **External Status:** click to go to External Clock Status page.

4.14.1 External Status

Web GUI: Monitor > Timing > External



External Status

Port	Status	Mode	Direction	Output Type	Input		
					Input Type	Quality Option	Quality
1	●	Disabled	Output	System 10MHz	10MHz	SyncE Option1	undefined
2	●	Disabled	Output	System 10MHz	10MHz	SyncE Option1	undefined
3	●	Disabled	Output	System 10MHz	10MHz	SyncE Option1	undefined

External Configuration

Figure 4-131: External Status

Table 4-125: External Status parameters

Port	Indicates sync port number.
Mode	Indicates whether the Sync port’s state is Enabled or Disabled.
Direction	Indicates whether the Sync port’s direction is Input or Output.
Output Type	Indicates the Sync port’s Output type.
Input	Indicates the Sync port’s Input type.
Quality Option	Indicates the Sync port’s Input Quality Option
Input Quality	Indicates the Sync port’s Input Quality level
Buttons	**External Configuration:** click to go to External Clock Configuration page.

4.15 Spanning Tree

Spanning Tree Protocol was developed to protect Ethernet networks from the bad effects of network loops: a loop is a circular path in the network which causes frame storms that overloads the Ethernet network.

Spanning Tree Protocol creates a spanning tree within a mesh network of connected Ethernet bridges and disables the links which are not part of that tree, leaving a single active path between any two network nodes.

Note: Spanning Tree is available in all Falcon R devices

Spanning Tree Versions:

- 802.1d Legacy Spanning Tree
- 802.1w Rapid Spanning Tree

Faster topology conversion by:

A faster method for temporary loop prevention: STP waits for the new topology to stabilize while RSTP makes the new root port forwarding immediately once all prior root ports have been made blocking, and then uses handshaking (on point-to-point links) to make designated ports forwarding as well.

Improvements in topology change detection, notification, and flushing of the learn tables.

- 802.1s Multiple-Instance Spanning Tree

A newer version supporting more than a single topology: each instance (group of VLANs) can have its own topology.

4.15.1 Understanding RSTP and MSTP

4.15.1.1 Understanding RSTP

STP provides basic loop prevention functionality with slow network convergence when topology changes occur.

RSTP converges faster because a handshake mechanism is deployed, based on P2P links instead of the timer-based process used by STP.

Under RTSP, port assignments change through exchanged messages RSTP device generates configuration messages once every hello time interval.

An RTSP device will respond to BPDUs sent from the root bridge. The RSTP device will propose its spanning tree information to its designated ports.

If another RSTP device receives this information and determines that this is the superior root information, it starts a synchronizing operation to ensure all its ports are in sync with the new information. This device may send an “agreement” to the first RSTP device confirming its superior spanning tree information.

The first RSTP device, upon receiving this agreement, knows now that it can rapidly change that port to the forwarding state.

Similar proposal agreement handshake messages propagate within the network, restoring the connectivity very quickly after a topology change, bypassing the traditional listening/learning state transition process.

Therefore, a cascading effect is created away from the RSTP root where each designated port proposes to its neighbors to determine if a rapid transition is possible. In this way RSTP achieves faster convergence times than STP.

RSTP device port roles:

Root – A forwarding port that is the best port from no root-bridge to Root bridge.

Designated –A forwarding port for every LAN segment.

Alternate – An alternate port to the root bridge.

Disabled – A network administrator can manually disable a port.

Backup – provides an alternate designated port.

4.15.1.2 Understanding MSTP

RSTP does not solve the problem inherent in STP: all VLANs within a LAN must share the same spanning tree topology. An STP or RSTP network has only one spanning tree instance for the entire network and includes all VLANs in the network. Falcon switches utilize the Multiple Spanning Tree protocol (MSTP, 802.1s) to ensure that only one active path exists between any two nodes in a spanning tree instance. An instance includes a unique set of VLANs, belongs to a specific spanning tree region and creates a separate per instance forwarding topology.

A region may comprise multiple spanning tree instances (each with a different set of VLANs). Each spanning tree instance is independent of other instances. Each region can support up to 16 spanning tree instances.

MSTP region: a group of interconnected switches that share the same attributes is defined as an MST region. An MST region includes multiple spanning tree instances (MSTI) which provide different paths for different VLAN. Each MSTI can have its own independent topology. Note that MSTP recognizes an STP or RSTP LAN as a distinct spanning tree region.

A region can include two types of STP instances:

- Internal Spanning Tree Instance (IST instance). This is the default spanning tree instance in any MST region. IST provides the root switch for the region and by default comprises all VLANs in the region except those VLANs assigned to MSTI.
- Multiple Spanning Tree Instance (MSTI). This type of configurable STP instance includes assigned VLANs which operate as part of the same single spanning tree topology. IST instance is defined as Instance 0 whereas all other MST instances are numbered from 1 to 15.
- All MST instances within the same region share the same protocol timers, each MST instance has its own topology Parameters, such root switch ID, root path cost and additional selected Parameters.

4.15.1.2.1 Common and Internal Spanning Tree (CSTI):

CSTI is a collection of the IST in each region and the Common Spanning Tree (CST) which interconnects the various MST regions and STP LANs, and RSTP LANs in a switched network.

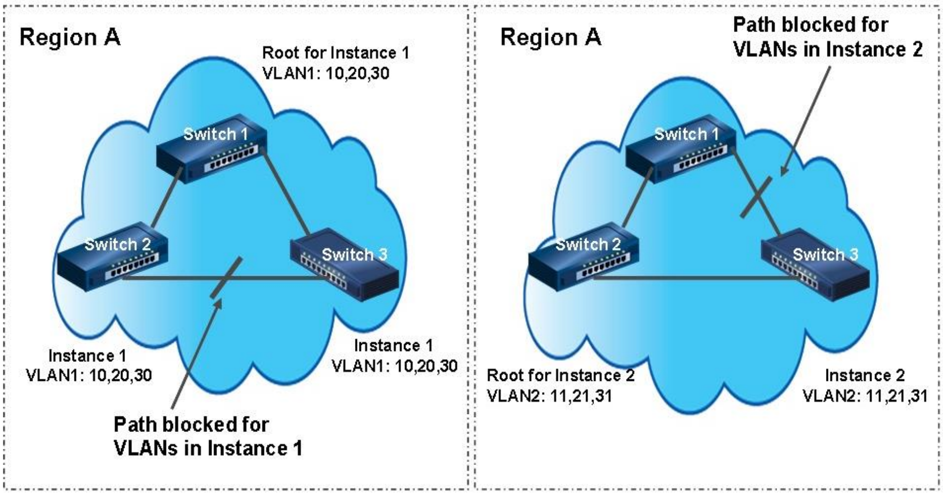
The CIST is created as a result of the STP algorithm running between switches that support the 802.1w, and the 802.ID protocols. MSTP allows for rapid port state transition just like RSTP. MSTP is compatible to STP and RSTP.

4.15.1.2.2 Example of a Multiple Spanning Tree Application

Assume we have tree switches in a region configured with VLANs grouped in two instances, as follows:

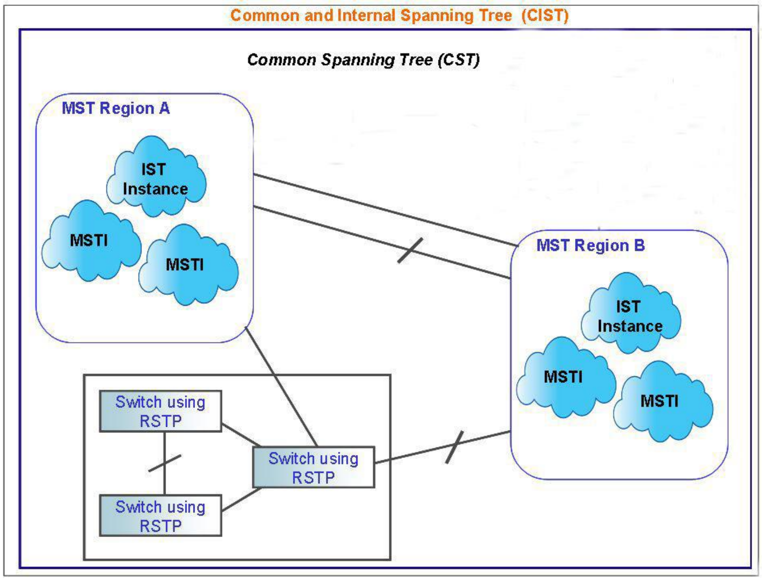
VLAN1 (10, 20, 30) mapped to Instance 1; VLAN2 (11, 21, 31) mapped to Instance 2. The logical topologies shown in the below drawing are the result from these VLAN/Instance grouping resulting on different blocked links for different VLANs as shown.

The MSTP configuration commands operate exactly like RSTP commands and MSTP is compatible with the RSTP and STP enable switches in our network.


Region A
Root for Instance 1
VLAN1: 10,20,30
Switch 1
Switch 2
Switch 3
Instance 1
VLAN1: 10,20,30
Instance 1
VLAN1: 10,20,30
Path blocked for
VLANs in Instance 1
Region A
Path blocked for
VLANs in Instance 2
Switch 1
Switch 2
Switch 3
Root for Instance 2
VLAN2: 11,21,31
Instance 2
VLAN2: 11,21,31

MSTP Network

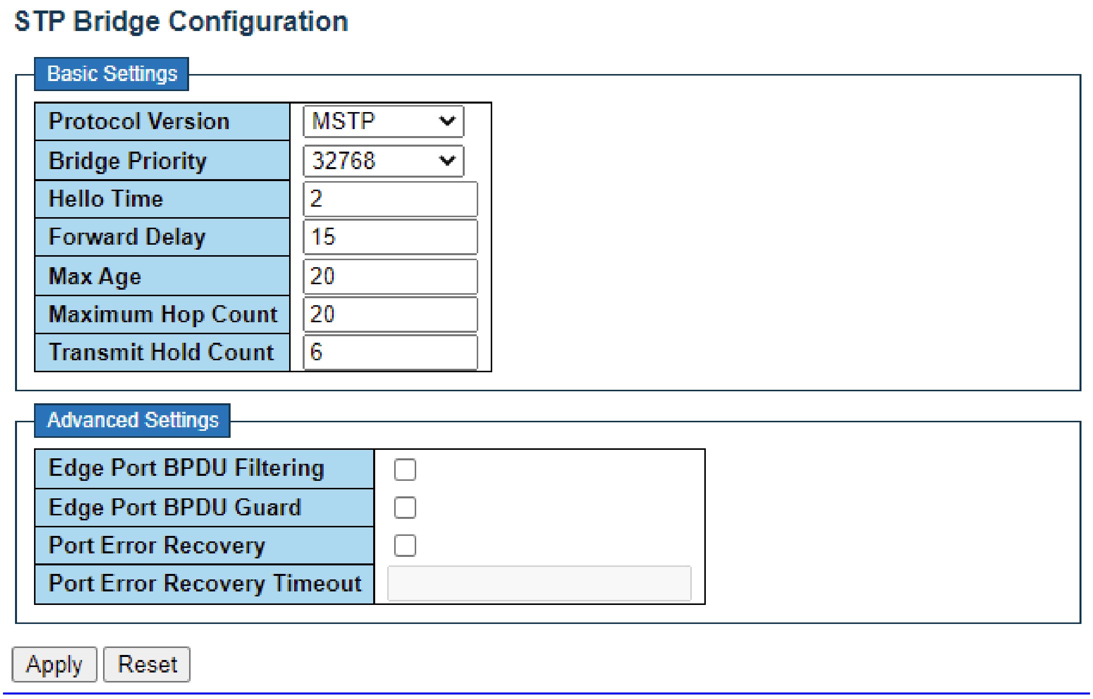
MSTP interconnects between various MST regions and maps active and separate paths through separate spanning tree instances. The below drawing depicts an MSTP network MSTP distinguish an STP or RSTP LAN as a distinct separate STP region.


Common and Internal Spanning Tree (CIST)
Common Spanning Tree (CST)
MST Region A
IST Instance
MSTI
MSTI
MST Region B
IST Instance
MSTI
MSTI
Switch using RSTP
Switch using RSTP
Switch using RSTP

4.15.2 Bridge settings

Spanning Tree protocol version (STP, RSTP or MSTP) is selected according to the networking environment. R Class series devices allows STP, RSTP, MSTP system settings configuration as detailed below.

Web GUI: Configuration > Spanning Tree > Bridge Settings


STP Bridge Configuration

Basic Settings

Protocol Version	MSTP
Bridge Priority	32768
Hello Time	2
Forward Delay	15
Max Age	20
Maximum Hop Count	20
Transmit Hold Count	6

Advanced Settings

Edge Port BPDU Filtering	☐
Edge Port BPDU Guard	☐
Port Error Recovery	☐
Port Error Recovery Timeout	

Apply
Reset

Figure 4-132: STP Bridge Configuration

Table 4-126: STP Bridge Configuration Parameters

Basic Settings	
Protocol version	The MSTP / RSTP / STP protocol version setting. Valid values are **STP**, **RSTP** and **MSTP**.

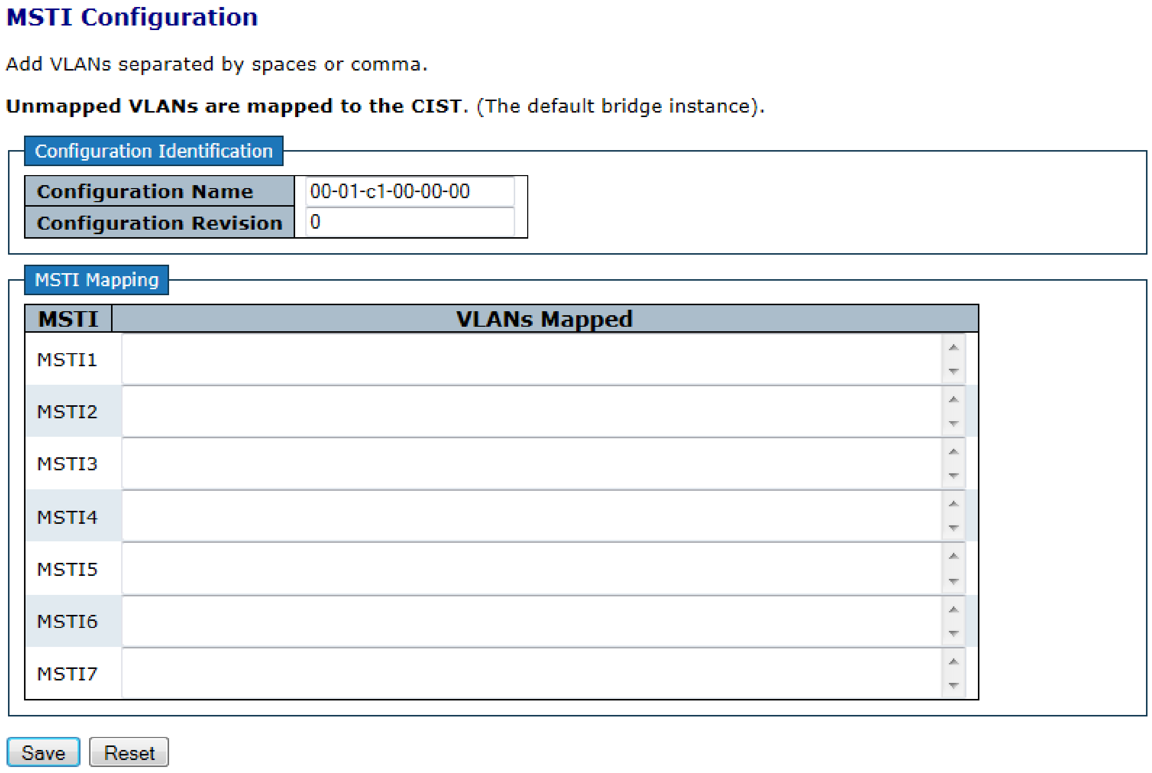
Bridge Priority	Controls the bridge priority. Lower numeric values have better priority. The bridge priority plus the MSTI instance number, concatenated with the 6-byte MAC address of the switch forms a Bridge Identifier. For MSTP operation, this is the priority of the CIST. Otherwise, this is the priority of the STP/RSTP bridge.
Hello Time	The interval between sending STP BPDU's. Valid values are in the range 1 to 10 seconds, default is 2 seconds. *Note: Changing this parameter from the default value is not recommended and may have adverse effects on your network.*
Forward Delay	The delay used by STP Bridges to transition Root and Designated Ports to Forwarding (used in STP compatible mode). Valid values are in the range 4 to 30 seconds.
Max Age	The maximum age of the information transmitted by the Bridge when it is the Root Bridge. Valid values are in the range 6 to 40 seconds, *and* Max Age must be <= (FwdDelay-1) *2.
Maximum Hop Count	This defines the initial value of remaining Hops for MSTI information generated at the boundary of a MSTI region. It defines how many bridges a root bridge can distribute its BPDU information to. Valid values are in the range 6 to 40 hops.
Transmit Hold Count	The number of BPDU's a bridge port can send per second. When exceeded, transmission of the next BPDU will be delayed. Valid values are in the range 1 to 10 BPDU's per second.
Advanced Settings	
Edge Port BDPU Filtering	Controls whether a port, *explicitly* configured as **Edge**, will transmit and receive BPDUs.
Edge Port BPDU Guard	Control whether a port, explicitly configured as **Edge**, will disable itself upon reception of a BPDU. The port will enter the error-disabled state and will be removed from the active topology.
Port Error Recovery	Control whether a port in the error-disabled state automatically will be enabled after a certain time. If recovery is not enabled, ports must be disabled and re-enabled for normal STP operation. This condition is also cleared by a system reboot.
Port Error Recovery Timeout	The time that must pass before a port in the error-disabled state can be enabled. Valid values are between 30 and 86400 seconds (24 hours).

4.15.3 MSTI Configuration

This section allows the user to inspect the current STP MSTI bridge instance (group of VLANs) priority configurations, and possibly change them as well.

Add VLANs separated by spaces or comma.

Web GUI: Configuration > Spanning Tree > MSTI Mapping



MSTI Configuration

Add VLANs separated by spaces or comma.

Unmapped VLANs are mapped to the CIST. (The default bridge instance).

Configuration Identification

Configuration Name	00-01-c1-00-00-00
Configuration Revision	0

MSTI Mapping

MSTI	VLANs Mapped
MSTI1	
MSTI2	
MSTI3	
MSTI4	
MSTI5	
MSTI6	
MSTI7	

Figure 4-133: MSTI Configuration

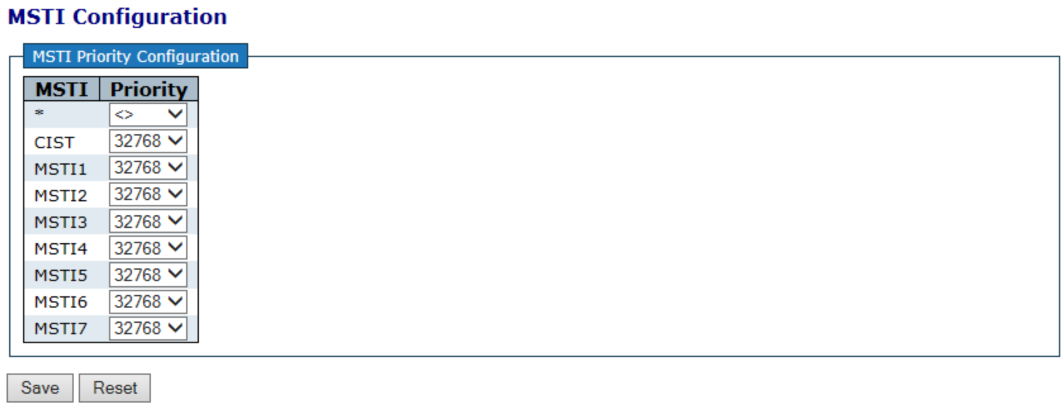
Table 4-127: MSTI Configuration Parameters

Configuration Identification	
Configuration Name	The name identifying the VLAN to MSTI mapping. Bridges must share the name and revision (see below), as well as the VLAN-to-MSTI mapping configuration in order to share spanning trees for MSTI's. (Intra-region). The name is at most 32 characters
Configuration Revision	The revision of the MSTI configuration named above. This must be an integer between 0 and 65535.
MSTI Mapping	
MSTI	The bridge instance. The CIST is not available for explicit mapping, as it will receive the VLANs not explicitly mapped.
VLANs Mapped	The list of VLAN's mapped to the MSTI. The VLANs can be given as a single (xx, xx being between 1 and 4094) VLAN, or a range (xx-yy), each of which must be separated with comma and/or space. A VLAN can only be mapped to one MSTI. An unused MSTI should just be left empty. (I.e., not having any VLANs mapped to it.) Example: 2,5,20-40.

4.15.4 MSTI Priority Configuration

The user is allowed to inspect the current STP MSTP bridge instance priority configurations and possibly change them as well

Web GUI: Configuration > Spanning Tree > MSTI Mapping



MSTI Configuration

MSTI Priority Configuration

MSTI	Priority
*	<>
CIST	32768
MSTI1	32768
MSTI2	32768
MSTI3	32768
MSTI4	32768
MSTI5	32768
MSTI6	32768
MSTI7	32768

Figure 4-134: STP MSTI Priority Configuration.

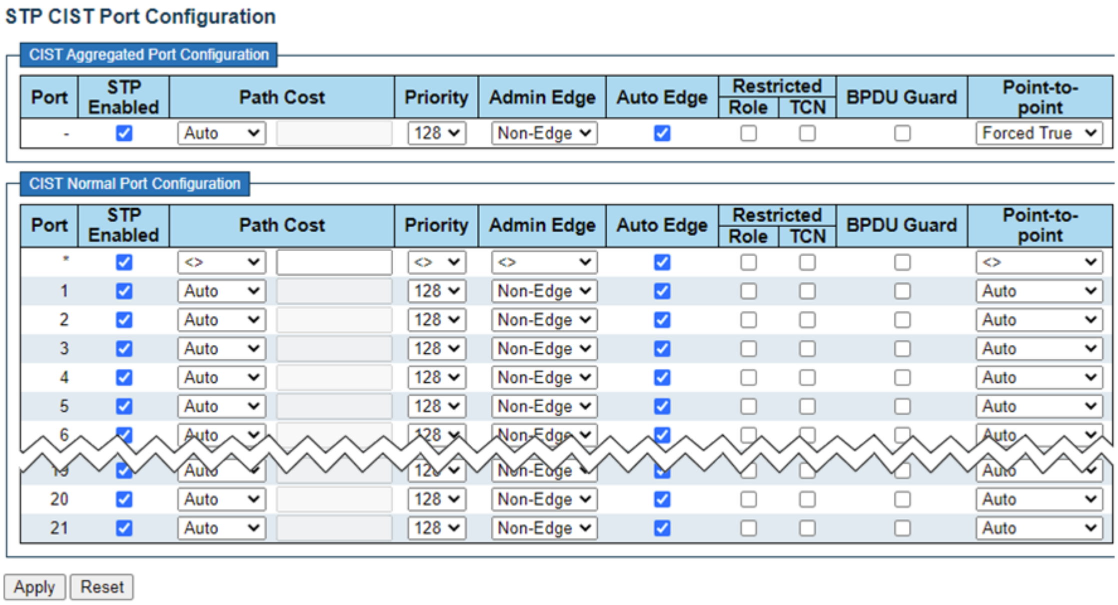
Table 4-128: STP MSTI Priority Configuration Parameters

MSTI	The bridge instance (group of VLANs). The CIST is the *default* instance, which is always active.
Priority	Controls the bridge priority Lower numeric values have better priority. The bridge priority plus the MSTI instance number, concatenated with the 6-byte MAC address of the switch forms a **Bridge Identifier.**

4.15.5 CIST Port Configuration

The user is allowed to inspect the current STP CIST port configurations, and possibly change them as well. This section contains settings **for physical and aggregated ports**.

Web GUI: Configuration > Spanning Tree > CIST Ports



STP CIST Port Configuration

CIST Aggregated Port Configuration

Port	STP Enabled	Path Cost		Priority	Admin Edge	Auto Edge	Restricted		BPDU Guard	Point-to-point
							Role	TCN		
-	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Forced True

CIST Normal Port Configuration

Port	STP Enabled	Path Cost		Priority	Admin Edge	Auto Edge	Restricted		BPDU Guard	Point-to-point
							Role	TCN		
*	☑	<>		<>	<>	☑	☐	☐	☐	<>
1	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
2	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
3	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
4	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
5	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
6	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
19	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
20	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
21	☑	Auto		128	Non-Edge	☑	☐	☐	☐	Auto

Figure 4-135: CIST Port Configuration displays

Table 4-129: CIST Port Configuration displays Parameters

CIST Aggregated and Normal Port Configurations	
Port	The switch port number of the logical STP port.
STP Enabled	Controls whether STP is enabled on this switch port.
Path Cost	Controls the path cost incurred by the port. The **Auto** setting will set the path cost as appropriate by the physical link speed, using the 802.1D recommended values. Using the **Specific** setting, a user-defined value can be entered. The path cost is used when establishing the active topology of the network. Lower path cost ports are chosen as forwarding ports in favor of higher path cost ports. Valid values are in the range 1 to 200000000.
Priority	Controls the port priority. This can be used to control priority of ports having identical port cost. (See above).
OperEdge (state flag)	Operational flag describing whether the port is connecting directly to edge devices. (No Bridges attached). Transitioning to the forwarding state is faster for edge ports (having *operEdge* true) than for other ports. The value of this flag is based on AdminEdge and AutoEdge fields. This flag is displayed as Edge in **Monitor**->**Spanning Tree** -> **STP Detailed Bridge Status**.
AdminEdge	Controls whether the *operEdge* flag should start as being set or cleared. (The initial operEdge state when a port is initialized).
AutoEdge	Controls whether the bridge should enable automatic edge detection on the bridge port. This allows **operEdge** to be derived from whether BPDU's are received on the port or not.
Restricted Role	If enabled, causes the port not to be selected as Root Port for the CIST or any MSTI, even if it has the best spanning tree priority vector. Such a port will be selected as an **Alternate Port** after the Root Port has been selected. If set, it can cause lack of spanning tree connectivity. It can be set by a network administrator to prevent bridges external to a core region of the network influencing the spanning tree active topology, possibly because those bridges are not under the full control of the administrator. This feature is also known as **Root Guard**.
Restricted TCN	If enabled, causes the port not to propagate received topology change notifications and topology changes to other ports. If set it can cause temporary loss of connectivity after changes in a spanning trees active topology as a result of persistent incorrectly learned station location information. It is set by a network administrator to prevent bridges external to a core region of the network, causing address flushing in that region, possibly because those bridges are not under the full control of the administrator or is the physical link state for the attached LANs changing frequently.

CIST Aggregated and Normal Port Configurations	
BPDU Guard	If enabled, causes the port to disable itself upon receiving valid BPDU's. Contrary to the similar bridge setting, the port **Edge** status does not affect this setting. A port entering error-disabled state due to this setting is subject to the bridge **Port Error Recovery** setting as well, located at STP Bridge Setting
Point to Point	Controls whether the port connects to a point-to-point LAN rather than a shared medium. This can be automatically determined or forced either true or false. Transition to the forwarding state is faster for point-to-point LANs than for shared media.

4.15.6 MSTI Port Configuration

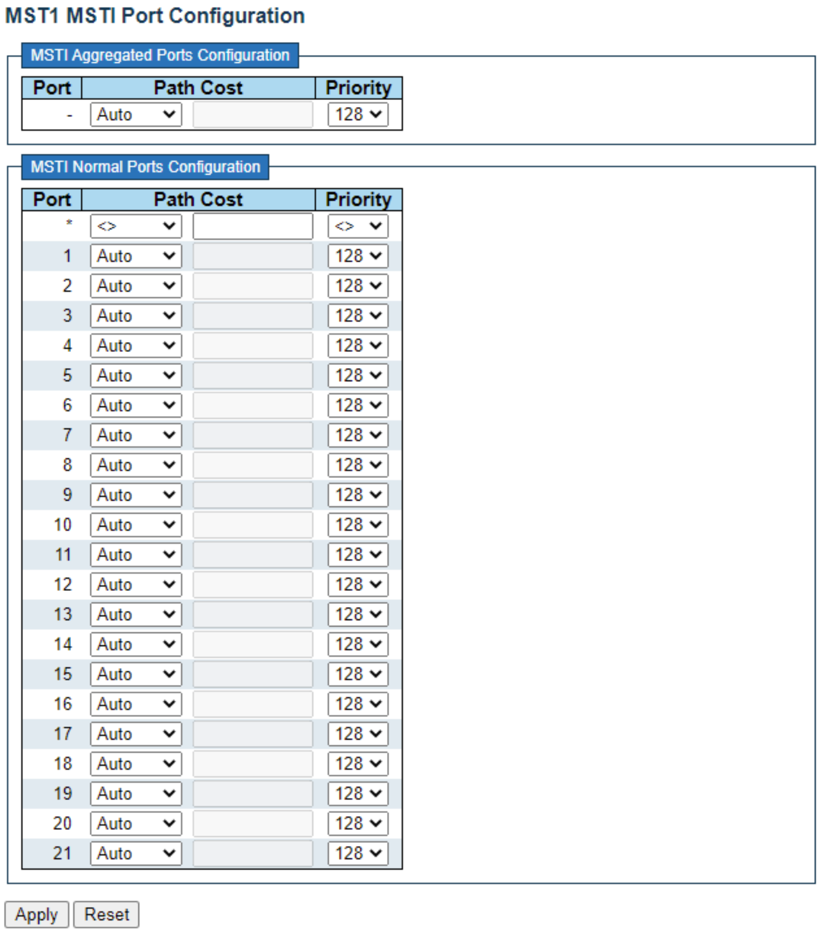
This section allows the user to inspect the current STP MSTI port configurations, and possibly change them as well.

A MSTI port is a virtual port, which is instantiated separately for each active CIST (physical) port for each MSTI instance configured and applicable for the port. The MSTI instance must be selected before displaying actual MSTI port configuration options.

This page contains MSTI port settings **for physical and aggregated ports.**

By clicking on **Get** we get the below display for the selected MSTI.

Web GUI: Configuration > Spanning Tree > MSTI Ports



MST1 MSTI Port Configuration

MSTI Aggregated Ports Configuration

Port	Path Cost		Priority
-	Auto		128

MSTI Normal Ports Configuration

Port	Path Cost		Priority
*	<>		<>
1	Auto		128
2	Auto		128
3	Auto		128
4	Auto		128
5	Auto		128
6	Auto		128
7	Auto		128
8	Auto		128
9	Auto		128
10	Auto		128
11	Auto		128
12	Auto		128
13	Auto		128
14	Auto		128
15	Auto		128
16	Auto		128
17	Auto		128
18	Auto		128
19	Auto		128
20	Auto		128
21	Auto		128

Figure 4-136: MSTI Port Configuration

Table 4-130: MSTI Port Configuration Parameters

Port	The switch port number of the corresponding STP CIST (and MSTI) port.
Path Cost	Controls the path cost incurred by the port. The **Auto** setting will set the path cost as appropriate by the physical link speed, using the 802.1D recommended values. Using the **Specific** setting, a user-defined value can be entered. The path cost is used when establishing the active topology of the network. Lower path cost ports are chosen as forwarding ports in favor of higher path cost ports. Valid values are in the range 1 to 200000000.
Priority	Controls the port priority. This can be used to control priority of ports having identical port cost. (See above). Lower priority is better.
Buttons	**Get**: Click to retrieve settings for a specific MSTI.

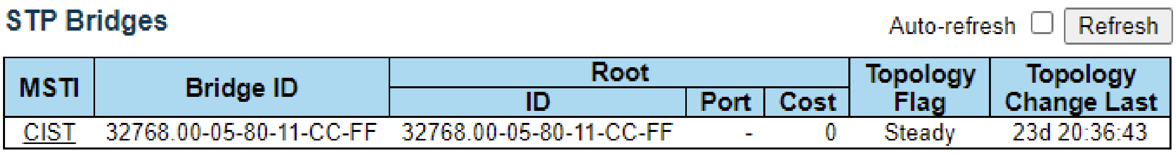
4.15.7 Spanning Tree Monitoring

This section provides various STP monitoring displays.

4.15.7.1 STP Bridges Status

This display provides a status overview of all STP bridge instances.

Web GUI: Monitor > Spanning Tree > Bridge Status



MSTI	Bridge ID	Root			Topology Flag	Topology Change Last
		ID	Port	Cost		
CIST	32768.00-05-80-11-CC-FF	32768.00-05-80-11-CC-FF	-	0	Steady	23d 20:36:43

Figure 4-137: STP Bridges

Table 4-131: STP Bridges Parameters

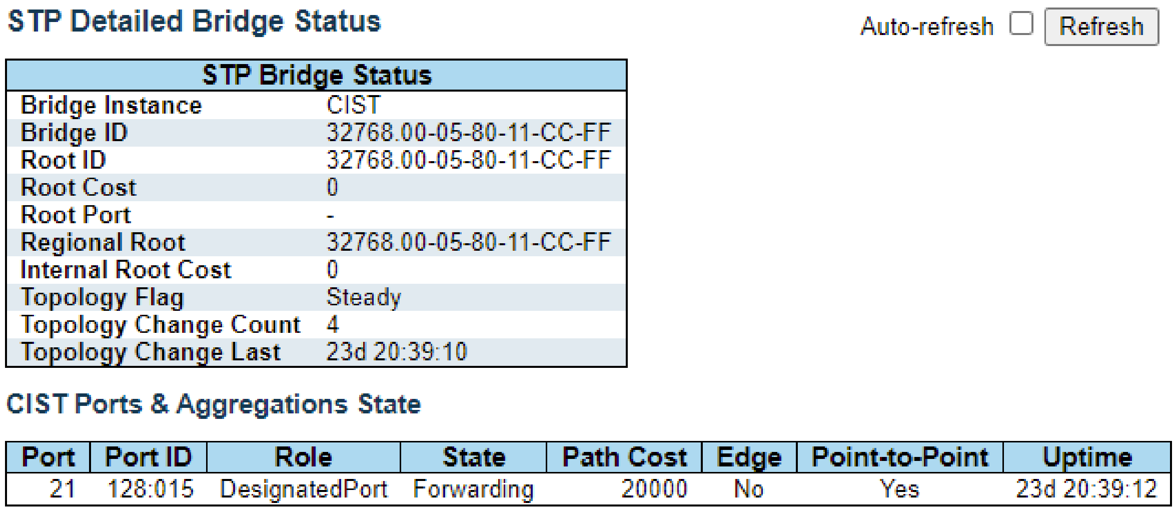
MSTI	The Bridge Instance. CIST also a link to the STP Detailed Bridge Status.
Bridge ID	The Bridge ID of this Bridge instance.
Root ID	The Bridge ID of the currently elected root bridge.
Root Port	The switch port currently assigned the root port role.
Root Cost	Root Path Cost. For the Root Bridge it is zero. For all other Bridges, it is the sum of the Port Path Costs on the least cost path to the Root Bridge.
Topology Flag	The current state of the Topology Change Flag of this Bridge instance.
Topology Change Last	The time since last Topology Change occurred.

By clicking on CIST on above display, an additional display is shown below (STP Detailed Bridge Status). This display provides detailed information on a single STP bridge instance, along with port state for all active associated ports. Refer to next sub-section for more details.

4.15.7.2 STP Detailed Bridge Status

This section provides detailed information on a single **STP** bridge instance, along with port state for all active ports associated.

Web GUI: Monitor > Spanning Tree > Bridge Status | MSTI



STP Detailed Bridge Status

STP Bridge Status	
Bridge Instance	CIST
Bridge ID	32768.00-05-80-11-CC-FF
Root ID	32768.00-05-80-11-CC-FF
Root Cost	0
Root Port	-
Regional Root	32768.00-05-80-11-CC-FF
Internal Root Cost	0
Topology Flag	Steady
Topology Change Count	4
Topology Change Last	23d 20:39:10

CIST Ports & Aggregations State

Port	Port ID	Role	State	Path Cost	Edge	Point-to-Point	Uptime
21	128:015	DesignatedPort	Forwarding	20000	No	Yes	23d 20:39:12

Figure 4-138: STP Detailed Bridge Status

Table 4-132: STP Detailed Bridge Status Parameters

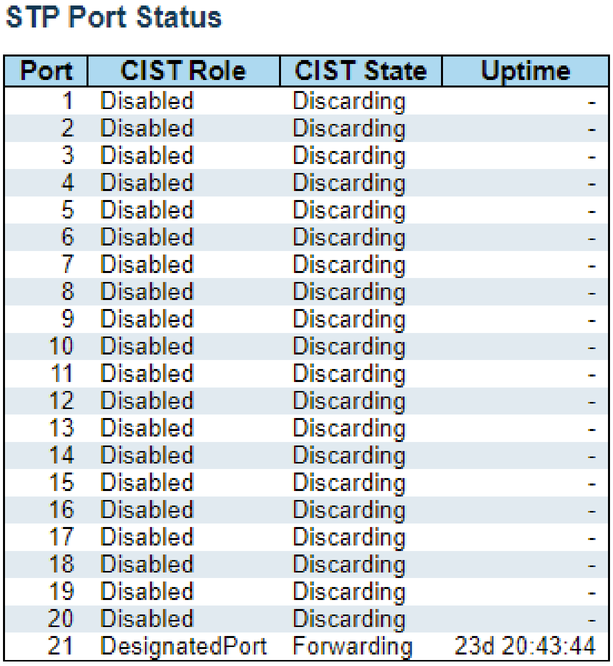
STP Bridge Status	
Bridge Instance	The Bridge instance -**CIST**, **MSTI**...
Bridge ID	The Bridge ID of this Bridge instance.
Root ID	The Bridge ID of the currently elected root bridge.
Root Port	The switch port currently assigned the root port role.
Root Cost	Root Path Cost. For the Root Bridge it is zero. For all other Bridges, it is the sum of the Port Path Costs on the least cost path to the Root Bridge
Regional Root	The Bridge ID of the currently elected regional root bridge, inside the MSTP region of this bridge. *(For the CIST instance only)*.
Internal Root Cost	The Regional Root Path Cost. For the Regional Root Bridge this is zero. For all other CIST instances in the same MSTP region, it is the sum of the Internal Port Path Costs on the least cost path to the Internal Root Bridge. *(For the CIST instance only)*.
Topology Flag	The current state of the Topology Change Flag of this Bridge instance.
Topology Change Count	The number of times where the topology change flag has been set (during a one-second interval).
Topology Change Last	The time passed since last Topology Flag was last set
CIST Ports & Aggregations State	
Port	The switch port number of the logical STP port
Port ID	The port id as used by the STP protocol. This is the priority part and the logical port index of the bridge port.

Role	The current STP port role. The port role can be one of the following values: **Alternate Port** **BackupPortRootPort** **Designated Port**
State	The current STP port state. The port state can be one of the following values: **Discarding** **Learning** **Forwarding**
Path Cost	The current STP port path cost. This will either be a value computed from the **Auto** setting, or any explicitly configured value
Edge	The current STP port (operational) Edge Flag. An Edge Port is a switch port to which no Bridges are attached. The flag may be automatically computed or explicitly configured. Each Edge Port transits directly to the Forwarding Port State, since there is no possibility of it participating in a loop.
Point-to-Point	The current STP port point-to-point flag. A point-to-point port connects to a non-shared LAN media. The flag may be automatically computed or explicitly configured. The point-to-point properties of a port affect how fast it can transit to STP state.
Uptime	The time since the bridge port was last initialized.

4.15.7.3 STP Port Status

This section displays the STP CIST port status for physical ports switch.

Web GUI: Monitor > Spanning Tree > Port Status



STP Port Status

Port	CIST Role	CIST State	Uptime
1	Disabled	Discarding	-
2	Disabled	Discarding	-
3	Disabled	Discarding	-
4	Disabled	Discarding	-
5	Disabled	Discarding	-
6	Disabled	Discarding	-
7	Disabled	Discarding	-
8	Disabled	Discarding	-
9	Disabled	Discarding	-
10	Disabled	Discarding	-
11	Disabled	Discarding	-
12	Disabled	Discarding	-
13	Disabled	Discarding	-
14	Disabled	Discarding	-
15	Disabled	Discarding	-
16	Disabled	Discarding	-
17	Disabled	Discarding	-
18	Disabled	Discarding	-
19	Disabled	Discarding	-
20	Disabled	Discarding	-
21	DesignatedPort	Forwarding	23d 20:43:44

Figure 4-139: STP Port Status

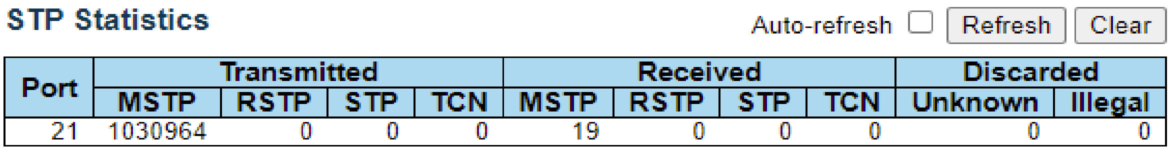
Table 4-133: STP Port Status Parameters

Port	The switch port number of the logical STP port
CIST Role	The current STP port role of the CIST port. The port role can be one of the following values: • AlternatePort • BackupPort • RootPort • DesignatedPort • Disabled
CIST State	The current STP port state of the CIST port. The port state can be one of the following values: • Discarding • Learning • Forwarding
Uptime	The time since the bridge port was last initialized.

4.15.7.4 STP Port Statistics

This page displays the STP port statistics counters of bridge ports in the switch.

Web GUI: Monitor > Spanning Tree > Port Statistics



Port	Transmitted				Received				Discarded	
	MSTP	RSTP	STP	TCN	MSTP	RSTP	STP	TCN	Unknown	Illegal
21	1030964	0	0	0	19	0	0	0	0	0

Figure 4-140: STP Statistics

Table 4-134: STP Statistics Parameters

Port	The switch port number of the logical STP port.
MSTP	The number of MSTP BPDU's received/transmitted on the port.
RSTP	The number of RSTP BPDU's received/transmitted on the port.
STP	The number of legacy STP Configuration BPDU's received/transmitted on the port.
TCN	The number of (legacy) Topology Change Notification BPDU's received/transmitted on the port.
Discarded Unknown	The number of unknown Spanning Tree BPDU's received (and discarded) on the port.
Discarded Illegal	The number of illegal Spanning Tree BPDU's received (and discarded) on the port.

4.16 IP Multicast

Multicast is the delivery of information to a group of destinations simultaneously using the most efficient strategy to deliver the messages over each link of the network only once, creating copies only when the links to the destinations split.

Internet Group Management Protocol (IGMP) is an IP (Layer 3) protocol used for signaling of multicast group membership (adding or removing clients to/from a multicast group).

IGMP snooping analyze all IGMP packets between hosts connected to the R Class series and multicast routers in the network. When the R Class series snoops an IGMP Join or IGMP Report from a host for a given multicast group, it adds the host's port number to the multicast list for that group. When the R Class series snoops an IGMP Leave, it removes the host's port from the table entry.

The following sections explain and demonstrate in detail IGMP snooping support using the Web screens description.

4.16.1 IGMP Snooping Configuration

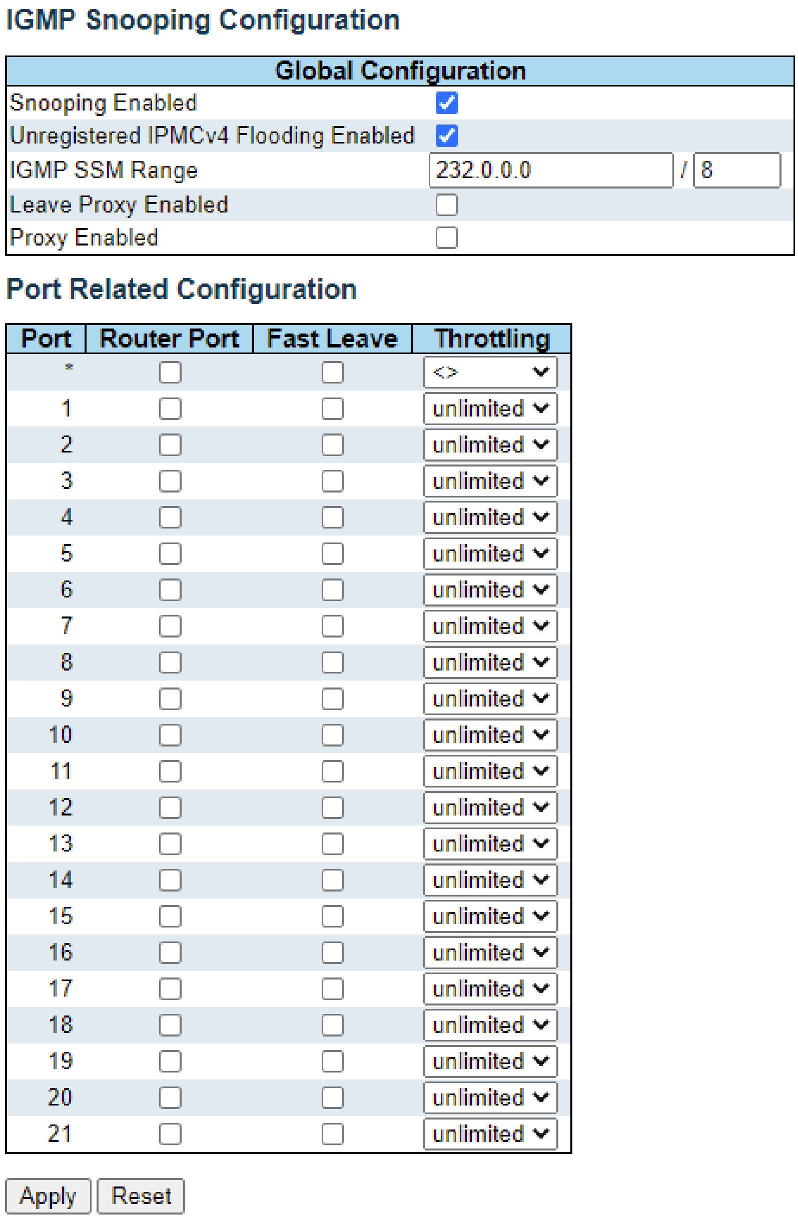
IGMP is an acronym for **I**nternet **G**roup **M**anagement **P**rotocol. It is a communications protocol used to manage the membership of Internet Protocol multicast groups. IGMP is used by IP hosts and adjacent multicast routers to establish multicast group memberships. It is an integral part of the IP multicast specification, like ICMP for unicast connections. IGMP can be used for online video and gaming and allows more efficient use of resources when supporting these uses.

IPMC is an acronym for **IP** **M**ulti**C**ast.

IPMC supports IPv4 and IPv6 multicasting. IPMCv4 denotes multicast for IPv4. IPMCv6 denotes multicast for IPv6.

This section enables IGMP Snooping related configuration.

Web GUI: Configuration > IPMC > IGMP Snooping > Basic Configuration



IGMP Snooping Configuration

Global Configuration	
Snooping Enabled	☑
Unregistered IPMCv4 Flooding Enabled	☑
IGMP SSM Range	232.0.0.0 / 8
Leave Proxy Enabled	☐
Proxy Enabled	☐

Port Related Configuration

Port	Router Port	Fast Leave	Throttling
*	☐	☐	<>
1	☐	☐	unlimited
2	☐	☐	unlimited
3	☐	☐	unlimited
4	☐	☐	unlimited
5	☐	☐	unlimited
6	☐	☐	unlimited
7	☐	☐	unlimited
8	☐	☐	unlimited
9	☐	☐	unlimited
10	☐	☐	unlimited
11	☐	☐	unlimited
12	☐	☐	unlimited
13	☐	☐	unlimited
14	☐	☐	unlimited
15	☐	☐	unlimited
16	☐	☐	unlimited
17	☐	☐	unlimited
18	☐	☐	unlimited
19	☐	☐	unlimited
20	☐	☐	unlimited
21	☐	☐	unlimited

Figure 4-141: IGMP Snooping Configurations

Table 4-135: IGMP Snooping Configuration Parameters

Global Configuration	
Snooping Enabled	Enables the Global IGMP Snooping.
Unregistered IPMCv4 Flooding enabled	Enables unregistered IPMCv4 traffic flooding. The flooding control takes effect only when IGMP Snooping is enabled. When IGMP Snooping is disabled, unregistered IPMCv4 traffic flooding is always active despite this setting.
IGMP SSM Range	SSM (Source-Specific Multicast) Range allows the SSM-aware hosts and routers run the SSM service model for the groups in the address range.
Leave Proxy Enabled	Enables IGMP Leave Proxy. This feature can be used to avoid forwarding unnecessary leave messages to the router side.
Proxy Enabled	Enable IGMP Proxy. This feature can be used to avoid forwarding unnecessary join and leave messages to the router side.
Port Related Configuration	
Router Port	Specify which ports act as router ports. A router port is a port on the Ethernet switch that leads towards the Layer 3 multicast device or IGMP querier. If an aggregation member port is selected as a router port, the whole aggregation will act as a router port.
Fast Leave	Enables the fast leave on the port. Multicast snooping Fast Leave processing allows the switch to remove an interface from the forwarding-table entry without first sending out group specific queries to the interface. The VLAN interface is pruned from the multicast tree for the multicast group specified in the original leave message. Fast-leave processing ensures optimal bandwidth management for all hosts on a switched network, even when multiple multicast groups are in use simultaneously. This processing applies to IGMP and MLD.
Throttling	Enable to limit the number of multicast groups to which a switch port can belong.

4.16.2 IGMP Snooping VLAN Configuration

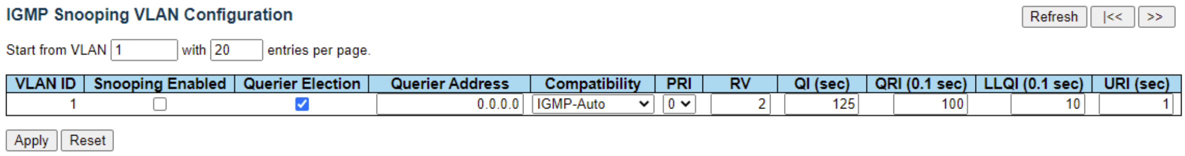
Navigating the IGMP Snooping VLAN Table

Each page shows up to 99 entries from the VLAN table, default being 20, selected through the **entries per page** input field. When first visited, the web page will show the first 20 entries from the beginning of the VLAN Table. The first displayed will be the one with the lowest VLAN ID found in the VLAN Table.

The **VLAN** input fields allow the user to select the starting point in the VLAN Table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest VLAN Table match.

The **>>** will use the last entry of the currently displayed entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

Web GUI: Configuration > IPMC > VLAN Configuration



IGMP Snooping VLAN Configuration

Start from VLAN 1 with 20 entries per page.

VLAN ID	Snooping Enabled	Querier Election	Querier Address	Compatibility	PRI	RV	QI (sec)	QRI (0.1 sec)	LLQI (0.1 sec)	URI (sec)
1	☐	☑	0.0.0.0	IGMP-Auto	0	2	125	100	10	1

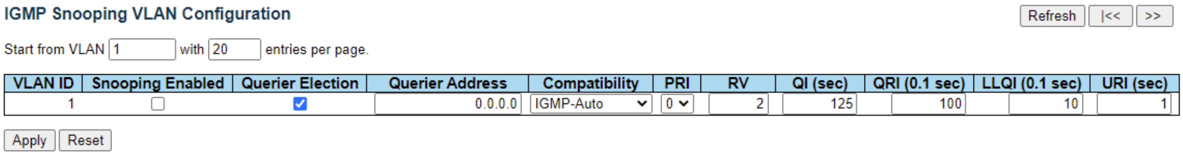
Figure 4-142: IGMP Snooping VLAN Configuration

Table 4-136: IGMP Snooping VLAN Configuration Parameters

VLAN ID	The VLAN ID of the entry.
Snooping Enabled	Enable the per-VLAN IGMP Snooping. Up to 32 VLANs can be selected for IGMP Snooping.
Querier Election	Enable to join IGMP Querier election in the VLAN. A router sends IGMP Query messages onto a particular link. This router is called the Querier.
Querier Address	Define the IPv4 address as source address used in IP header for IGMP Querier election. When the Querier address is not set, system uses IPv4 management address of the IP interface associated with this VLAN. When the IPv4 management address is not set, system uses the first available IPv4 management address. Otherwise, system uses a pre-defined value. By default, this value will be 192.0.2.1.
Compatibility	Compatibility is maintained by hosts and routers taking appropriate actions depending on the versions of IGMP operating on hosts and routers within a network. The allowed selection is **IGMP-Auto**, **Forced IGMPv1**, **Forced IGMPv2**, **Forced IGMPv3**, default compatibility value is **IGMP-Auto**.
PRI	Priority of Interface. It indicates the IGMP control frame priority level generated by the system. These values can be used to prioritize different classes of traffic. The allowed range is **0** (best effort) to **7** (highest), default interface priority value is 0.
RV	**Robustness Variable**. The Robustness Variable allows tuning for the expected packet loss on a network. The allowed range is **1** to **255**, default robustness variable value is 2.
QI	**Query Interval**. The Query Interval is the interval between General Queries sent by the Querier. The allowed range is **1** to **31744** seconds, default query interval is 125 seconds.
QRI	**Query Response Interval**. The Maximum Response Delay used to calculate the Maximum Response Code inserted into the periodic General Queries. The allowed range is **0** to **31744** in tenths of seconds, default query response interval is 100 in tenths of seconds (10 seconds).

LLQI (LMQI for IGMP)	**Last Member Query Interval.** The Last Member Query Time is the time value represented by the Last Member Query Interval, multiplied by the Last Member Query Count. The allowed range is **0** to **31744** in tenths of seconds, default last member query interval is 10 in tenths of seconds (1 second).
URI	**Unsolicited Report Interval.** The Unsolicited Report Interval is the time between repetitions of a host's initial report of membership in a group. The allowed range is **0** to **31744** seconds, default unsolicited report interval is 1 second.
Buttons	**Add New IGMP VLAN**: Click to add new IGMP VLAN. Specify the VID and configure the new entry. Click "Save". The specific IGMP VLAN starts working after the corresponding static VLAN is also created.

Note: by clicking on "Add New IGMP VLAN", we get the following display:



IGMP Snooping VLAN Configuration

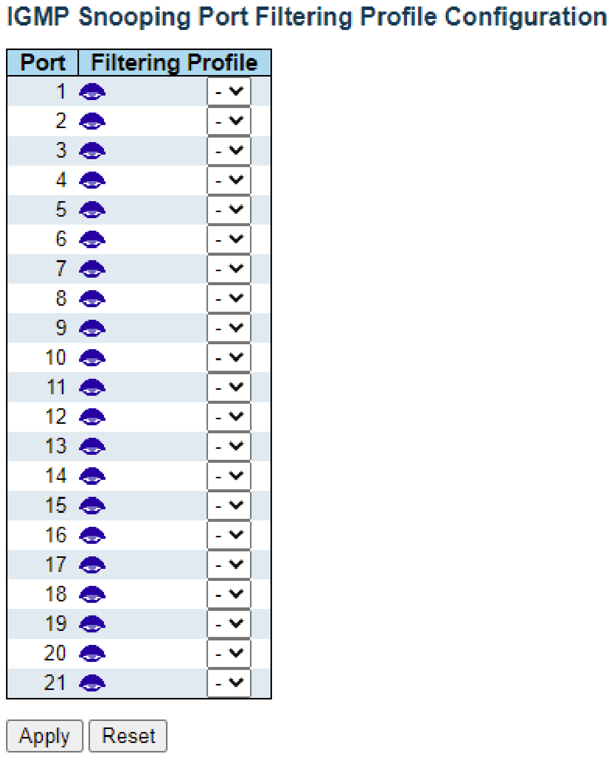
Start from VLAN 1 with 20 entries per page.

VLAN ID	Snooping Enabled	Querier Election	Querier Address	Compatibility	PRI	RV	QI (sec)	QRI (0.1 sec)	LLQI (0.1 sec)	URI (sec)
1	☐	☑	0.0.0.0	IGMP-Auto	0	2	125	100	10	1

Refer to previous table for terminology.

4.16.3 IGMP Snooping Port Group Filtering Configuration

Web GUI: Configuration > IPMC > IGMP Snooping > Port Filtering Profile



IGMP Snooping Port Filtering Profile Configuration

Port	Filtering Profile
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-
16	-
17	-
18	-
19	-
20	-
21	-

Figure 4-143: IGMP Snooping Port Group Filtering Configuration

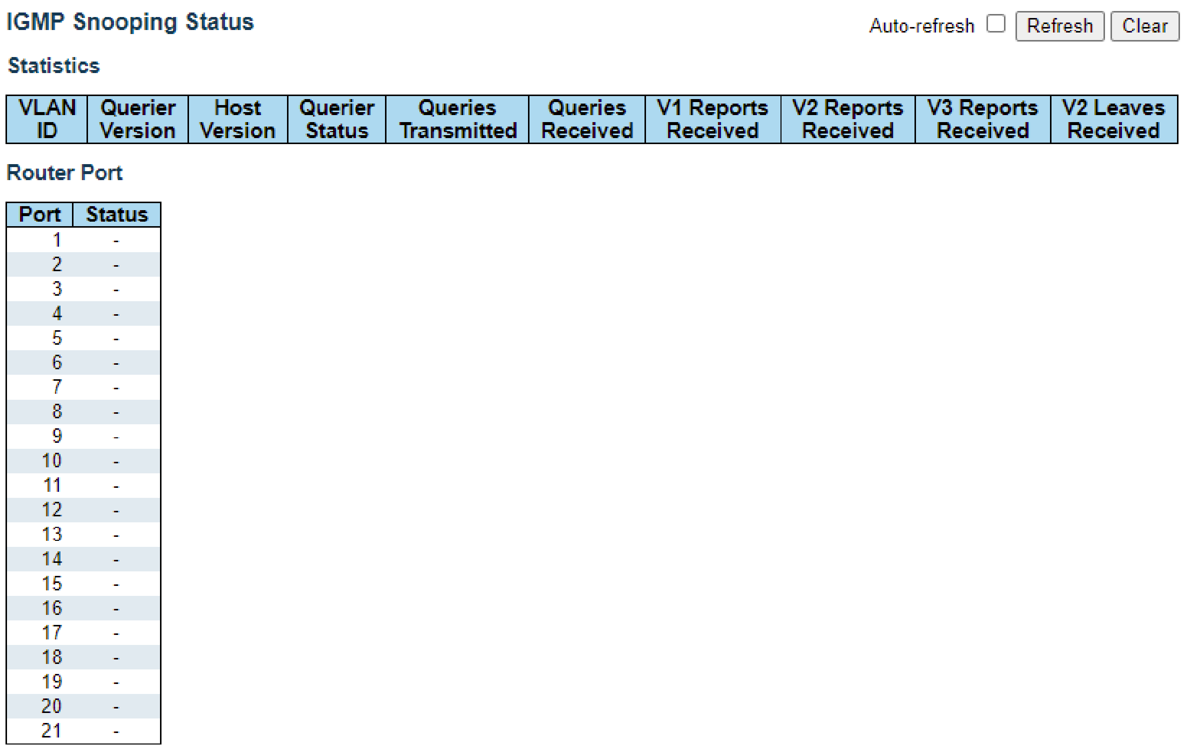
Table 4-137: IGMP Snooping Port Group Filtering Configuration Parameters

Port	The logical port for the settings.
Filtering Profile	Select the **IPMC Profile** as the filtering condition for the specific port. Summary about the designated profile will be shown by clicking the view button. IP Multicast Profile is an acronym for **IP** **M**ulti**C**ast Profile. IP Multicast Profile is used to deploy the access control on IP multicast streams.
Profile Management Button	You can inspect the rules of the designated profile by using the following button: 👁: List the rules associated with the designated profile.

4.16.4 IGMP Snooping Status

This section provides IGMP Snooping status.

Web GUI: Configuration > IPMC > IGMP Snooping > Status



IGMP Snooping Status

Statistics

VLAN ID	Querier Version	Host Version	Querier Status	Queries Transmitted	Queries Received	V1 Reports Received	V2 Reports Received	V3 Reports Received	V2 Leaves Received

Router Port

Port	Status
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-
16	-
17	-
18	-
19	-
20	-
21	-

Figure 4-144: IGMP Snooping Status

Table 4-138: IGMP Snooping Status Parameters

Statistics	
VLAN ID	The VLAN ID of the entry.
Querier Version	Currently Working Querier Version.
Host Version	Currently Working Host Version.
Querier Status	Shows the Querier status is "ACTIVE" or "IDLE". "DISABLE" denotes the specific interface is administratively disabled.

Querier Transmitted	The number of Transmitted Queries.
Querier Received	The number of Received Queries.
V1 Reports Received	The number of Received V1 Reports.
V2 Reports Received	The number of Received V2 Reports.
V3 Reports Received	The number of Received V3 Reports.
V2 Leave Received	The number of Received V2 Leaves.
Router Port	
Display which ports act as router ports. A router port is a port on the Ethernet switch that leads towards the Layer 3 multicast device or IGMP querier. Static denotes the specific port is configured to be a router port. Dynamic denotes the specific port is learnt to be a router port. Both denote the specific port is configured or learnt to be a router port.	
Port	Switch port number.
Status	Indicate whether specific port is a router port or not.

4.16.5 IGMP Snooping Groups Information

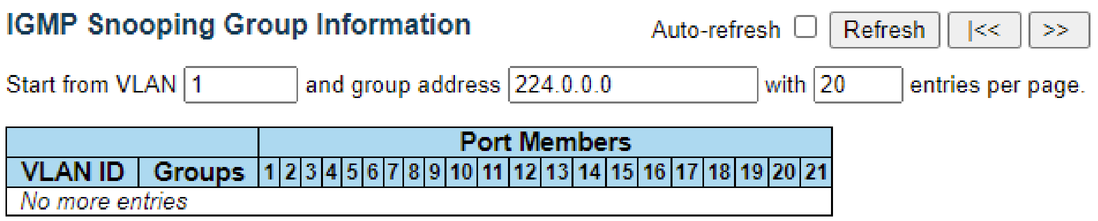
Entries in the IGMP Group Table are shown on this section. The IGMP Group Table is sorted first by VLAN ID, and then by group.

Navigating the IGMP Group Table

Each page shows up to 99 entries from the IGMP Group table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the IGMP Group Table. The "Start from VLAN", and "group" input fields allow the user to select the starting point in the IGMP Group Table. Clicking the **Refresh** button will update the displayed table starting from that or the closest next IGMP Group Table match. In addition, the two input fields will – upon a button click – assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

Web GUI: Configuration > IPMC > IGMP Snooping > Groups Information



IGMP Snooping Group Information

Start from VLAN 1 and group address 224.0.0.0 with 20 entries per page.

		Port Members																				
VLAN ID	Groups	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No more entries																						

Figure 4-145: IGMP Snooping Groups Information

Table 4-139: IGMP Snooping Groups Parameters

VLAN ID	VLAN ID of the group.
Groups	Group address of the group displayed.
Port Members	Ports under this group.

4.16.6 IGMP SFM Information

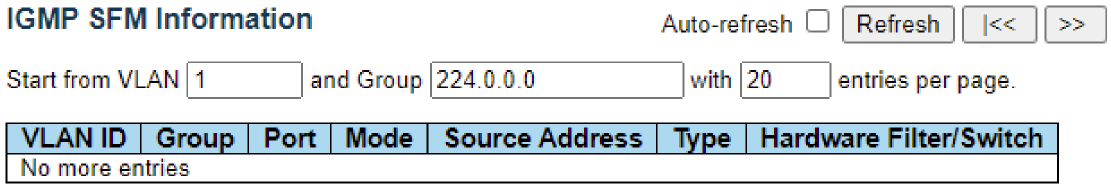
Entries in the IGMP SFM Information Table are shown on this section. The IGMP SFM (Source-Filtered Multicast) Information Table also contains the SSM (Source-Specific Multicast) information. This table is sorted first by VLAN ID, then by group, and then by Port. Different source addresses belonging to the same group are treated as single entry.

Navigating the IGMP SFM Information Table

Each page shows up to 99 entries from the IGMP SFM Information table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the IGMP SFM Information Table. The "Start from VLAN", and "group" input fields allow the user to select the starting point in the IGMP SFM Information Table. Clicking **Refresh** the button will update the displayed table starting from that or the closest next IGMP SFM Information Table match. In addition, the two input fields will - upon a button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over**.**

Web GUI: Configuration > IPMC > IGMP Snooping > IPv4 SFM Information



Start from VLAN 1 and Group 224.0.0.0 with 20 entries per page.

VLAN ID	Group	Port	Mode	Source Address	Type	Hardware Filter/Switch
No more entries						

Figure 4-146: IGMP SFM Information

Table 4-140: IGMP SFM Information Parameters

VLAN ID	VLAN ID of the group.
Group	Group address of the group displayed.
Port	Switch port number.
Mode	Indicates the filtering mode maintained per (VLAN ID, port number, Group Address) basis. It can be either Include or Exclude.
Source Address	IP Address of the source. Currently, system limits the total number of IPv4 source addresses for filtering (per group) is 8. When there is no any source filtering address, the text "None" is shown in the Source Address field.
Type	Indicates the Type. It can be either Allow or Deny.

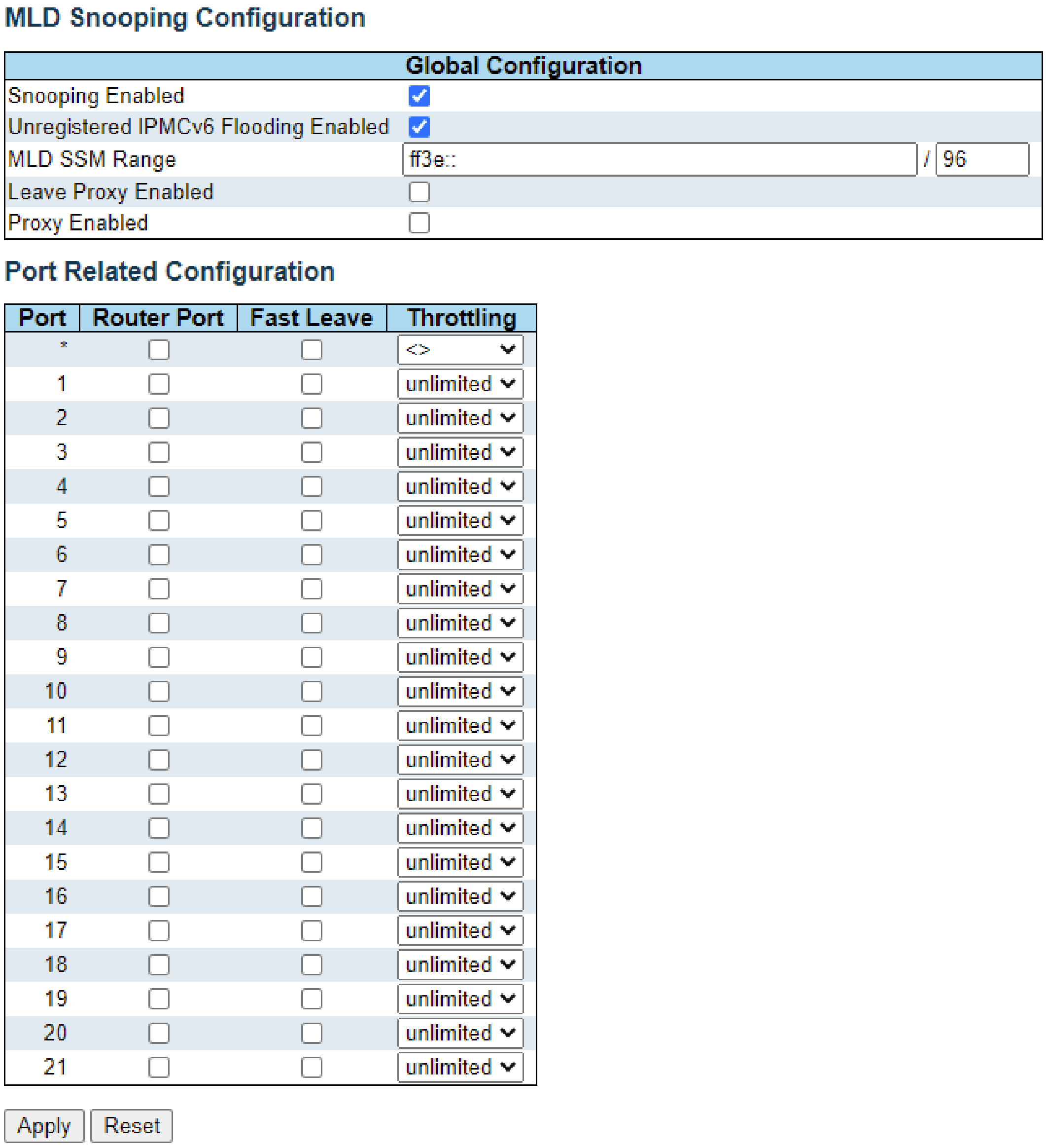
Hardware Filter/Switch	Indicates whether data plane destined to the specific group address from the source Ipv4 address could be handled by chip or not.

4.16.7 MLD Snooping Configuration

This section provides MLD Snooping related configuration.

MLD is an acronym for Multicast Listener Discovery for Ipv6. MLD is used by Ipv6 routers to discover multicast listeners on a directly attached link, much as IGMP is used in Ipv4. The protocol is embedded in ICMPv6 instead of using a separate protocol.

Web GUI: Configuration > IPMC > MLD Snooping > Basic Configuration



MLD Snooping Configuration

Global Configuration	
Snooping Enabled	☑
Unregistered IPMCv6 Flooding Enabled	☑
MLD SSM Range	ff3e:: / 96
Leave Proxy Enabled	☐
Proxy Enabled	☐

Port Related Configuration

Port	Router Port	Fast Leave	Throttling
*	☐	☐	<>
1	☐	☐	unlimited
2	☐	☐	unlimited
3	☐	☐	unlimited
4	☐	☐	unlimited
5	☐	☐	unlimited
6	☐	☐	unlimited
7	☐	☐	unlimited
8	☐	☐	unlimited
9	☐	☐	unlimited
10	☐	☐	unlimited
11	☐	☐	unlimited
12	☐	☐	unlimited
13	☐	☐	unlimited
14	☐	☐	unlimited
15	☐	☐	unlimited
16	☐	☐	unlimited
17	☐	☐	unlimited
18	☐	☐	unlimited
19	☐	☐	unlimited
20	☐	☐	unlimited
21	☐	☐	unlimited

Figure 4-147: MLD Snooping Configurations

Table 4-141: MLD Snooping Configurations Parameters

MLD Snooping Configuration	
Snooping Enabled	Enables the Global MLD Snooping.

Unregistered IPMCv6 Flooding enabled	Enables unregistered IPMCv6 traffic flooding. The flooding control takes effect only when MLD Snooping is enabled. When MLD Snooping is disabled, unregistered IPMCv6 traffic flooding is always active despite this setting
MLD SSM Range	SSM (Source-Specific Multicast) Range allows the SSM-aware hosts and routers run the SSM service model for the groups in the address range.
Leave Proxy Enabled	Enables MLD Leave Proxy. This feature can be used to avoid forwarding unnecessary leave messages to the router side.
Proxy Enabled	Enable MLD Proxy. This feature can be used to avoid forwarding unnecessary join and leave messages to the router side.
Port Related Configuration	
Router Port	Specify which ports act as router ports. A router port is a port on the Ethernet switch that leads towards the Layer 3 multicast device or MLD querier. If an aggregation member port is selected as a router port, the whole aggregation will act as a router port.
Fast Leave	Enable the fast leave on the port. System will remove group record and stop forwarding data upon receiving the MLDv1 leave message without sending last member query messages. It is recommended to enable this feature only when a single MLDv1 host is connected to the specific port.
Throttling	Enable to limit the number of multicast groups to which a switch port can belong.

4.16.8 MLD Snooping VLAN Configuration

Navigating the MLD Snooping VLAN Table

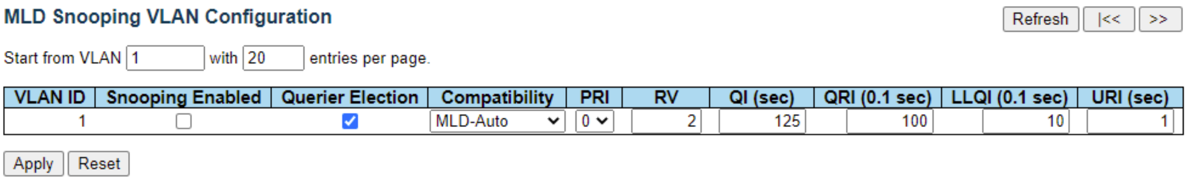
Each page shows up to 99 entries from the VLAN table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the VLAN Table. The first displayed will be the one with the lowest VLAN ID found in the VLAN Table.

The "VLAN" input fields allow the user to select the starting point in the VLAN Table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest VLAN Table match.

The **>>** will use the last entry of the currently displayed entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table.

Use **<<** the button to start over.

Web GUI: Configuration > IPMC > MLD Snooping > VLAN Configuration



MLD Snooping VLAN Configuration

Start from VLAN 1 with 20 entries per page.

VLAN ID	Snooping Enabled	Querier Election	Compatibility	PRI	RV	QI (sec)	QRI (0.1 sec)	LLQI (0.1 sec)	URI (sec)
1	☐	☑	MLD-Auto	0	2	125	100	10	1

Figure 4-148: MLD Snooping VLAN Configurations

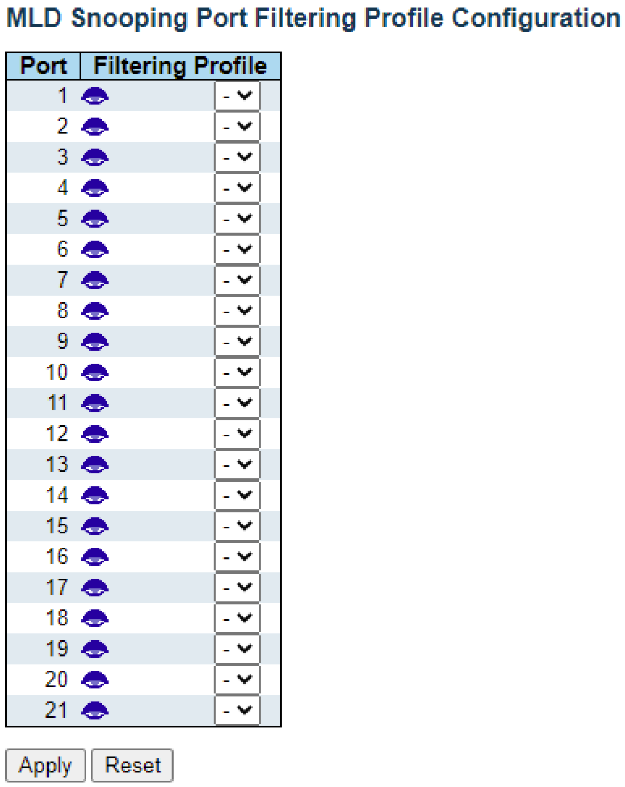
Table 4-142: MLD Snooping VLAN Configuration Parameters

VLAN ID	The VLAN ID of the entry.
MLD Snooping Enabled	Enable the per-VLAN MLD Snooping. Up to **511** VLANs can be selected for MLD Snooping.
Querier Election	Enable the MLD **Querier election** in the VLAN. Disable to act as a MLD Non-Querier.
Compatibility	Compatibility is maintained by hosts and routers taking appropriate actions depending on the versions of MLD operating on hosts and routers within a network. The allowed selection is: **MLD-Auto**, **Forced MLD v1, Forced MLD v2.** Default compatibility value is **MLD-Auto**.
PRI	Priority of Interface. It indicates the MLD control frame priority level generated by the system. These values can be used to prioritize different classes of traffic. The allowed range is **0** (best effort) to **7** (highest), default interface priority value is **0**.
RV	**Robustness Variable**. The Robustness Variable allows tuning for the expected packet loss on a LINK. The allowed range is **1** to **255**, default robustness variable value is 2.
QI	**Query Interval**. The Query Interval is the interval between General Queries sent by the Querier. The allowed range is **1** to **31744** seconds, default query interval is 125 seconds.
QRI	**Query Response Interval**. The Maximum Response Delay used to calculate the Maximum Response Code inserted into the periodic General Queries. The allowed range is **0** to **31744** in tenths of seconds, default query response interval is 100 in tenths of seconds (10 seconds).
LLQI	**Last Listener Query Interval**. The Last Listener Query Interval is the Maximum Response Delay used to calculate the Maximum Response Code inserted into Multicast Address Specific Queries sent in response to Version 1 Multicast Listener Done messages. It is also the Maximum Response Delay used to calculate the Maximum Response Code inserted into Multicast Address and Source Specific Query messages. The allowed range is **0** to **31744** in tenths of seconds, default last listener query interval is 10 in tenths of seconds (1 second).
URI	**Unsolicited Report Interval.** The Unsolicited Report Interval is the time between repetitions of a node's initial report of interest in a multicast address. The allowed range is **0** to **31744** seconds, default unsolicited report interval is 1 second.

***Note:** By clicking on the **"Add New MLD VLAN"**, we get the following display:*

MLD Snooping Port Group Filtering Configuration

Web GUI: Configuration > IPMC > MLD Snooping > Port Filtering Profile



MLD Snooping Port Filtering Profile Configuration

Port	Filtering Profile
1	👁 -
2	👁 -
3	👁 -
4	👁 -
5	👁 -
6	👁 -
7	👁 -
8	👁 -
9	👁 -
10	👁 -
11	👁 -
12	👁 -
13	👁 -
14	👁 -
15	👁 -
16	👁 -
17	👁 -
18	👁 -
19	👁 -
20	👁 -
21	👁 -

Figure 4-149: MLD Snooping Port Group Filtering Configuration

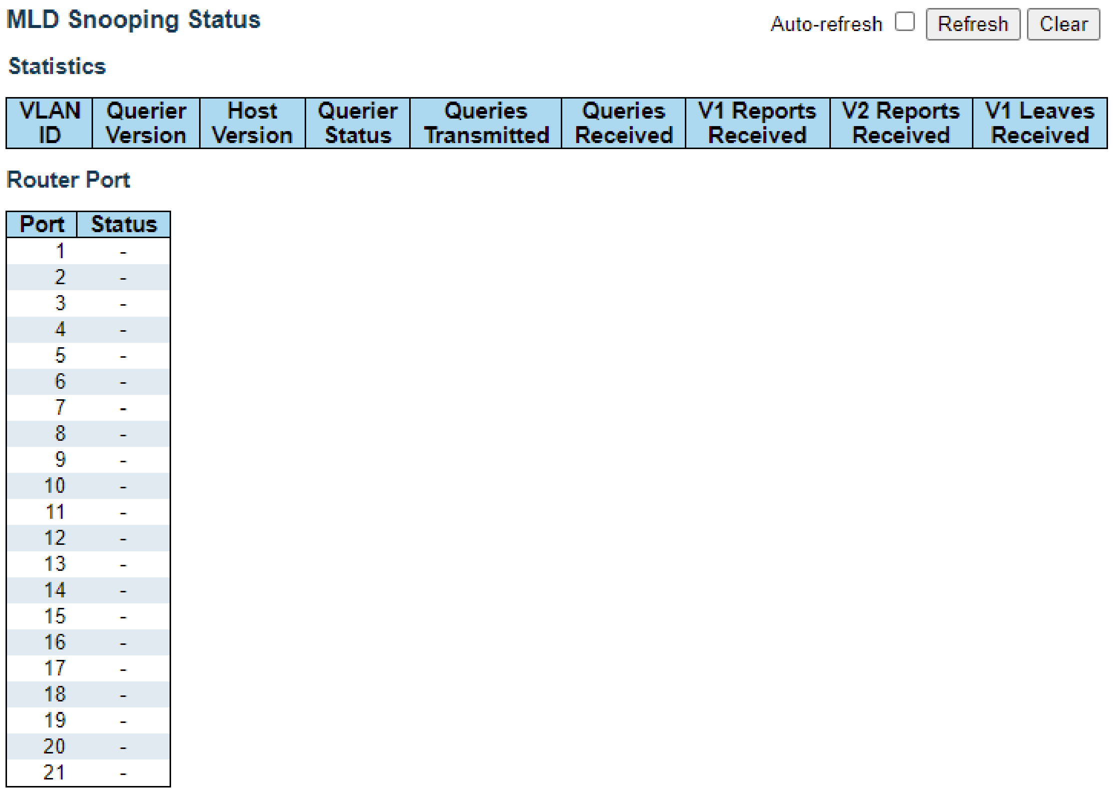
Table 4-143: MLD Snooping Port Group Filtering Configuration Parameters

Port	The logical port for the settings.
Filtering Profile	Select the IPMC Profile as the filtering condition for the specific port. Summary about the designated profile will be shown by clicking the view button.
Profile Management Button	You can inspect the rules of the designated profile by using the following button: 👁: List the rules associated with the designated profile.

4.16.9 MLD Snooping Status

This section provides MLD Snooping status.

Web GUI: Configuration > IPMC > MLD Snooping > VLAN Configuration



VLAN ID	Querier Version	Host Version	Querier Status	Queries Transmitted	Queries Received	V1 Reports Received	V2 Reports Received	V1 Leaves Received

Router Port

Port	Status
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-
16	-
17	-
18	-
19	-
20	-
21	-

Figure 4-150: MLD Snooping Port Group Filtering Configuration

Table 4-144 MLD Snooping Status Parameters

Statistics	
VLAN ID	The VLAN ID of the entry.
Querier Version	Working Querier Version.
Host Version	Working Host Version.
Querier Status	Shows the Querier status is **ACTIVE** or **IDLE**. **DISABLE** denotes the specific interface is administratively disabled.
Querier Transmitted	The number of Transmitted Queries.
Querier Received	The number of Received Queries.
V1 Reports Received	The number of Received V1 Reports.
V2 Reports Received	The number of Received V2 Reports.
V1 Leaves Receive	The number of Received V1 Reports.
Router Port	
Display which ports act as router ports. A router port is a port on the Ethernet switch that leads towards the Layer 3 multicast device or MLD querier. Static denotes the specific port is configured to be a router port. Dynamic denotes the specific port is learnt to be a router port. Both denote the specific port is configured or learnt to be a router port.	
Port	Switch port number.

Status	Indicate whether specific port is a router port or not.

4.16.10 MLD Snooping Groups Information

Entries in the MLD Group Table are shown on this section

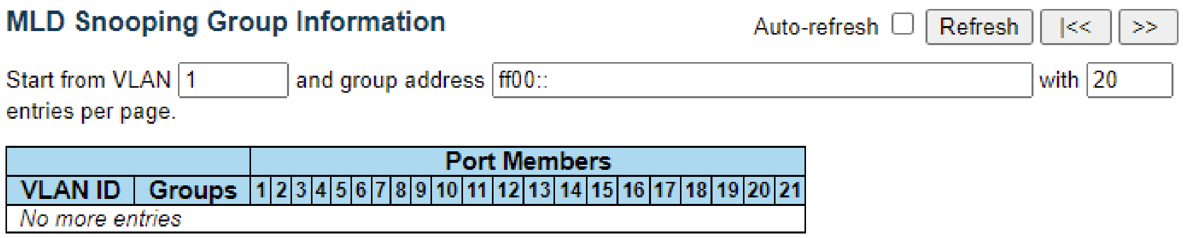
Navigating the MLD Group Table.

Each page shows up to 99 entries from the MLD Group table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the MLD Group Table.

The "Start from VLAN", and "group" input fields allow the user to select the starting point in the MLD Group Table. Clicking the Refresh button will update the displayed table starting from that or the closest next MLD Group Table match. In addition, the two input fields will – upon a Refresh button click – assume the value of the first displayed entry, allowing for continuous refresh with the same start address

The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

Web GUI: Configuration > IPMC > MLD Snooping > Group Information



Start from VLAN 1 and group address ff00:: with 20 entries per page.

		Port Members																				
VLAN ID	Groups	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No more entries																						

Figure 4-151: MLD Snooping Groups Information.

Table 4-145: MLD Snooping Groups Information Parameters

VLAN ID	VLAN ID of the group.
Groups	Group address of the group displayed.
Port Members	Ports under this group.

4.16.11 MLD SFM Information

Entries in the MLD SFM Information Table are shown on this page. The MLD SFM (Source-Filtered Multicast) Information Table also contains the SSM (Source-Specific Multicast) information. This table is sorted first by VLAN ID, then by group, and then by Port. Different source addresses belong to the same group are treated as single entry.

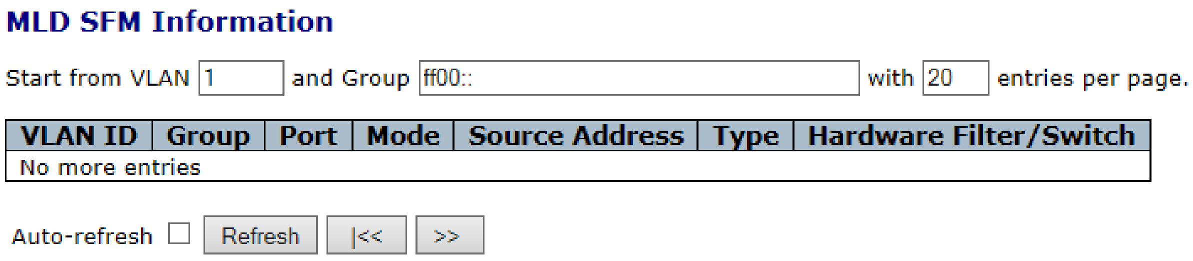
Navigating the MLD SFM Information Table

Each page shows up to 99 entries from the MLD SFM Information table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the MLD SFM Information Table.

The "Start from VLAN", and "group" input fields allow the user to select the starting point in the MLD SFM Information Table. Clicking the Refresh button will update the displayed table starting from that or the closest next MLD SFM Information Table match. In addition, the two input fields will - upon a Refresh button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

Web GUI: Configuration > IPMC > MLD Snooping > IPv6 SFM Information



MLD SFM Information

Start from VLAN 1 and Group ff00:: with 20 entries per page.

VLAN ID	Group	Port	Mode	Source Address	Type	Hardware Filter/Switch
No more entries						

Figure 4-152: MLD SFM Information

Table 4-146: MLD SFM Information Parameters

VLAN ID	VLAN ID of the group.
Group	Group address of the group displayed.
Port	Switch port number.
Mode	Indicates the filtering mode maintained per (VLAN ID, port number, Group Address) basis. It can be either Include or Exclude
Source Address	IP Address of the source. Currently, system limits the total number of IPv6 source addresses for filtering (per group) is 8.
Type	Indicates the Type. It can be either Allow or Deny.
Hardware Filter/Switch	Indicates whether data plane destined to the specific group address from the source IPv6 address could be handled by chip or not.

4.17 Link Aggregation

LACP is an IEEE 802.3ad standard protocol. The Link Aggregation Control Protocol, allows bundling several physical ports together to form a single logical port.

Link aggregation bundles multiple ports (member ports) together into a single logical link. It is primarily used to increase available bandwidth without introducing loops in the network and to improve resiliency against faults. A link aggregation group (LAG) can be established with individual links being added or removed. This enables bandwidth to be incrementally scaled based on changing requirements. A link aggregation group can be quickly reconfigured if faults are identified.

Link aggregation (or IEEE 802.3ad) uses multiple Ethernet network links/ports in parallel to increase the link speed beyond the limits of any one single port, and to increase the redundancy for higher availability.

Two switches directly connected over several links can negotiate as to which ports should be selected as active members of an aggregation group.

A group of ports is selected to belong to a specific group ID (trunk) in order to generate an aggregated link.

Typically, the ports used in an aggregated link should be of the same type.

Link aggregation configuration is performed in two variants.

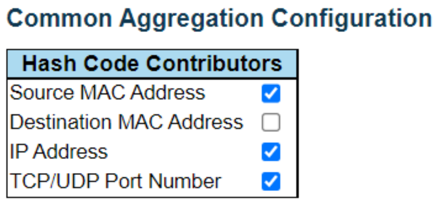
- Static – This mode is used to manually select the ports of the group.
- Link Aggregation Control Protocol (LACP) – In this mode two switches which are directly connected over several physical links, can negotiate which ports should be selected as active members of a group.

LACP works by sending frames (LACPDUs) down all links which have the protocol enabled. If it finds a device on the other end of the link which has also the LACP enabled, it will also independently send frames along the same links enabling the two devices to detect multiple links between themselves and the combine them into a single logical link.

4.17.1 Common Aggregation Configuration

The aggregation hash code contributor settings are global (hashes are calculated when the first connection is established and then kept in the device memory for the session lifetime).

Web GUI: Configuration > Aggregation > Common



Common Aggregation Configuration

Hash Code Contributors	
Source MAC Address	☑
Destination MAC Address	☐
IP Address	☑
TCP/UDP Port Number	☑

Figure 4-153: Common Aggregation Configuration

Table 4-147: Common Aggregation Configuration Parameters

Aggregation Mode Configuration	
Hash Code Contributors	
Source MAC Address	The Source MAC ADDRESS can be used to calculate the destination port for the frame. Check to enable the use of the Source MAC address or uncheck to disable. By default, source MAC Address is "Enabled".
Destination MAC Address	Used to calculate the destination port for the frame. Check to enable the use of the Destination MAC Address or uncheck to disable. By default, destination MAC Address is "Disabled".
IP Address	The IP Address can be used to calculate the destination port for the frame. Check to enable the use of the IP Address or uncheck to disable. By default, IP Address is "Enabled".

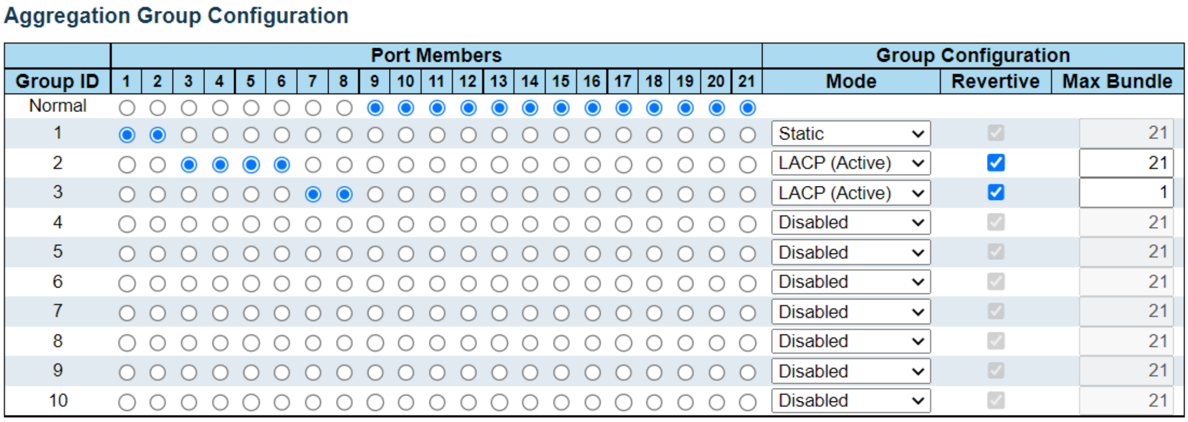
TCP/UDP Port Number	The TCP/UDP port number can be used to calculate the destination port for the frame. Check to enable the use of the port number or uncheck to disable. By default, the port number is “Enabled”.

4.17.2 Aggregation Group and Mode Configuration

R Class series allows set up of the Aggregation Mode Configuration and the Aggregation Group.

This section is used to configure the Aggregation hash mode and the aggregation group.

Web GUI: Configuration > Aggregation > Groups



Aggregation Group Configuration

	Port Members																					Group Configuration		
Group ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mode	Revertive	Max Bundle
Normal	○	○	○	○	○	○	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●			
1	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Static	☑	21
2	○	○	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	LACP (Active)	☑	21
3	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	LACP (Active)	☑	1
4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
9	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21
10	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disabled	☑	21

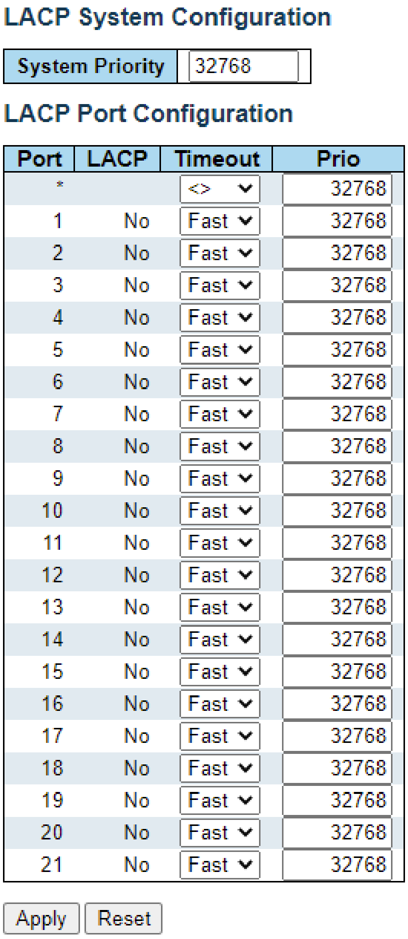
Figure 4-154: Aggregation Group and Mode Configuration

Aggregation Group Configuration	
Group ID	Indicates the group ID for the settings contained in the same row. Group ID "Normal" indicates there is no aggregation. Only one group ID is valid per port.
Port Members	Each switch port is listed for each group ID. Select a radio button to include a port in an aggregation or clear the radio button to remove the port from the aggregation. By default, no ports belong to any aggregation group. Only full duplex ports can join an aggregation and ports must be in the same speed in each group.
Mode	This parameter determines the mode for the aggregation group. • **Disabled**: The group is disabled. • **Static**: The group operates in static aggregation mode. • **LACP** (**Active**): The group operates in LACP active aggregation mode. See IEEE 801.AX-2014, section 6.4.1 for details. • **LACP** (**Passive**): The group operates in LACP passive aggregation mode. See IEEE 801.AX-2014, section 6.4.1 for details.

Revertive	This parameter only applies to LACP-enabled groups. It determines if the group will perform automatic link (re-)calculation when links with higher priority becomes available.
Max Bundle	This parameter only applies to LACP-enabled groups. It determines the maximum number of active bundled LACP ports allowed in an aggregation.

4.17.3 LACP Configuration

Web GUI: Configuration > Aggregation > LACP



LACP System Configuration

System Priority: 32768

LACP Port Configuration

Port	LACP	Timeout	Prio
*		<>	32768
1	No	Fast	32768
2	No	Fast	32768
3	No	Fast	32768
4	No	Fast	32768
5	No	Fast	32768
6	No	Fast	32768
7	No	Fast	32768
8	No	Fast	32768
9	No	Fast	32768
10	No	Fast	32768
11	No	Fast	32768
12	No	Fast	32768
13	No	Fast	32768
14	No	Fast	32768
15	No	Fast	32768
16	No	Fast	32768
17	No	Fast	32768
18	No	Fast	32768
19	No	Fast	32768
20	No	Fast	32768
21	No	Fast	32768

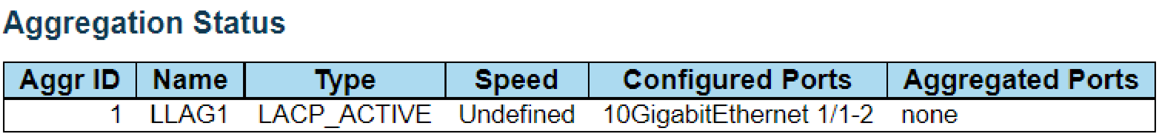
Figure 4-155: LACP Configuration

Table 4-148: LACP Port Parameters

Port	The switch port number.
LACP	Show whether LACP is currently enabled on this switch port.
Timeout	The **Timeout** controls the period between BPDU transmissions. **Fast** will transmit LACP packets each second, while **Slow** will wait for 30 seconds before sending a LACP packet.
Prio	The **Prio** controls the priority of the port, range 1-65535. If the LACP partner wants to form a larger group than is supported by this device, then this parameter will control which ports will be active and which ports will be in a backup role. Lower number means greater priority.

4.17.4 Aggregation Status

Web GUI: Monitor > Aggregation > Status



Aggregation Status

Aggr ID	Name	Type	Speed	Configured Ports	Aggregated Ports
1	LLAG1	LACP_ACTIVE	Undefined	10GigabitEthernet 1/1-2	none

Figure 4-156: Aggregation Status

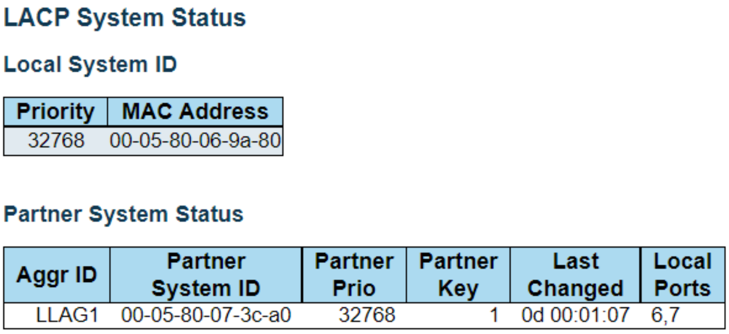
Table 4-149: Aggregation Status Parameters

Aggregation Status	
Aggr ID	The Aggregation ID associated with this aggregation instance.
Name	Name of the Aggregation group ID.
Type	Type of the Aggregation group (Static or LACP).
Speed	Speed of the Aggregation group.
Configured ports	Configured member ports of the Aggregation group.
Aggregated ports	Aggregated member ports of the Aggregation group.

4.17.5 LACP Monitoring

4.17.5.1 System Status

Web GUI: Monitor > Aggregation > LACP > System Status



LACP System Status

Local System ID

Priority	MAC Address
32768	00-05-80-06-9a-80

Partner System Status

Aggr ID	Partner System ID	Partner Prio	Partner Key	Last Changed	Local Ports
LLAG1	00-05-80-07-3c-a0	32768	1	0d 00:01:07	6,7

Figure 4-157: LACP System Status

Table 4-150: LACP System ID

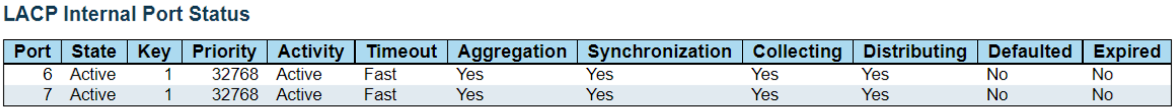
Local System ID
This table display both the local system priority and the local system MAC address which forms the local LACP System ID.

Table 4-151: Partner System Status Parameters

Partner System Status	
This table display the partner system information for each LACP aggregation group.	
Aggr ID	The Aggregation ID associated with this aggregation instance.
Partner System ID	The system ID (MAC address) of the aggregation partner.
Partner Prio	The priority that the partner has assigned to this aggregation ID.
Partner Key	The Key that the partner has assigned to this aggregation ID.
Last changed	The time since this aggregation changed.
Local Ports	Shows which ports are a part of this aggregation for this switch.

4.17.5.2 Internal Status

Web GUI: Monitor > Aggregation > LACP > Internal Status



LACP Internal Port Status

Port	State	Key	Priority	Activity	Timeout	Aggregation	Synchronization	Collecting	Distributing	Defaulted	Expired
6	Active	1	32768	Active	Fast	Yes	Yes	Yes	Yes	No	No
7	Active	1	32768	Active	Fast	Yes	Yes	Yes	Yes	No	No

Figure 4-158: LACP Internal Status

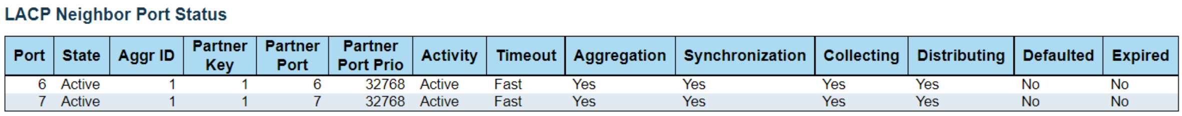
Table 4-152: LACP Internal Status Parameters

Internal Status	
This page provides a status overview for the LACP internal (i.e. local system) status for all ports. Only ports that are part of an LACP group are shown. For details on the shown parameters please refer to IEEE 801.AX-2014.	
Port	The switch port number.
State	The current port state: • Down: The port is not active. • Active: The port is in active state. • Standby: The port is in standby state.
Key	The key assigned to this port. Only ports with the same key can aggregate together.
Priority	The priority assigned to this aggregation group.
Activity	The LACP mode of the group (Active or Passive).
Timeout	The timeout mode configured for the port (Fast or Slow).
Aggregation	Show whether the system considers this link to be "aggregateable"; i.e., a potential candidate for aggregation.

Synchronization	Show whether the system considers this link to be "IN_SYNC"; i.e., it has been allocated to the correct LAG, the group has been associated with a compatible Aggregator, and the identity of the LAG is consistent with the System ID and operational Key information transmitted.
Collecting	Show if collection of incoming frames on this link is enabled.
Distributing	Show if distribution of outgoing frames on this link is enabled.
Defaulted	Show if the Actor's Receive machine is using Defaulted operational Partner information.
Expired	Show if that the Actor's Receive machine is in the EXPIRED state.

4.17.5.3 Neighbor Status

Web GUI: Monitor > Aggregation > LACP > Neighbor Status



LACP Neighbor Port Status

Port	State	Aggr ID	Partner Key	Partner Port	Partner Port Prio	Activity	Timeout	Aggregation	Synchronization	Collecting	Distributing	Defaulted	Expired
6	Active	1	1	6	32768	Active	Fast	Yes	Yes	Yes	Yes	No	No
7	Active	1	1	7	32768	Active	Fast	Yes	Yes	Yes	Yes	No	No

Figure 4-159: LACP Neighbor Status

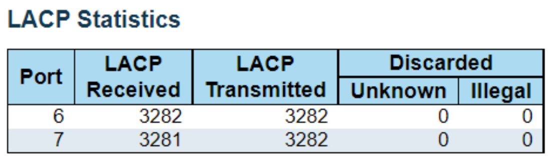
Table 4-153: LACP Neighbor Status Parameters

Neighbor Status	
This page provides a status overview for the LACP neighbor status for all ports. Only ports that are part of an LACP group are shown. For details on the shown parameters please refer to IEEE 801.AX-2014.	
Port	The switch port number.
State	The current port state: • Down: The port is not active. • Active: The port is in active state. • Standby: The port is in standby state.
Aggr ID	The aggregation group ID which the port is assigned to.
Partner Key	The key assigned to this port by the partner.
Partner Port	The partner port number associated with this link.
Partner Port Priority	The priority assigned to this partner port .
Activity	The LACP mode of the group (Active or Passive).
Timeout	The timeout mode configured for the port (Fast or Slow).
Aggregation	Show whether the system considers this link to be "aggregateable"; i.e., a potential candidate for aggregation.

Synchronization	Show whether the system considers this link to be "IN_SYNC"; i.e., it has been allocated to the correct LAG, the group has been associated with a compatible Aggregator, and the identity of the LAG is consistent with the System ID and operational Key information transmitted.
Collecting	Show if collection of incoming frames on this link is enabled.
Distributing	Show if distribution of outgoing frames on this link is enabled.
Defaulted	Show if the Actor's Receive machine is using Defaulted operational Partner information.
Expired	Show if that the Actor's Receive machine is in the EXPIRED state.

4.17.5.4 Port Statistics

Web GUI: Monitor > Aggregation > LACP > Neighbor Status



LACP Statistics

Port	LACP Received	LACP Transmitted	Discarded	
			Unknown	Illegal
6	3282	3282	0	0
7	3281	3282	0	0

Figure 4-160: LACP Neighbor Status

Table 4-154: LACP Neighbor Status Parameters

Neighbor Status	
This page provides an overview for LACP statistics for all ports.	
Port	The switch port number.
LACP Received	Shows how many LACP frames have been received at each port.
LACP Transmitted	Shows how many LACP frames have been sent from each port.
Discarded	Shows how many unknown or illegal LACP frames have been discarded at each port.

4.18 LLDP-Link Discovery

LLDP is an IEEE 802.1ab standard protocol. The **L**ink **L**ayer **D**iscovery **P**rotocol is used for network discovery and works by having the units in the network exchanging information with their neighbors using LLDP frames.

Link discovery specifies a method and associated procedures that automatically discover transmission links and paths between network devices.

Unlike more traditional centralized polling techniques rooted in a management plane, autonomous link discovery procedures are rooted in and triggered by network elements composing the transport plane. As such, autonomous link discovery procedures may be event driven and executed in a coordinated, distributed fashion to automatically detect new link connectivity associations and correlate link endpoint attributes between these network elements.

Once successful link correlations have been determined, autonomous notifications of these correlated link associations are sent to management elements and/or control elements residing in their respective management and control plane domains.

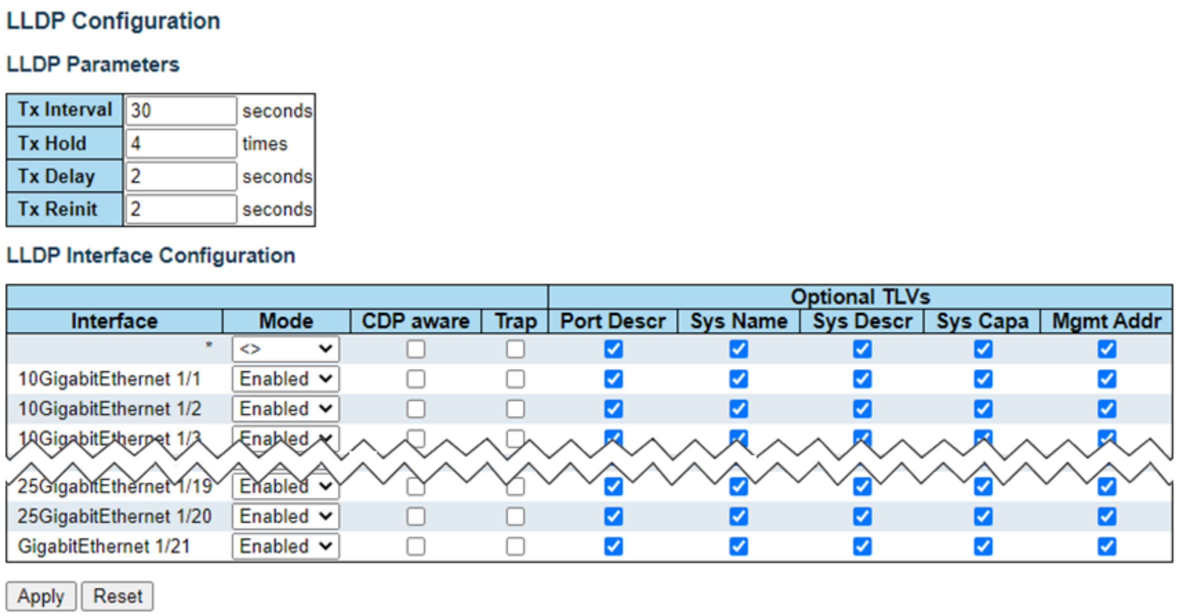
Link Layer Discovery Protocol (LLDP) is a media independent protocol allowing the LLDP agent to learn higher-level management reachability and connection and point information from neighboring devices. Each configured device is an active LLDP agent that sends periodic messages to all physical interfaces that listen for LLDP messages.

LLDP monitoring is implemented by collecting both LLDP neighbor information and LLDP statistics.

4.18.1 LLDP Configuration

This section allows the user to inspect and configure the current LLDP port settings.

Web GUI: Configuration > LLDP > LLDP



LLDP Configuration

LLDP Parameters

Tx Interval	30	seconds
Tx Hold	4	times
Tx Delay	2	seconds
Tx Reinit	2	seconds

LLDP Interface Configuration

				Optional TLVs				
Interface	Mode	CDP aware	Trap	Port Descr	Sys Name	Sys Descr	Sys Capa	Mgmt Addr
*	<>	☐	☐	☑	☑	☑	☑	☑
10GigabitEthernet 1/1	Enabled	☐	☐	☑	☑	☑	☑	☑
10GigabitEthernet 1/2	Enabled	☐	☐	☑	☑	☑	☑	☑
10GigabitEthernet 1/3	Enabled	☐	☐	☑	☑	☑	☑	☑
25GigabitEthernet 1/19	Enabled	☐	☐	☑	☑	☑	☑	☑
25GigabitEthernet 1/20	Enabled	☐	☐	☑	☑	☑	☑	☑
GigabitEthernet 1/21	Enabled	☐	☐	☑	☑	☑	☑	☑

Figure 4-161: LLDP Configuration

Table 4-155: LLDP Configuration Parameters

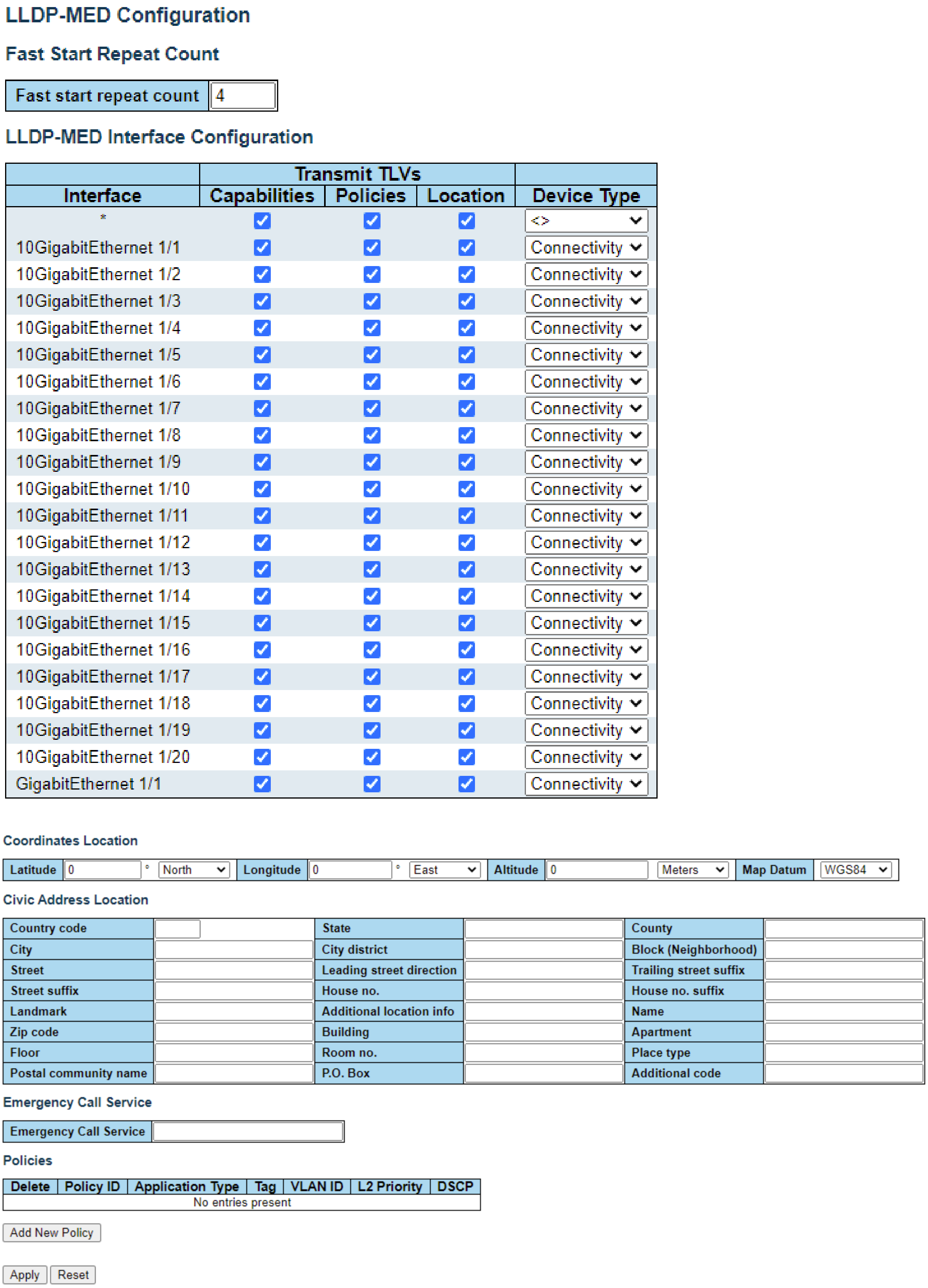
LLDP Parameters	
Tx Interval	The switch is periodically transmitting LLDP frames to its neighbors for having the network discovery information up to date. The interval between each LLDP frame is determined by the Tx Interval value. Valid values are restricted to 5 - 32768 seconds.
Tx Hold	Each LLDP frame contains information about the length of time the information in the LLDP frame shall be considered valid. The LLDP information valid period is set to **Tx Hold** multiplied by **Tx Interval** seconds. Valid values are restricted to 2 - 10 times.
Tx Delay	If some configuration is changed (e.g., the IP address) a new LLDP frame is transmitted, but the time between the LLDP frames will always be at least the value of **Tx Delay** in seconds. Tx Delay cannot be larger than a 1/4 of the **Tx Interval** value. Valid values are restricted to 1 - 8192 seconds.
Tx Reinit	When a port is disabled, LLDP is disabled or if the switch is rebooted, a LLDP shutdown frame is transmitted to the neighbor units for signaling that the LLDP information is not valid anymore. **Tx Reinit** controls the number of seconds between the shutdown frame and a new LLDP initialization. Valid values are restricted to 1 – 10 seconds.
LLDP Interface Configuration	
Interface	The switch interface name of the logical LLDP interface.
Mode	Select the LLDP mode. • **Rx only**: The switch will not send out LLDP information, but LLDP information from neighbor units is analyzed. • **Tx only**: The switch will drop LLDP information received from neighbors but will send out LLDP information. • **Disabled**: The switch will not send out LLDP information and will drop LLDP information received from neighbors. • **Enabled**: The switch will send out LLDP information and will analyze LLDP information received from neighbors.
CDP Aware	Select CDP awareness. The CDP operation is restricted to decoding incoming CDP frames (The switch does not transmit CDP frames). CDP frames are only decoded if LLDP for the port is enabled. Only CDP TLVs that can be mapped into a corresponding field in the LLDP neighbors table are decoded. All other TLVs are discarded (Unrecognized CDP TLVs and discarded CDP frame are not shown in the LLDP statistic). CDP TLVs are mapped into LLDP neighbors table as shown below. CDP TLV "Device ID" is mapped into the LLDP "Chassis ID" field. CDP TLV "Address" is mapped into the LLDP "Management Address" field. The CDP address TLV can contain multiple addresses, but only the first address is shown in the LLDP neighbors table.

	CDP TLV "Port ID" is mapped into the LLDP "Port ID" field. CDP TLV "Version and Platform" is mapped into the LLDP "System Description" field. Both the CDP and LLDP supports "system capabilities", but the CDP capabilities cover capabilities that are not part of the LLDP. These capabilities are shown as "others" in the LLDP neighbors table. If all ports have CDP awareness disabled, the switch forwards CDP frames received from neighbor devices. If at least one port has CDP awareness enabled all CDP frames are terminated by the switch. *Notes:* *When CDP awareness for a port is disabled the CDP information isn't removed immediately but will be removed when the hold time is exceeded. CDP is an acronym for Cisco Discovery Protocol.*
Optional TLVs	
TLV is an acronym for Type Length Value. A LLDP frame can contain multiple pieces of information. Each of these pieces of information is known as TLV.	
Port Descr	Optional TLV: When checked the "port description" is included in LLDP information transmitted.
Sys Name	Optional TLV: When checked the "system name" is included in LLDP information transmitted.
Sys Descr	Optional TLV: When checked the "system description" is included in LLDP information transmitted.
Sys Capa	Optional TLV: When checked the "system capability" is included in LLDP information transmitted.
Mgmt Addr	Optional TLV: When checked the "management address" is included in LLDP information transmitted.

4.18.2 LLDP Media Configuration

This section allows you to configure the LLDP-MED. This function applies to VoIP devices which support LLDP-MED.

Web GUI: Configuration > LLDP > LLDP-MED



LLDP-MED Configuration

Fast Start Repeat Count

Fast start repeat count	4

LLDP-MED Interface Configuration

	Transmit TLVs			
Interface	Capabilities	Policies	Location	Device Type
*	☑	☑	☑	<>
10GigabitEthernet 1/1	☑	☑	☑	Connectivity
10GigabitEthernet 1/2	☑	☑	☑	Connectivity
10GigabitEthernet 1/3	☑	☑	☑	Connectivity
10GigabitEthernet 1/4	☑	☑	☑	Connectivity
10GigabitEthernet 1/5	☑	☑	☑	Connectivity
10GigabitEthernet 1/6	☑	☑	☑	Connectivity
10GigabitEthernet 1/7	☑	☑	☑	Connectivity
10GigabitEthernet 1/8	☑	☑	☑	Connectivity
10GigabitEthernet 1/9	☑	☑	☑	Connectivity
10GigabitEthernet 1/10	☑	☑	☑	Connectivity
10GigabitEthernet 1/11	☑	☑	☑	Connectivity
10GigabitEthernet 1/12	☑	☑	☑	Connectivity
10GigabitEthernet 1/13	☑	☑	☑	Connectivity
10GigabitEthernet 1/14	☑	☑	☑	Connectivity
10GigabitEthernet 1/15	☑	☑	☑	Connectivity
10GigabitEthernet 1/16	☑	☑	☑	Connectivity
10GigabitEthernet 1/17	☑	☑	☑	Connectivity
10GigabitEthernet 1/18	☑	☑	☑	Connectivity
10GigabitEthernet 1/19	☑	☑	☑	Connectivity
10GigabitEthernet 1/20	☑	☑	☑	Connectivity
GigabitEthernet 1/1	☑	☑	☑	Connectivity

Coordinates Location

Latitude	0 °	North	Longitude	0 °	East	Altitude	0	Meters	Map Datum	WGS84

Civic Address Location

Country code		State		County	
City		City district		Block (Neighborhood)	
Street		Leading street direction		Trailing street suffix	
Street suffix		House no.		House no. suffix	
Landmark		Additional location info		Name	
Zip code		Building		Apartment	
Floor		Room no.		Place type	
Postal community name		P.O. Box		Additional code	

Emergency Call Service

Emergency Call Service	

Policies

Delete	Policy ID	Application Type	Tag	VLAN ID	L2 Priority	DSCP
No entries present						

Figure 4-162: LLDP-MED Configuration displays

Table 4-156: LLDP MED Configuration Parameters

Fast start repeat count	
Fast start repeat count	Rapid startup and Emergency Call Service Location Identification Discovery of endpoints is a critically important aspect of VoIP systems in general. It is best to advertise only those pieces of information which are specifically relevant to particular endpoint types (for example only advertise the voice network policy to permitted voice-capable devices), both in order to conserve the limited LLDPU space and to reduce security and system integrity issues that can come with inappropriate knowledge of the network policy. With this in mind LLDP-MED defines an LLDP-MED Fast Start interaction between the protocol and the application layers on top of the protocol, in order to achieve these related properties. Initially, a Network Connectivity Device will only transmit LLDP TLVs in an LLDPDU. Only after an LLDP-MED Endpoint Device is detected, will an LLDP-MED capable Network Connectivity Device start to advertise LLDP-MED TLVs in outgoing LLDPDUs on the associated port. The LLDP-MED application will temporarily speed up the transmission of the LLDPDU to start within a second, when a new LLDP-MED neighbor has been detected in order share LLDP-MED information as fast as possible to new neighbors. Because there is a risk of an LLDP frame being lost during transmission between neighbors', it is recommended to repeat the fast start transmission multiple times to increase the possibility of the neighbors' receiving the LLDP frame. With **Fast start repeat count** it is possible to specify the number of times the fast start transmission would be repeated. The recommended value is 4 times, given that 4 LLDP frames with a 1 second interval will be transmitted, when an LLDP frame with new information is received. It should be noted that LLDP-MED and the LLDP-MED Fast Start mechanism is only intended to run on links between LLDP-MED Network Connectivity Devices and Endpoint Devices, and as such does not apply to links between LAN infrastructure elements, including Network Connectivity Devices, or other types of links.
LLDP Interface Configuration	
It is possible to select which LLDP-MED information that shall be transmitted to the neighbors. When the checkbox is checked the information is included in the frame transmitted to the neighbor.	
Interface	The port name to which the configuration applies.
Capabilities	When checked the switch's capabilities is included in LLDP-MED information transmitted.
Policies	When checked the configured policies for the interface is included in LLDP-MED information transmitted
Location	When checked the configured location information for the switch is included in LLDP-MED information transmitted

Device Type	Any LLDP-MED Device is operating as a specific type of LLDP-MED Device, which may be either a Network Connectivity Device or a specific Class of Endpoint Device, as defined below. A Network Connectivity Device is a LLDP-MED Device that provides access to the IEEE 802 based LAN infrastructure for LLDP-MED Endpoint Devices An LLDP-MED Network Connectivity Device is a LAN access device based on any of the following technologies: 1. LAN Switch/Router. 2. IEEE 802.1 Bridge. 3. IEEE 802.3 Repeater (included for historical reasons). 4. IEEE 802.11 Wireless Access Point. 5. Any device that supports the IEEE 802.1AB and MED extensions that can relay IEEE 802 frames via any method. An Endpoint Device a LLDP-MED Device that sits at the network edge and provides some aspect of IP communications service, based on IEEE 802 LAN technology. The main difference between a Network Connectivity Device and an Endpoint Device is that only an Endpoint Device can start the LLDP-MED information exchange. Even though a switch always should be a Network Connectivity Device, it is possible to configure it to act as an Endpoint Device, and thereby start the LLDP-MED information exchange (In the case where two Network Connectivity Devices are connected).
Coordinates Location	
Latitude	**Latitude** SHOULD be normalized to within 0-90 degrees with a maximum of 4 digits. It is possible to specify the direction to either **North** of the equator or **South** of the equator.
Longitude	**Longitude** SHOULD be normalized to within 0-180 degrees with a maximum of 4 digits. It is possible to specify the direction to either **East** of the prime meridian or **West** of the prime meridian.
Altitude	**Altitude** SHOULD be normalized to within -2097151.9 to 2097151.9 with a maximum of 1 digit. It is possible to select between two altitude types (floors or meters). **Meters**: Representing meters of Altitude defined by the vertical datum specified. **Floors**: Representing altitude in a form more relevant in buildings which have different floor-to-floor dimensions. An altitude = 0.0 is meaningful even outside a building and represents ground level at the given latitude and longitude. Inside a building, 0.0 represents the floor level associated with ground level at the main entrance.
Map Datum	The **Map Datum** is used for the coordinates given in these options:

	WGS84: (Geographical 3D) - World Geodesic System 1984, CRS Code 4327, Prime Meridian Name: Greenwich. **NAD83/NAVD88**: North American Datum 1983, CRS Code 4269, Prime Meridian Name: Greenwich; The associated vertical datum is the North American Vertical Datum of 1988 (NAVD88). This datum pair is to be used when referencing locations on land, not near tidal water (which would use Datum = NAD83/MLLW). **NAD83/MLLW**: North American Datum 1983, CRS Code 4269, Prime Meridian Name: Greenwich; The associated vertical datum is Mean Lower Low Water (MLLW). This datum pair is to be used when referencing locations on water/sea/ocean.
Civic Address Location	
IETF Geopriv Civic Address based Location Configuration Information (Civic Address LCI). The total number of characters for the combined civic address information must not exceed 250 characters. A couple of notes to the limitation of 250 characters. 1) A non-empty civic address location will use 2 extra characters in addition to the civic address location text. 2) The 2-letter country code is not part of the 250 characters limitation.	
Country code	The two-letter ISO 3166 country code in capital ASCII letters - Example: DK, DE or US.
State	National subdivisions (state, canton, region, province, prefecture.
County	County, parish, gun (Japan), district.
City	City, township, shi (Japan) - Example: Copenhagen.
City District	City division, borough, city district, ward, chou (Japan).
Block (Neighborhood)	Neighborhood, block.
Street	Street - Example: Poppelvej.
Leading street direction	Leading street direction - Example: N.
Trailing street suffix	Trailing street suffix - Example: SW.
Street suffix	Street suffix - Example: Ave, Platz.
House no.	House number - Example: 21.
House no. suffix	House number suffix - Example: A, 1/2.
Landmark	Landmark or vanity address - Example: Columbia University.
Additional location info	Additional location info - Example: South Wing.
Name	Name (residence and office occupant) - Example: Flemming Jahn.
Zip code	Postal/zip code - Example: 2791.

Building	Building (structure) - Example: Low Library.
Apartment	Unit (Apartment, suite) - Example: Apt 42.
Floor	Floor - Example: 4
Room no.	Room number - Example: 450F.
Place type	Place type - Example: Office.
Postal community name	Postal community name - Example: Leonia.
P.O. Box	Post office box (P.O. BOX) - Example: 12345.
Additional code	Additional code - Example: 1320300003.

Emergency Call Service

Emergency Call Service ELIN identifier data format is defined to carry the ELIN identifier as used during emergency call setup to a traditional CAMA or ISDN trunk-based PSAP. This format consists of a numerical digit string, corresponding to the ELIN to be used for emergency calling.

Policies

Network Policy Discovery enables the efficient discovery and diagnosis of mismatch issues with the VLAN configuration, along with the associated Layer 2 and Layer 3 attributes, which apply for a set of specific protocol applications on that port. Improper network policy configurations are a significant issue in VoIP environments that frequently result in voice quality degradation or loss of service.

Policies are only intended for use with applications that have specific 'real-time' network policy requirements, such as interactive voice and/or video services. The network policy attributes advertised are:

1. Layer 2 VLAN ID (IEEE 802.1Q-2003.

2. Layer 2 priority value (IEEE 802.1D-2004.

3. Layer 3 Differentiated Services Code Point. (DSCP) value (IETF RFC 2474).

This network policy is potentially advertised and associated with multiple sets of application types supported on a given port. The application types specifically addressed are:

- Voice
- Guest Voice
- Softphone Voice
- Video Conferencing
- Streaming Video
- 6. Control / Signaling (conditionally support a separate network policy for the media types above)

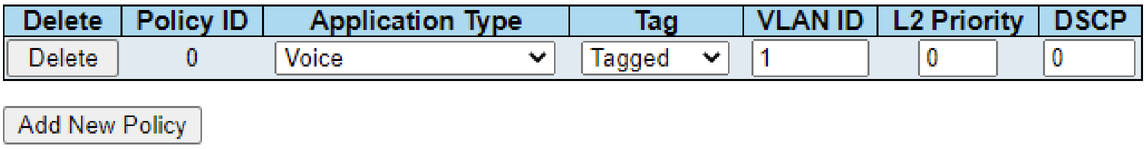
A large network may support multiple VoIP policies across the entire organization, and different policies per application type. LLDP-MED allows multiple policies to be advertised per port, each corresponding to a different application type. Different ports on the same Network Connectivity Device may advertise different sets of policies, based on the authenticated user identity or port configuration.

It should be noted that LLDP-MED is not intended to run on links other than between Network Connectivity Devices and Endpoints, and therefore does not need to advertise the multitude of network policies that frequently run on an aggregated link interior to the LAN.	
Delete	Check to delete the policy. It will be deleted during the next save.
Policy ID	ID for the policy. This is auto generated and shall be used when selecting the polices that shall be mapped to the specific interfaces
Application Type	Intended use of the application types: 1. **Voice** - for use by dedicated IP Telephony handsets and other similar appliances supporting interactive voice services. These devices are typically deployed on a separate VLAN for ease of deployment and enhanced security by isolation from data applications. 2. **Voice Signaling** (conditional) - for use in network topologies that require a different policy for the voice signaling than for the voice media. This application type should not be advertised if all the same network policies apply as those advertised in the **Voice** application policy. 3. **Guest Voice** - support a separate 'limited feature-set' voice service for guest users and visitors with their own IP Telephony handsets and other similar appliances supporting interactive voice services. 4. **Guest Voice Signaling** (conditional) - for use in network topologies that require a different policy for the guest voice signaling than for the guest voice media. This application type should not be advertised if all the same network policies apply as those advertised in the **Guest Voice** application policy. 5. **Softphone Voice** - for use by softphone applications on typical data centric devices, such as PCs or laptops. This class of endpoints frequently does not support multiple VLANs, if at all, and are typically configured to use an 'untagged' VLAN or a single 'tagged' data specific VLAN. When a network policy is defined for use with an 'untagged' VLAN (see Tagged flag below), then the L2 priority field is ignored and only the DSCP value has relevance. 6. **Video Conferencing** - for use by dedicated Video Conferencing equipment and other similar appliances supporting real-time interactive video/audio services. 7. **Streaming** Video - for use by broadcast or multicast-based video content distribution and other similar applications supporting streaming video services that require specific network policy treatment. Video applications relying on TCP with buffering would not be an intended use of this application type. 8. **Video Signaling** (conditional) - for use in network topologies that require a separate policy for the video signaling than for the video media. This application type should not be advertised if all the same network policies apply as those advertised in the **Video Conferencing** application policy.
Tag	**Tag** indicating whether the specified application type is using a 'tagged' or an 'untagged' VLAN. **Untagged** indicates that the device is using an untagged frame format and as such does not include a tag header as defined by IEEE 802.1Q-2003. In this case, both the VLAN ID and the Layer 2 priority fields are ignored and only the DSCP value has relevance.

	Tagged indicates that the device is using the IEEE 802.1Q tagged frame format, and that both the VLAN ID and the Layer 2 priority values are being used, as well as the DSCP value. The tagged format includes an additional field, known as the tag header. The tagged frame format also includes priority tagged frames as defined by IEEE 802.1Q-2003.
VLAN ID	VLAN identifier (VID) for the port as defined in IEEE 802.1Q-2003.
L2 Priority	**L2 Priority** is the Layer 2 priority to be used for the specified application type. **L2 Priority** may specify one of eight priority levels (0 through 7), as defined by IEEE 802.1D-2004. A value of 0 represents use of the default priority as defined in IEEE 802.1D-2004.
DSCP	**DSCP** value to be used to provide Diffserv node behavior for the specified application type as defined in IETF RFC 2474. **DSCP** may contain one of 64 code point values (0 through 63). A value of 0 represents use of the default DSCP value as defined in RFC 2475.
Adding a new policy	Click to **Add New Policy**. to add a new policy. Specify the **Application type**, **Tag**, **VLAN ID**, **L2 Priority** and **DSCP** for the new policy. Click "Save". The number of policies supported is 32.
Policies Interface Configuration	
Every port may advertise a unique set of network policies or different attributes for the same network policies, based on the authenticated user identity or port configuration.	
Interface	The interface number to which the configuration applies.
Policy Id	The set of policies that shall apply to a given port. The set of policies is selected by check marking the checkboxes that corresponds to the policies.

By clicking on “Add new policy” the following display is shown:

Web GUI: Configuration > LLDP > LLDP-MED | New Policy



Delete	Policy ID	Application Type	Tag	VLAN ID	L2 Priority	DSCP
Delete	0	Voice	Tagged	1	0	0

Figure 4-163: LLDP-MED Configuration displays

4.18.3 LLDP Monitoring

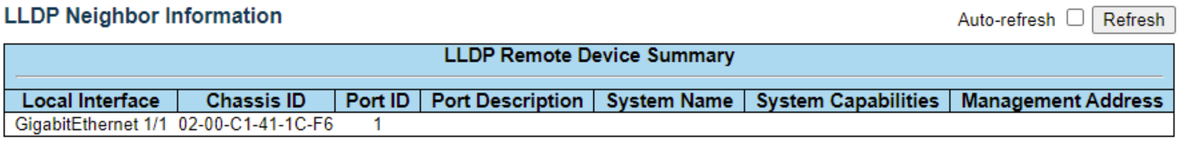
LLDP Monitoring is implemented by collecting:

- Neighbor
- LLDP-MED Neighbor
- EEE
- Port Statistics

4.18.3.1 Neighbors

This page provides a status overview for all LLDP neighbors. The displayed table contains a row for each interface on which an LLDP neighbor is detected. The columns hold the following information:

Web GUI: Monitor > LLDP > Neighbors



LLDP Neighbor Information

LLDP Remote Device Summary

Local Interface	Chassis ID	Port ID	Port Description	System Name	System Capabilities	Management Address
GigabitEthernet 1/1	02-00-C1-41-1C-F6	1				

Figure 4-164: LLDP – Neighbor Information

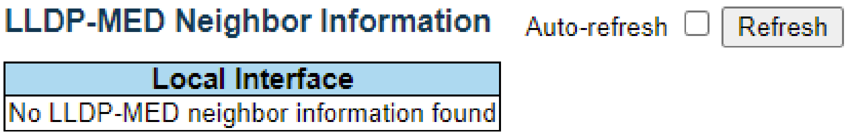
Table 4-157: LLDP Neighbor Information Parameters

Local Interface	The interface on which the LLDP frame was received.
Chassis ID	The **Chassis ID** is the identification of the neighbor's LLDP frames.
Remote Port ID	The **Remote Port ID** is the identification of the neighbor port.
Port Description	**Port description** is the port description advertised by the 228 neighbor unit.
System Name	**System name** is the name advertised by the neighbor unit.
System Capabilities	Describes the 228 neighbor unit's capabilities. The possible capabilities are: • Other • Repeater • Bridge • WLAN Access Point • Router • Telephone • DOCSIS cable device • Station only • Reserved When a capability is "Enabled" – the capability is followed by (+). When a capability is "Disabled" – the capability is followed by (-).
Management Address	The neighbor unit's address used for higher layer entities to assist the discovery by the network management. This could for instance hold the neighbor's IP address.

4.18.3.2 LLDP-MED Neighbour

This section provides a status overview of all LLDP-MED neighbours. The displayed table contains a row for each port on which an LLDP neighbor is detected. This function applies to VoIP devices which support LLDP-MED. The columns hold the following information:

Web GUI: Monitor > LLDP > LLDP-MED Neighbors



LLDP-MED Neighbor Information

Local Interface
No LLDP-MED neighbor information found

Figure 4-165: LLDP MED - Neighbour Information

Table 4-158: LLDP MED Neighbour Parameters

Interface	The port on which the LLDP frame was received.
Device Type	LLDP-MED Devices are comprised of two primary **Device Types**: Network Connectivity Devices and Endpoint Devices. **LLDP-MED Network Connectivity Device Definition** LLDP-MED Network Connectivity Devices, as defined in TIA-1057, provide access to the IEEE 802 based LAN infrastructure for LLDP-MED Endpoint Devices. An LLDP-MED Network Connectivity Device is a LAN access device based on any of the following technologies: • LAN Switch/Router • IEEE 802.1 Bridge • IEEE 802.3 Repeater (included for historical reasons) • IEEE 802.11 Wireless Access Point • Any device that supports the IEEE 802.1AB and MED extensions defined by TIA-1057 and can relay IEEE 802 frames via any method **LLDP-MED Endpoint Device Definition** LLDP-MED Endpoint Devices, as defined in TIA-1057, are located at the IEEE 802 LAN network edge, and participate in IP communication service using the LLDP-MED framework. Within the LLDP-MED Endpoint Device category, the LLDP-MED scheme is broken into further Endpoint Device Classes, as defined in the following. Each LLDP-MED Endpoint Device Class is defined to build upon the capabilities defined for the previous Endpoint Device Class. For-example will any LLDP-MED Endpoint Device claiming compliance as a Media Endpoint (Class II) also support all aspects of TIA-1057 applicable to Generic Endpoints (Class I), and any LLDP-MED Endpoint Device claiming compliance as a Communication Device (Class III) will also support all aspects of TIA-1057 applicable to both Media Endpoints (Class II) and Generic Endpoints (Class I). **LLDP-MED Generic Endpoint (Class I)** The LLDP-MED Generic Endpoint (Class I) definition is applicable to all endpoint products that require the base LLDP discovery services defined in TIA-1057, however do not support IP media or act as an end-user communication appliance. Such devices may include (but are not limited to) IP Communication Controllers, other communication related servers, or any device requiring basic services as defined in TIA-1057. Discovery services defined in this class include LAN configuration, device location, network policy, power management, and inventory management. **LLDP-MED Media Endpoint (Class II)** The LLDP-MED Media Endpoint (Class II) definition is applicable to all endpoint products that have IP media capabilities however may or may not be associated with a particular end user. Capabilities include all of the capabilities defined for the previous Generic Endpoint Class (Class I) and are extended to include aspects related to media streaming. Example product categories expected to

	adhere to this class include (but are not limited to) Voice / Media Gateways, Conference Bridges, Media Servers, and similar. Discovery services defined in this class include media-type-specific network layer policy discovery. **LLDP-MED Communication Endpoint (Class III)** The LLDP-MED Communication Endpoint (Class III) definition is applicable to all endpoint products that act as end user communication appliances supporting IP media. Capabilities include all of the capabilities defined for the previous Generic Endpoint (Class I) and Media Endpoint (Class II) classes and are extended to include aspects related to end user devices. Example product categories expected to adhere to this class include (but are not limited to) end user communication appliances, such as IP Phones, PC-based softphones, or other communication appliances that directly support the end user. Discovery services defined in this class include provision of location identifier (including ECS / E911 information), embedded L2 switch support, inventory management.
LLDP-MED Capabilities	**LLDP-MED Capabilities** describes the neighbor unit's LLDP-MED capabilities. The possible capabilities are: • LLDP-MED capabilities • Network Policy • Location Identification • Extended Power via MDI – PSE • Extended Power via MDI – PD • Inventory • Reserved
Application Type	**Application Type** indicating the primary function of the application(s) defined for this network policy, advertised by an Endpoint or Network Connectivity Device. The possible application types are shown below. • **Voice** - for use by dedicated IP Telephony handsets and other similar appliances supporting interactive voice services. These devices are typically deployed on a separate VLAN for ease of deployment and enhanced security by isolation from data applications. • **Voice signaling** - for use in network topologies that require a different policy for the voice signaling than for the voice media. • **Guest Voice** - to support a separate limited feature-set voice service for guest users and visitors with their own IP Telephony handsets and other similar appliances supporting interactive voice services. • **Guest Voice Signaling** - for use in network topologies that require a different policy for the guest voice signalling than for the guest voice media. • **Softphone Voice** - for use by softphone applications on typical data centric devices, such as PCs or laptops. • **Video Conferencing** - for use by dedicated Video Conferencing equipment and other similar appliances supporting real-time interactive video/audio services. • **Streaming Video -** for use by broadcast or multicast-based video content distribution and other similar applications supporting streaming video

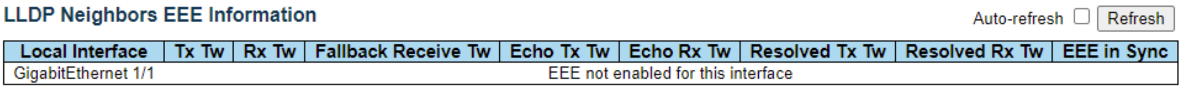
	services that require specific network policy treatment. Video applications relying on TCP with buffering would not be an intended use of this application type. - **Video Signaling** - for use in network topologies that require a separate policy for the video signaling than for the video media.
Policy	**Policy** indicates that an Endpoint Device wants to explicitly advertise that the policy is required by the device. Can be either Defined or Unknown. Unknown: The network policy for the specified application type is currently unknown. Defined: The network policy is defined.
TAG	**TAG** is indicative of whether the specified application type is using a tagged or an untagged VLAN. Can be Tagged or Untagged. **Untagged**: The device is using an untagged frame format and as such does not include a tag header as defined by IEEE 802.1Q-2003. **Tagged:** The device is using the IEEE 802.1Q tagged frame format.
VLAN ID	**VLAN ID** is the VLAN identifier (VID) for the port as defined in IEEE 802.1Q-2003. A value of 1 through 4094 is used to define a valid VLAN ID. A value of 0 (Priority Tagged) is used if the device is using priority tagged frames as defined by IEEE 802.1Q-2003, meaning that only the IEEE 802.1D priority level is significant and the default PVID of the ingress port is used instead.
Priority	**Priority** is the Layer 2 priority to be used for the specified application type. One of the eight priority levels (0 through 7).
DSCP	**DSCP** is the DSCP value to be used to provide Diffserv node behavior for the specified application type as defined in IETF RFC 2474. Contain one of 64 code point values (0 through 63).
Auto-negotiation	**Auto-negotiation** identifies if MAC/PHY auto-negotiation is supported by the link partner.
Auto-negotiation status	**Auto-negotiation status** identifies if auto-negotiation is currently enabled at the link partner. If **Auto-negotiation** is supported and **Auto-negotiation status** is disabled, the 802.3 PMD operating mode will be determined the operational MAU type field value rather than by auto-negotiation.
Auto-negotiation Capabilities	**Auto-negotiation Capabilities** shows the link partners MAC/PHY capabilities.

4.18.3.3 EEE

By using EEE power savings can be achieved at the expense of traffic latency. This latency occurs due to that the circuits EEE turn off to save power, need time to boot up before sending traffic over the link. This time is called "wakeup time". To achieve minimal latency, devices can use LLDP to exchange information about their respective tx and rx "wakeup time ", as a way to agree upon the minimum wakeup time they need.

EEE is an abbreviation for Energy Efficient Ethernet defined in IEEE 802.3az. This page provides an overview of EEE information exchanged by LLDP.

Web GUI: Monitor > LLDP > LLDP-MED Neighbors > EEE



LLDP Neighbors EEE Information

Local Interface	Tx Tw	Rx Tw	Fallback Receive Tw	Echo Tx Tw	Echo Rx Tw	Resolved Tx Tw	Resolved Rx Tw	EEE in Sync
GigabitEthernet 1/1	EEE not enabled for this interface							

Figure 4-166: LLDP Neighbors EEE Information

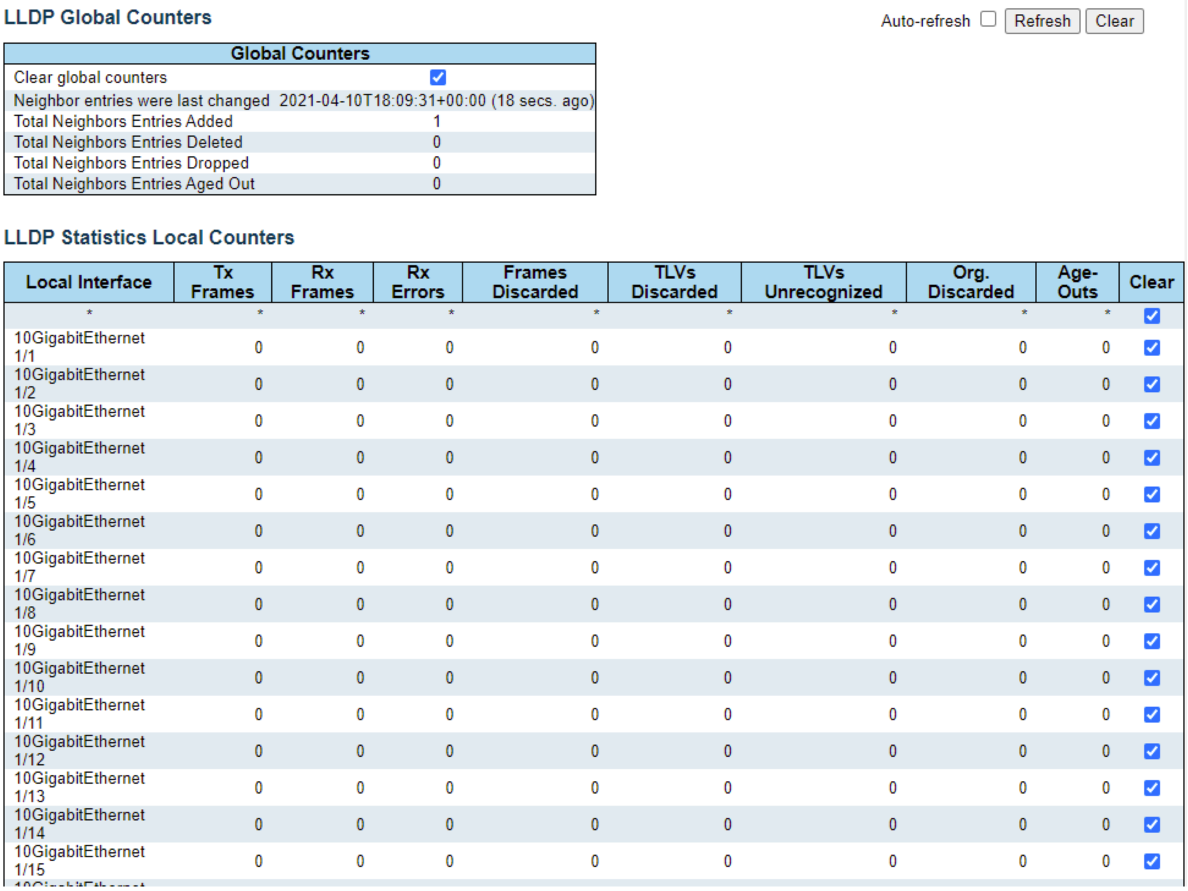
Table 4-159: LLDP Neighbors EEE Parameters

The displayed table contains a row for each interface. If the interface does not support EEE, then it displays as "EEE not supported for this interface". If EEE is not enabled on particular interface, then it displays as "EEE not enabled for this interface". If the link partner doesn't supports EEE, then it displays as "Link partner is not EEE capable. The columns hold the following information:	
Local Interface	The interface at which LLDP frames are received or transmitted.
Tx Tw	The link partner's maximum time that transmits path can hold-off sending data after deassertion of LPI
Rx Tw	The link partner's time that receiver would like the transmitter to hold-off to allow time for the receiver to wake from sleep.
Fallback Receive Tw	The link partner's fallbacks receive Tw. A receiving link partner may inform the transmitter of an alternate desired Tw_sys_tx. Since a receiving link partner is likely to have discrete levels for savings, this provides the transmitter with additional information that it may use for a more efficient allocation. Systems that do not implement this option default the value to be the same as that of the Receive Tw_sys_tx.
Echo Tx Tw	The link partner's fallback receives Tw. The respective echo values shall be defined as the local link partners reflection (echo) of the remote link partners respective values. When a local link partner receives its echoed values from the remote link partner it can determine whether the remote link partner has received, registered and processed its most recent values. For example, if the local link partner receives echoed parameters that do not match the values in its local MIB, then the local link partner infers that the remote link partners request was based on stale information.
Echo Rx Tw	The link partner's Echo Rx Tw value.
Resolved Tx Tw	The resolved Rx Tw for this link. Note: NOT the link partner The resolved value that is the actual "tx wakeup time " used for this link (based on EEE information exchanged via LLDP).
Resolved Rx Tw	The resolved Rx Tw for this link Note: NOT the link partner. The resolved value that is the actual "Rx wakeup time " used for this link (based on EEE information exchanged via LLDP).
EEE in Sync	Shows whether the switch and the link partner have agreed on wake times. **Red** – Switch and link partner have not agreed on wakeup times. **Green** – Switch and link partner have agreed on wakeup times**.**

4.18.3.4 Port Statistics

The R Class series unit provides an overview of all LLDP traffic. Two types of counters are shown: **Global counters** are counters that refer to the whole switch, while **local counters** (LLDP Statistics) refer to counters for the currently selected switch port.

Web GUI: Monitor > LLDP > Port Statistics



LLDP Global Counters

Global Counters	
Clear global counters	☑
Neighbor entries were last changed	2021-04-10T18:09:31+00:00 (18 secs. ago)
Total Neighbors Entries Added	1
Total Neighbors Entries Deleted	0
Total Neighbors Entries Dropped	0
Total Neighbors Entries Aged Out	0

LLDP Statistics Local Counters

Local Interface	Tx Frames	Rx Frames	Rx Errors	Frames Discarded	TLVs Discarded	TLVs Unrecognized	Org. Discarded	Age-Outs	Clear
*	*	*	*	*	*	*	*	*	☑
10GigabitEthernet 1/1	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/2	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/3	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/4	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/5	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/6	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/7	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/8	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/9	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/10	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/11	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/12	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/13	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/14	0	0	0	0	0	0	0	0	☑
10GigabitEthernet 1/15	0	0	0	0	0	0	0	0	☑

Figure 4-167: Port Statistics

Table 4-160: Port Statistic Parameters

Global Counters	
Clear Global counters	If checked the global counters are cleared when **Clear** is pressed.
Neighbor entries were last changed	Shows the time for the last entry when was last deleted or added. It also shows the time elapsed since last change was detected.
Total Neighbor Entries added	Shows the number of new entries added since switch reboot.
Total Neighbor Entries Deleted	Shows the number of new entries deleted since switch reboot.
Total Neighbor Entries Dropped	Shows the number of LLDP frames dropped due to that the entry table was full.

Total Neighbor Entries Aged Out	Shows the number of entries deleted due to Time-To-Live expiring.
Local Counters	
The displayed table contains a row for each interface.	
Local Port	The port on which LLDP frames are received or transmitted.
Tx Frames	The number of LLDP frames transmitted on the port.
Rx Frames	The number of LLDP frames received on the port.
Rx Errors	The number of received LLDP frames containing error.
Frames Discarded	If an LLDP frame is received on a port, and the switch's internal table is full, the LLDP frame is counted and discarded. This situation is known as "Too Many Neighbors" in the LLDP standard. LLDP frames require a new entry in the table when **Chassis ID** or **Remote Port ID** is not already contained within the table. Entries are removed from the table when a given port link is down, an LLDP shutdown frame has been received, or when the entry ages out.
TLVs Discarded	Each LLDP frame can contain multiple pieces of information, known as TLVs (Type Length Value). If a TLV is malformed, it is counted and discarded.
TLVs Unrecognized	The number of well-formed TLVs, but with an unknown type of value.
Org. Discarded	If LLDP frame is received with an organizationally TLV, but the TLV is not supported the TLV is discarded and counted.
Age-Outs	Each LLDP frame contains information about how long the LLDP information is valid (age-out time). If no new LLDP frame is received within the Age-Out time, the LLDP information is removed, and the **Age-Out Counter** is incremented.
Clear	If checked the counters for the specific interface are cleared when is pressed.

4.19 Link OAM

The 802.3ah OAM standard provides the operation, administration and maintenance tools and mechanisms for monitoring link operation, fault detection and remote loopback control.

The 802.3ah is a complete standard for Ethernet in the first mile, which contains a link level (as opposed to service level) OAM mechanism. The protocol automatically discovers 802.3ah neighbors on a link. It can monitor and detect link degradation or failure in both bi-directional links and unidirectional links. Once a degradation or failure is detected, it provides diagnostic tools, e.g., it can set a link to “loopback” mode in order to check and isolate specific link problems.

The IEEE link layer OAM operates at the Ethernet layer and therefore (unlike SNMP or Ping) does not require an IP address.

The MIB variable retrieval operation allows collection of performance statistics.

The 802.3ah standard is a link oriented (port to port) protocol, i.e., it operates on a port level and communicates with the neighbor device directly connected to its port.

R Class series can communicate with any neighbor device supporting this protocol.

The major capabilities of 802.3ah are:

1. **Discovery**: detects the endpoints of a link and its OAM capabilities
2. **Remote Fault Detection**: allows one endpoint to convey severe events and failure conditions to its OAM link partner (Link fault, Dying Gasp, specific critical events)
3. **Link Performance Monitoring**: detection and notifications of different link faults. Event notification is delivered to the link partner when one of these events is detected on the link: Frame Error events, Frame Period Error events, Symbol Period Error events, Event Seconds Summary
4. **Remote Loopback**: can be used to put the remote port in loopback mode, useful for data-path test
5. **MIB variable retrieval**: collecting performance statistics. A MIB (Management Information Base) is a collection of variables which are deployed for measuring the link capability to support the defined SLA.
6. Verification of link port status
7. Simultaneous operation on multiple ports

A typical link OAM scenario is shown below:

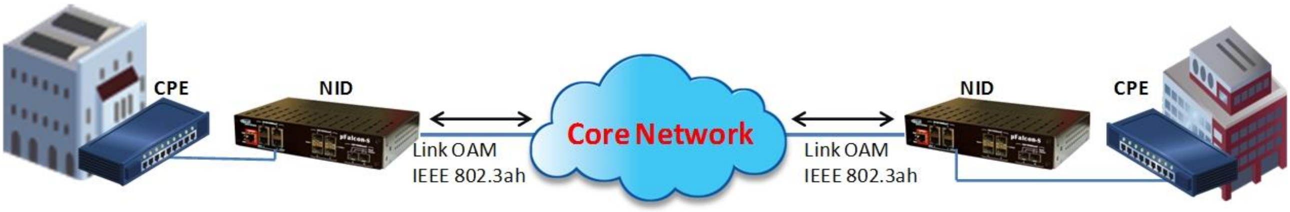
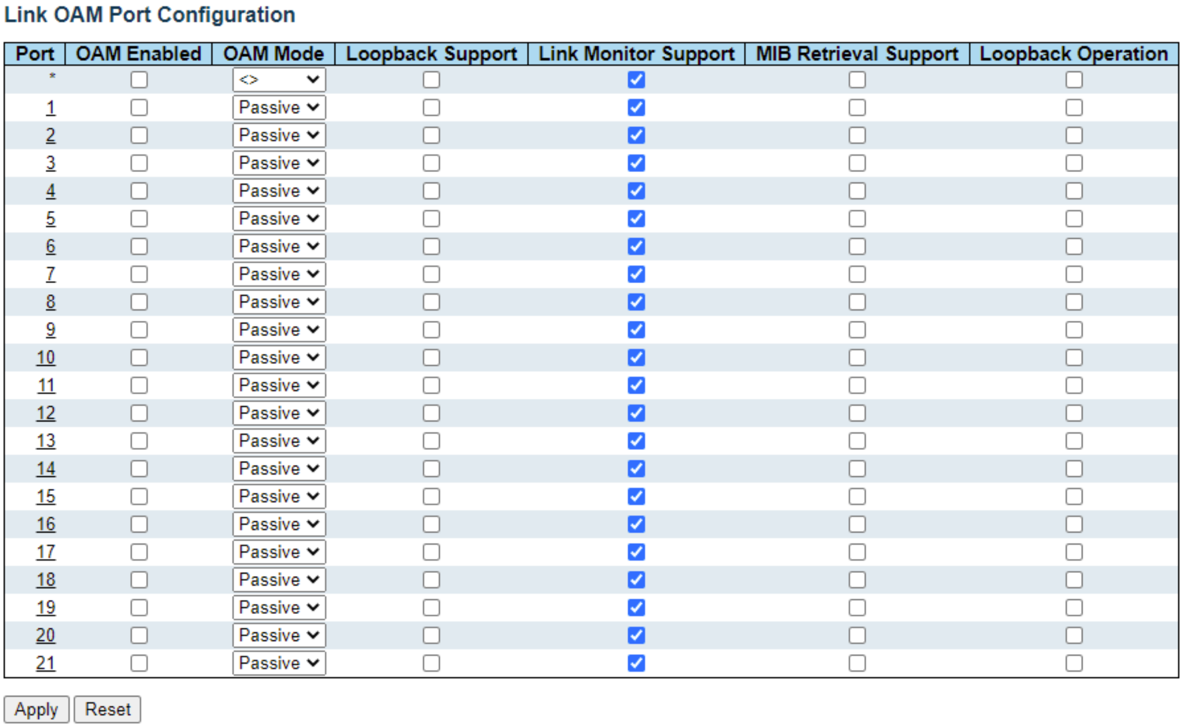


Figure 4-168: Sample Network with OAM functionality.

4.19.1 Link OAM Port Configuration

This section allows the user to inspect the current Link OAM port configurations and change them as well.

Web GUI: Configuration > Link OAM > Port Settings



Link OAM Port Configuration

Port	OAM Enabled	OAM Mode	Loopback Support	Link Monitor Support	MIB Retrieval Support	Loopback Operation
*	☐	<>	☐	☑	☐	☐
1	☐	Passive	☐	☑	☐	☐
2	☐	Passive	☐	☑	☐	☐
3	☐	Passive	☐	☑	☐	☐
4	☐	Passive	☐	☑	☐	☐
5	☐	Passive	☐	☑	☐	☐
6	☐	Passive	☐	☑	☐	☐
7	☐	Passive	☐	☑	☐	☐
8	☐	Passive	☐	☑	☐	☐
9	☐	Passive	☐	☑	☐	☐
10	☐	Passive	☐	☑	☐	☐
11	☐	Passive	☐	☑	☐	☐
12	☐	Passive	☐	☑	☐	☐
13	☐	Passive	☐	☑	☐	☐
14	☐	Passive	☐	☑	☐	☐
15	☐	Passive	☐	☑	☐	☐
16	☐	Passive	☐	☑	☐	☐
17	☐	Passive	☐	☑	☐	☐
18	☐	Passive	☐	☑	☐	☐
19	☐	Passive	☐	☑	☐	☐
20	☐	Passive	☐	☑	☐	☐
21	☐	Passive	☐	☑	☐	☐

Figure 4-169: Link OAM Port Configuration

Table 4-161: Link OAM Port Configuration Parameters

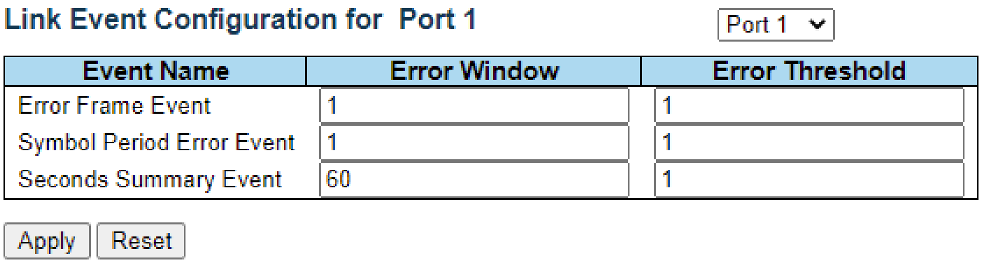
Port	The switch port number.
OAM Enabled	Controls whether Link OAM is enabled on this switch port. Enabling Link OAM provides the network operators the ability to monitor the health of the network and quickly determine the location of failing links or fault conditions.
OAM Mode	Configures the OAM Mode as Active or Passive. The default mode is Passive. **Active mode** DTE's configured in Active mode initiates the exchange of Information OAMPDUs as defined by the Discovery process. Once the Discovery process completes, Active DTE's are permitted to send any OAMPDU while connected to a remote OAM peer entity in Active mode. Active DTE's operates in a limited respect if the remote OAM entity is operating in Passive mode. Active devices should not respond to OAM remote loopback commands and variable requests from a Passive peer. **Passive mode** DTE's configured in Active mode initiates the exchange of Information OAMPDUs as defined by the Discovery process. Passive DTE's react to the initiation of the Discovery process by the remote DTE. This eliminates the possibility of passive-to-passive links. Passive DTE's shall not send Variable Request or Loopback Control OAMPDUs.
Loopback Support	Controls whether the loopback support is enabled for the switch port. Link OAM remote loopback can be used for fault localization and link

	performance testing. Enabling the loopback support will allow the DTE to execute the remote loopback command that helps in the fault detection.
Link Monitor Support	Controls whether the Link Monitor support is enabled for the switch port. On enabling the Link Monitor support, the DTE supports event notification that permits the inclusion of diagnostic information.
MIB Retrieval Support	Controls whether the MIB Retrieval Support is enabled for the switch port. On enabling the MIB retrieval support, the DTE supports polling of various Link OAM based MIB variables' contents.
Loopback Operation	If the Loopback support is enabled, enabling this field will start a loopback operation for the port.

4.19.2 Link Event Configuration for selected Port

This section allows the user to inspect the current Link OAM Link Event configurations and change them as well.

Web GUI: Configuration > Link OAM > Events Settings



Link Event Configuration for Port 1

Port 1

Event Name	Error Window	Error Threshold
Error Frame Event	1	1
Symbol Period Error Event	1	1
Seconds Summary Event	60	1

Figure 4-170: Link Event Configuration for selected port

Table 4-162: Link Event Configuration for selected port Parameters

Port	The switch port number.
Event Name	Name of the Link Event which is being configured.
Error Window	Represents the window period in the order of 1 sec for the observation of various link events.
Error Threshold	Represents the threshold value for the window period for the appropriate Link event so as to notify the peer of this error.
Error Frame Event	The Errored Frame Event counts the number of errored frames detected during the specified period. The period is specified by a time interval (Window in order of 1 sec). This event is generated if the errored frame count is equal to or greater than the specified threshold for that period (Period Threshold). Errored frames are frames that had transmission errors as detected at the Media Access Control sublayer. Error Window for 'Error Frame Event' must be an integer value between 1-60 and its default value is '1'. Whereas Error Threshold must be between 0-0xffffffff and its default value is '0'.
Symbol Period Error Event	Controls whether the MIB Retrieval Support is enabled for the switch port. On enabling the MIB retrieval support, the DTE supports polling of various Link OAM based MIB variables' contents.

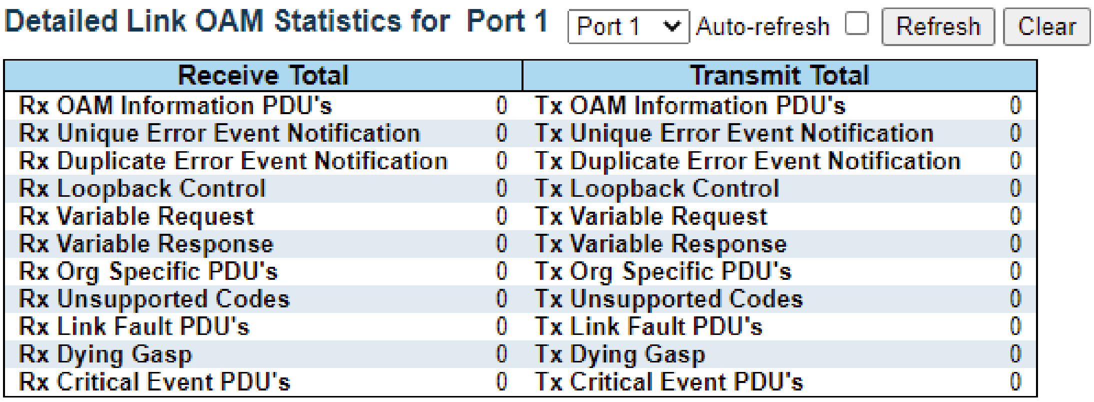
Seconds Summary Event	The Errored Frame Seconds Summary Event TLV counts the number of errored frame seconds that occurred during the specified period. The period is specified by a time interval. This event is generated if the number of errored frame seconds is equal to or greater than the specified threshold for that period. An errored frame second is a one second interval wherein at least one frame error was detected. Errored frames are frames that had transmission errors as detected at the Media Access Control sublayer. Error Window for 'Seconds Summary Event' must be an integer value between 10-900 and its default value is '60'. Whereas Error Threshold must be between 0-0xffff and its default value is '1'.

4.19.3 Detailed Link OAM Statistics for selected port

This section provides detailed OAM traffic statistics for a specific switch port. Use the port select box to select which switch port details to display.

The displayed counters represent the total number of OAM frames received and transmitted for the selected port. Discontinuities of these counters can occur at re-initialization of the management system.

Web GUI: Configuration > Link OAM > Events Settings



Receive Total		Transmit Total	
Rx OAM Information PDU's	0	Tx OAM Information PDU's	0
Rx Unique Error Event Notification	0	Tx Unique Error Event Notification	0
Rx Duplicate Error Event Notification	0	Tx Duplicate Error Event Notification	0
Rx Loopback Control	0	Tx Loopback Control	0
Rx Variable Request	0	Tx Variable Request	0
Rx Variable Response	0	Tx Variable Response	0
Rx Org Specific PDU's	0	Tx Org Specific PDU's	0
Rx Unsupported Codes	0	Tx Unsupported Codes	0
Rx Link Fault PDU's	0	Tx Link Fault PDU's	0
Rx Dying Gasp	0	Tx Dying Gasp	0
Rx Critical Event PDU's	0	Tx Critical Event PDU's	0

Figure 4-171: Detailed Link OAM Statistics for selected port

Table 4-163: Detailed Link OAM Statistics for selected port Parameters

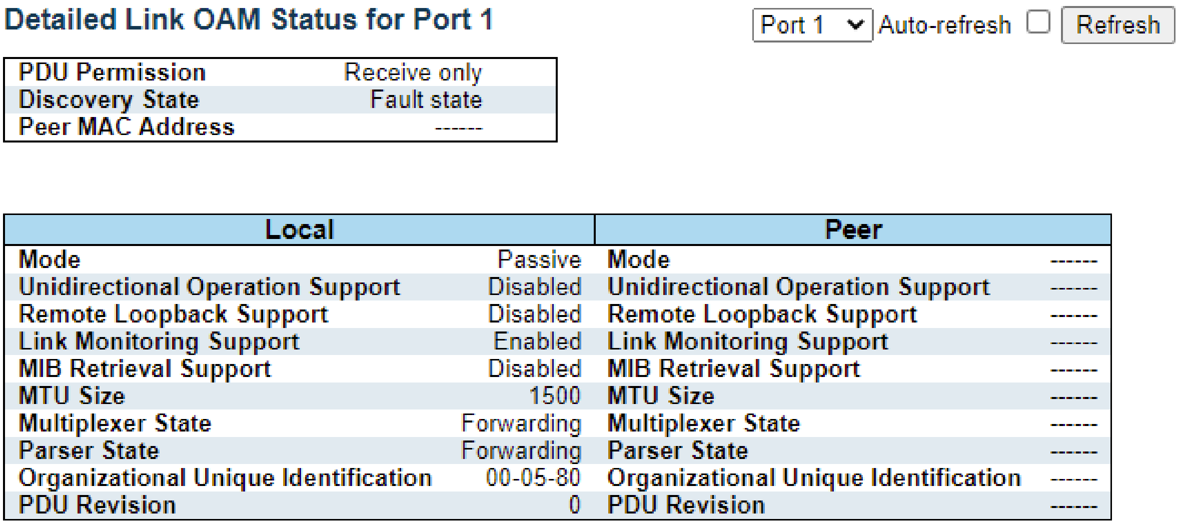
Receive Total and Transmit Total	
Rx and Tx OAM Information PDU's	The number of received and transmitted OAM Information PDU's. Discontinuities of this counter can occur at re-initialization of the management system.
Rx and Tx Unique Error Event Notification	A count of the number of unique Event OAMPDUs received and transmitted on this interface. Event Notifications may be sent in duplicate to increase the probability of successfully being received, given the possibility that a frame may be lost in transit. Duplicate Event Notification transmissions are counted by Duplicate Event Notification counters for Tx and Rx respectively. A unique Event Notification OAMPDU is indicated as an Event Notification OAMPDU with a Sequence Number field that is distinct from the previously transmitted Event Notification OAMPDU Sequence Number.

Rx and Tx Duplicate Error Event Notification	A count of the number of duplicate Event OAMPDUs received and transmitted on this interface. Event Notification OAMPDUs may be sent in duplicate to increase the probability of successfully being received, given the possibility that a frame may be lost in transit. A duplicate Event Notification OAMPDU is indicated as an Event Notification OAMPDU with a Sequence Number field that is identical to the previously transmitted Event Notification OAMPDU Sequence Number.
Rx and Tx Loopback Control	A count of the number of Loopback Control OAMPDUs received and transmitted on this interface.
Rx and Tx Variable Request	A count of the number of Variable Request OAMPDUs received and transmitted on this interface.
Rx and Tx Variable Response	A count of the number of Variable Response OAMPDUs received and transmitted on this interface
Rx and Tx Org Specific PDU's	A count of the number of Organization Specific OAMPDUs transmitted on this interface.
Rx and Tx Unsupported Codes	A count of the number of OAMPDUs transmitted on this interface with an unsupported op-code.
Rx and Tx Link fault PDU's	A count of the number of Link fault PDU's received and transmitted on this interface.
Rx and Tx Dying Gasp	A count of the number of Dying Gasp events received and transmitted on this interface.
Rx and Tx Critical Event PDU's	A count of the number of Critical event PDU's received and transmitted on this interface.

4.19.4 Detailed Link OAM Status for selected port

This page provides Link OAM configuration operational status. The displayed fields show the active configuration status for the selected port.

Web GUI: Monitor > Link OAM > Port Status



Detailed Link OAM Status for Port 1

PDU Permission	Receive only
Discovery State	Fault state
Peer MAC Address	------

Local		Peer	
Mode	Passive	Mode	------
Unidirectional Operation Support	Disabled	Unidirectional Operation Support	------
Remote Loopback Support	Disabled	Remote Loopback Support	------
Link Monitoring Support	Enabled	Link Monitoring Support	------
MIB Retrieval Support	Disabled	MIB Retrieval Support	------
MTU Size	1500	MTU Size	------
Multiplexer State	Forwarding	Multiplexer State	------
Parser State	Forwarding	Parser State	------
Organizational Unique Identification	00-05-80	Organizational Unique Identification	------
PDU Revision	0	PDU Revision	------

Figure 4-172: Detailed Link OAM Status for selected port

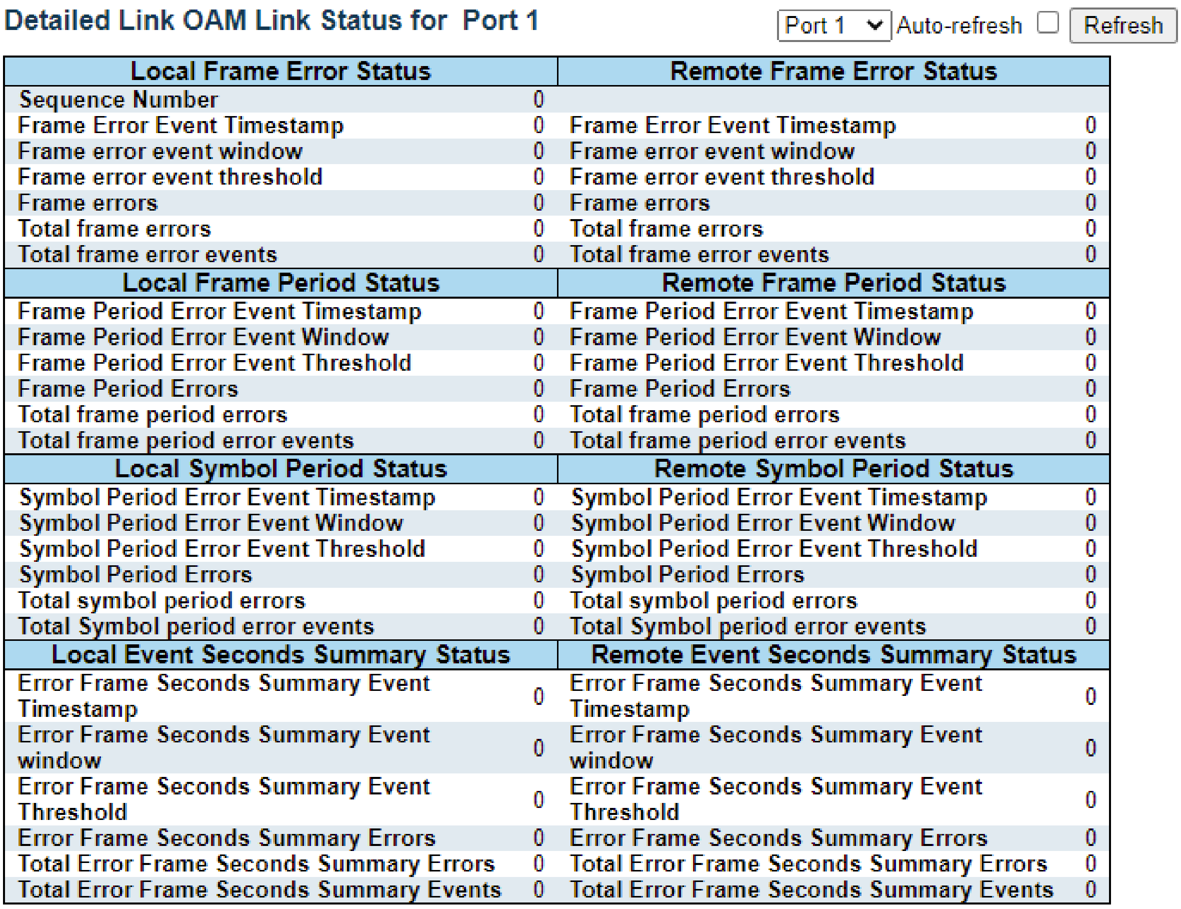
Table 4-164: Detailed Link OAM Status for selected port Parameters

Local and Peer	
Mode	The Mode in which the Link OAM is operating, Active or Passive.
Unidirectional Operation Support	This feature is not available to be configured by the user. The status of this configuration is retrieved from the PHY.
Remote Loopback Support	If status is enabled, DTE is capable of OAM remote loopback mode.
Link Monitoring Support	If status is enabled, DTE supports interpreting Link Events.
MIB Retrieval Support	If status ie enabled DTE supports sending Variable Response OAMPDUs.
MTU Size	It represents the largest OAMPDU, in octets, supported by the DTE. This value is compared to the remotes Maximum PDU Size and the smaller of the two is used.
Multiplexer State	When in forwarding state, the Device is forwarding non-OAMPDUs to the lower sublayer. In case of discarding, the device discards all the non-OAMPDU's.
Parser State	When in forwarding state, Device is forwarding non-OAMPDUs to higher sublayer. When in loopback, Device is looping back non-OAMPDUs to the lower sublayer. When in discarding state, Device is discarding non-OAMPDUs.
Organizational Unique Identification	24-bit Organizationally Unique Identifier of the vendor.
PDU Revision	It indicates the current revision of the Information TLV. The value of this field shall start at zero and be incremented each time something in the Information TLV changes.
PDU Permission	This field is available only for the Local DTE. It displays the current permission rules set for the local DTE. Possible values are "Link fault", "Receive only", "Information exchange only", "ANY".
Discovery State	Displays the current state of the discovery process. Possible states are Fault state, Active state, Passive state, SEND_LOCAL_REMOTE_STATE, SEND_LOCAL_REMOTE_OK_STATE, SEND_ANY_STATE.

4.19.5 Detailed Link OAM Link Events Status for selected port

This section allows the user to inspect the current Link OAM Link Event configurations and change them as well. The left pane displays the Event status for the Local OAM unit while the right pane displays the status for the Peer for the respective port.

Web GUI: Monitor > Link OAM > Event Status



Detailed Link OAM Link Status for Port 1

Local Frame Error Status		Remote Frame Error Status	
Sequence Number	0		
Frame Error Event Timestamp	0	Frame Error Event Timestamp	0
Frame error event window	0	Frame error event window	0
Frame error event threshold	0	Frame error event threshold	0
Frame errors	0	Frame errors	0
Total frame errors	0	Total frame errors	0
Total frame error events	0	Total frame error events	0
Local Frame Period Status		**Remote Frame Period Status**	
Frame Period Error Event Timestamp	0	Frame Period Error Event Timestamp	0
Frame Period Error Event Window	0	Frame Period Error Event Window	0
Frame Period Error Event Threshold	0	Frame Period Error Event Threshold	0
Frame Period Errors	0	Frame Period Errors	0
Total frame period errors	0	Total frame period errors	0
Total frame period error events	0	Total frame period error events	0
Local Symbol Period Status		**Remote Symbol Period Status**	
Symbol Period Error Event Timestamp	0	Symbol Period Error Event Timestamp	0
Symbol Period Error Event Window	0	Symbol Period Error Event Window	0
Symbol Period Error Event Threshold	0	Symbol Period Error Event Threshold	0
Symbol Period Errors	0	Symbol Period Errors	0
Total symbol period errors	0	Total symbol period errors	0
Total Symbol period error events	0	Total Symbol period error events	0
Local Event Seconds Summary Status		**Remote Event Seconds Summary Status**	
Error Frame Seconds Summary Event Timestamp	0	Error Frame Seconds Summary Event Timestamp	0
Error Frame Seconds Summary Event window	0	Error Frame Seconds Summary Event window	0
Error Frame Seconds Summary Event Threshold	0	Error Frame Seconds Summary Event Threshold	0
Error Frame Seconds Summary Errors	0	Error Frame Seconds Summary Errors	0
Total Error Frame Seconds Summary Errors	0	Total Error Frame Seconds Summary Errors	0
Total Error Frame Seconds Summary Events	0	Total Error Frame Seconds Summary Events	0

Figure 4-173: Detailed Link OAM Link Status Events for selected port

Table 4-165: Link OAM Link Status Events for selected port Parameters

Port	The switch port number.
Sequence Number	This two-octet field indicates the total number of events occurred at the remote end.
Frame Error Event Timestamp	This two-octet field indicates the time reference when the event was generated, in terms of 100 ms intervals.
Frame error event window	This two-octet field indicates the duration of the period in terms of 100 ms intervals. 1) The default value is one second. 2) The lower bound is one second. 3) The upper bound is one minute.
Frame error event threshold	This four-octet field indicates the number of detected errored frames in the period is required to be equal to or greater than in order for the event to be generated. 1) The default value is one frame error. 2) The lower bound is zero frame errors. 3) The upper bound is unspecified.
Frame errors	This four-octet field indicates the number of detected errored frames in the period.
Total frame errors	This eight-octet field indicates the sum of errored frames that have been detected since the OAM sublayer was reset.

Total frame error events	This four-octet field indicates the number of Errored Frame Event TLVs that have been generated since the OAM sublayer was reset.
Frame Period Error Event Timestamp	This two-octet field indicates the time reference when the event was generated, in terms of 100 ms intervals
Frame Period Error Event Window	This four-octet field indicates the duration of period in terms of frames.
Frame Period Error Event Threshold	This four-octet field indicates the number of errored frames in the period is required to be equal to or greater than in order for the event to be generated
Frame Period Errors	This four-octet field indicates the number of frame errors in the period.
Total frame period errors	This eight-octet field indicates the sum of frame errors that have been detected since the OAM sublayer was reset.
Total frame period error events	This four-octet field indicates the number of Errored Frame Period Event TLVs that have been generated since the OAM sublayer was reset.
Symbol Period Error Event Timestamp	This two-octet field indicates the time reference when the event was generated, in terms of 100 ms intervals
Symbol Period Error Event Window	This eight-octet field indicates the number of symbols in the period.
Symbol Period Error Event Threshold	This eight-octet field indicates the number of errored symbols in the period is required to be equal to or greater than in order for the event to be generated.
Symbol Period Errors	This eight-octet field indicates the number of symbol errors in the period.
Total symbol period errors	This eight-octet field indicates the sum of symbol errors since the OAM sublayer was reset.
Total Symbol period error events	This four-octet field indicates the number of Errored Symbol Period Event TLVs that have been generated since the OAM sublayer was reset.
Error Frame Seconds Summary Event Timestamp	This two-octet field indicates the time reference when the event was generated, in terms of 100 ms intervals, encoded as a 16-bit unsigned integer.
Error Frame Seconds Summary Event window	This two-octet field indicates the duration of the period in terms of 100 ms intervals, encoded as a 16-bit unsigned integer.
Error Frame Seconds Summary Event Threshold	This two-octet field indicates the number of errored frame seconds in the period is required to be equal to or greater than in order for the event to be generated, encoded as a 16-bit unsigned integer.
Error Frame Seconds Summary Errors	This two-octet field indicates the number of errored frame seconds in the period, encoded as a 16-bit unsigned integer.

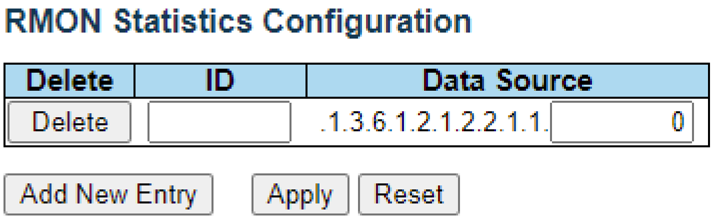
Total Error Frame Seconds Summary Errors	This four-octet field indicates the sum of errored frame seconds that have been detected since the OAM sublayer was reset.
Total Error Frame Seconds Summary Events	This four-octet field indicates the number of Errored Frame Seconds Summary Event TLVs that have been generated since the OAM sublayer was reset, encoded as a 32bit unsigned integer.

4.20 RMON (Remote Network Monitoring)

4.20.1 RMON Statistics Configuration

Configure RMON Statistics table on this section. The entry index key is **ID.**

Web GUI: Configuration > RMON > Statistics



RMON Statistics Configuration

Delete	ID	Data Source
Delete		.1.3.6.1.2.1.2.2.1.1. 0

Figure 4-174: RMON Statistics Configuration

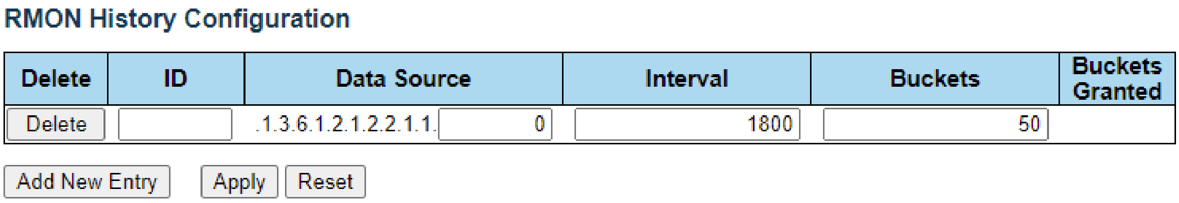
Table 4-166: RMON Statistics Configuration Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
ID	Indicates the index of the entry. The range is from 1 to 65535.
Data Source	Indicates the port ID which wants to be monitored. If in stacking switch, the value must add 1000000*(switch ID-1), for example, if the port is switch 3 port 5, the value is 20000005.

4.20.2 RMON History Configuration

Configure RMON History table on this section. The entry index key is **ID**.

Web GUI: Configuration > RMON > History



RMON History Configuration

Delete	ID	Data Source	Interval	Buckets	Buckets Granted
Delete		.1.3.6.1.2.1.2.2.1.1. 0	1800	50	

Figure 4-175: RMON History Configuration

Table 4-167: RMON History Configuration Parameters

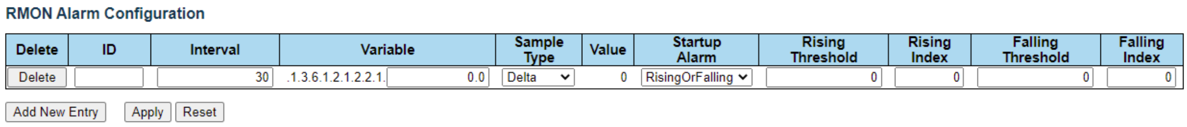
Delete	Check to delete the entry. It will be deleted during the next save.
ID	Indicates the index of the entry. The range is from 1 to 65535.
Data Source	Indicates the port ID which must be monitored. If in stacking switch, the value must add 1000000*(switch ID-1), for example, if the port is switch 3 port 5, the value is 2000005
Interval	Indicates the interval in seconds for sampling the history statistics data. The range is from 1 to 3600, default value is 1800 seconds
Buckets	Indicates the maximum data entries associated this History control entry stored in RMON. The range is from 1 to 3600. Default value is **50**.

Buckets Granted	The number of data that shall be saved in the RMON.

4.20.3 RMON Alarm Configuration

This section provides configuration of RMON Alarm table. The entry index key is `ID`.

Web GUI: Configuration > RMON > Alarm



RMON Alarm Configuration

Delete	ID	Interval	Variable	Sample Type	Value	Startup Alarm	Rising Threshold	Rising Index	Falling Threshold	Falling Index
Delete		30	.1.3.6.1.2.1.2.2.1. 0.0	Delta	0	RisingOrFalling	0	0	0	0

Figure 4-176: RMON Alarm Configuration

Table 4-168: RMON Alarm Configuration Parameters

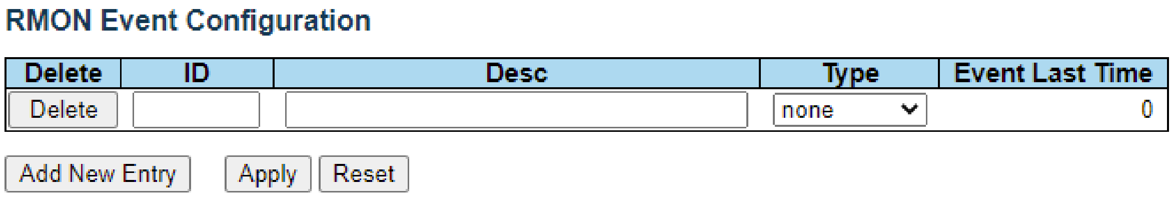
Delete	Check to delete the entry. It will be deleted during the next save.
ID	Indicates the index of the entry. The range is from 1 to 65535.
Interval	Indicates the interval in seconds for sampling and comparing the rising and falling threshold. The range is from 1 to 2^31-1.
Variable	Indicates the variable to be sampled, the possible variables are: • **InOctets**: The total number of octets received on the interface, including framing characters. • **InUcastPkts:** The number of uni-cast packets delivered to a higher-layer protocol. • **InNUcastPkts**: The number of broad-cast and multi-cast packets delivered to a higher-layer protocol. • **InDiscards**: The number of inbound packets that are discarded even the packets are normal. • **InErrors**: The number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol. • **InUnknownProtos**: the number of the inbound packets that were discarded because of the unknown or un-support protocol. • **OutOctets**: The number of octets transmitted out of the interface, including framing characters. • **OutUcastPkts**: The number of uni-cast packets that request to transmit. • **OutNUcastPkts**: The number of broad-cast and multi-cast packets that request to transmit. • **OutDiscards**: The number of outbound packets that are a discarded event the packets is normal. • **OutErrors**: The number of outbound packets that could not be transmitted because of errors. • **OutQLen**: The length of the output packet queue (in packets).
Sample Type	The method of sampling the selected variable and calculating the value to be compared against the thresholds, possible sample types are: **Absolute**: Get the sample directly. **Delta**: Calculate the difference between samples (default).

Value	The value of the statistic during the last sampling period.
Startup Alarm	The method of sampling the selected variable and calculating the value to be compared against the thresholds, possible sample types are: • **Rising** Trigger alarm when the first value is larger than the rising threshold. • **Failing** Trigger alarm when the first value is less than the falling threshold. • **RisingOrFalling** Trigger alarm when the first value is larger than the rising threshold or less than the falling threshold (default).
Rising Threshold	Rising threshold value (-2147483648-2147483647).
Rising Index	Rising event index (1-65535).
Falling Threshold	Falling threshold value (-2147483648-2147483647)
Falling Index	Falling event index (1-65535).

4.20.4 RMON Event Configuration

Configure RMON Event table on this section. The entry index key is **ID**.

Web GUI: Configuration > RMON > Event



RMON Event Configuration

Delete	ID	Desc	Type	Event Last Time
Delete			none	0

Figure 4-177: RMON Event Configuration

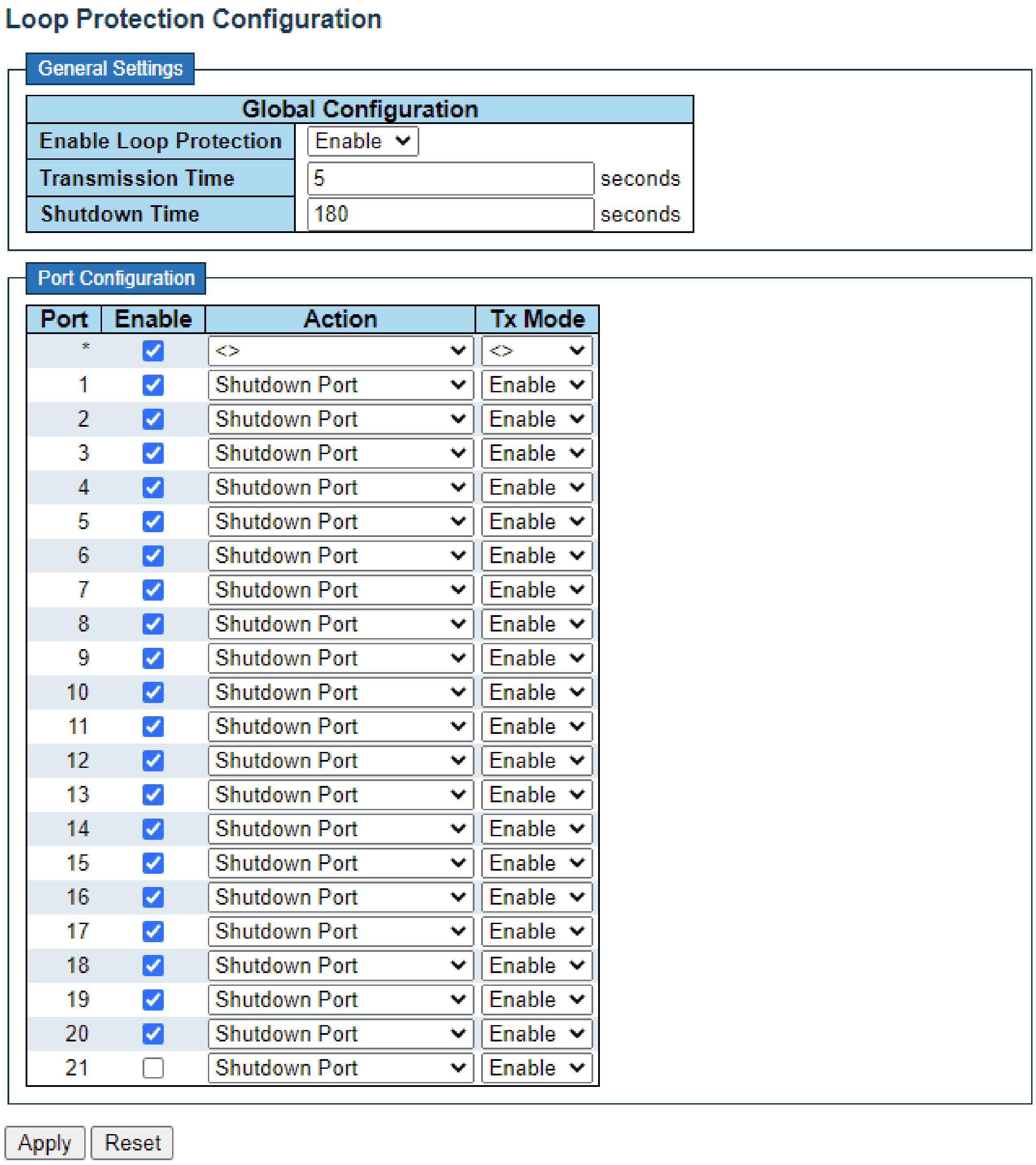
Table 4-169: RMON Event Configuration Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
ID	Indicates the index of the entry. The range is from 1 to 65535.
Desc	Indicates this event, the string length is from 0 to 127, default is a null string.
Type	Indicates the notification of the event, the possible types are: • **none**: No SNMP log is created, no SNMP trap is sent. • **log**: Create SNMP log entry when the event is triggered. • **snmptrap**: Send SNMP trap when the event is triggered. • **logandtrap**: Create SNMP log entry and sent SNMP trap when the event is triggered.
Event Last Time	Indicates the value of sysUpTime at the time this event entry last generated an event.

4.21 Loop Protection

This page allows the user to inspect the current Loop Protection configurations, and possibly change them as well.

Web GUI: Configuration > Loop Protection



Loop Protection Configuration

General Settings

Global Configuration		
Enable Loop Protection	Enable	
Transmission Time	5	seconds
Shutdown Time	180	seconds

Port Configuration

Port	Enable	Action	Tx Mode
*	☑	<>	<>
1	☑	Shutdown Port	Enable
2	☑	Shutdown Port	Enable
3	☑	Shutdown Port	Enable
4	☑	Shutdown Port	Enable
5	☑	Shutdown Port	Enable
6	☑	Shutdown Port	Enable
7	☑	Shutdown Port	Enable
8	☑	Shutdown Port	Enable
9	☑	Shutdown Port	Enable
10	☑	Shutdown Port	Enable
11	☑	Shutdown Port	Enable
12	☑	Shutdown Port	Enable
13	☑	Shutdown Port	Enable
14	☑	Shutdown Port	Enable
15	☑	Shutdown Port	Enable
16	☑	Shutdown Port	Enable
17	☑	Shutdown Port	Enable
18	☑	Shutdown Port	Enable
19	☑	Shutdown Port	Enable
20	☑	Shutdown Port	Enable
21	☐	Shutdown Port	Enable

Figure 4-178: Loop Protection Configuration

Table 4-170: Loop Protection Configuration Parameters

General Settings Global Configuration	
Enable Loop Protection	Controls whether Loop Protection is enabled (as a whole).

Transmission Time	The interval between each Loop Protection PDU sent on each port. valid values are 1 to 10 seconds. Default value is 5 seconds
Shutdown Time	The period (in seconds) for which a port will be kept disabled in the event of a loop is detected (and the port action shuts down the port). Valid values are 0 to 604800 seconds (7 days). A value of zero will keep a port disabled (until next device restart). Default value is 180 seconds.
Port Configuration	
Port	The switch port number of the port.
Enable	Controls whether Loop Protection is enabled on this switch port.
Action	Configures the action performed when a loop is detected on a port. Valid values are **Shutdown Port**, **Shutdown Port and Log** or **Log Only**.
Tx Mode	Controls whether the port is actively generating Loop Protection PDU's, or whether it is just passively looking for looped PDU's.

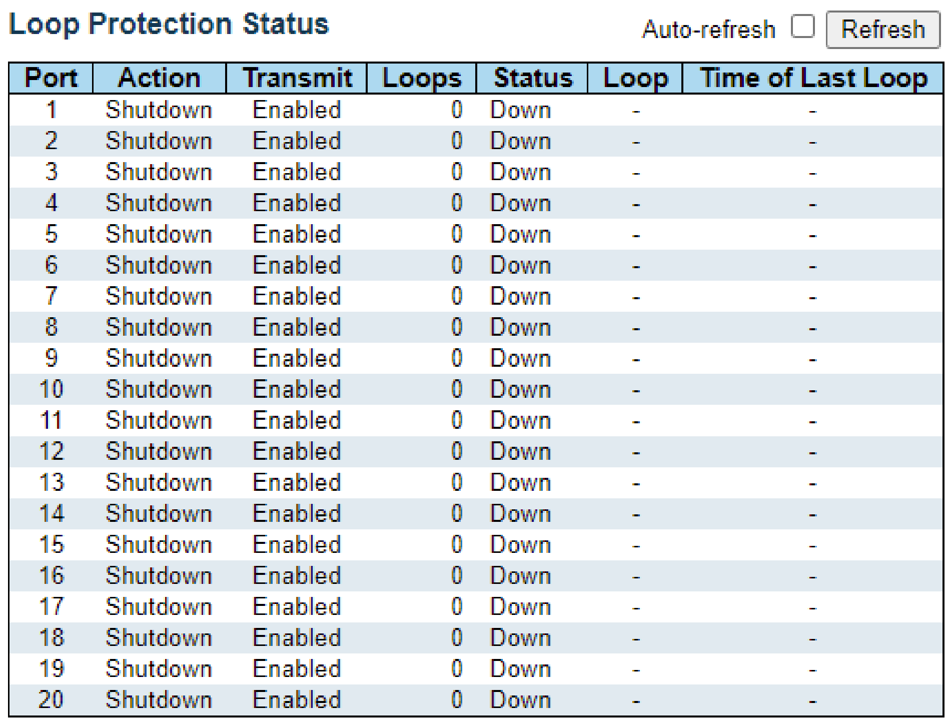
4.21.1 Loop Protection Status

This page displays the loop protection port status the ports of the switch.

Loop protection port status is:

Port

Web GUI: Monitor > Loop Protection



Loop Protection Status

Port	Action	Transmit	Loops	Status	Loop	Time of Last Loop
1	Shutdown	Enabled	0	Down	-	-
2	Shutdown	Enabled	0	Down	-	-
3	Shutdown	Enabled	0	Down	-	-
4	Shutdown	Enabled	0	Down	-	-
5	Shutdown	Enabled	0	Down	-	-
6	Shutdown	Enabled	0	Down	-	-
7	Shutdown	Enabled	0	Down	-	-
8	Shutdown	Enabled	0	Down	-	-
9	Shutdown	Enabled	0	Down	-	-
10	Shutdown	Enabled	0	Down	-	-
11	Shutdown	Enabled	0	Down	-	-
12	Shutdown	Enabled	0	Down	-	-
13	Shutdown	Enabled	0	Down	-	-
14	Shutdown	Enabled	0	Down	-	-
15	Shutdown	Enabled	0	Down	-	-
16	Shutdown	Enabled	0	Down	-	-
17	Shutdown	Enabled	0	Down	-	-
18	Shutdown	Enabled	0	Down	-	-
19	Shutdown	Enabled	0	Down	-	-
20	Shutdown	Enabled	0	Down	-	-

Figure 4-179: Loop Protection Status

Table 4-171: Loop Protection Status Parameters

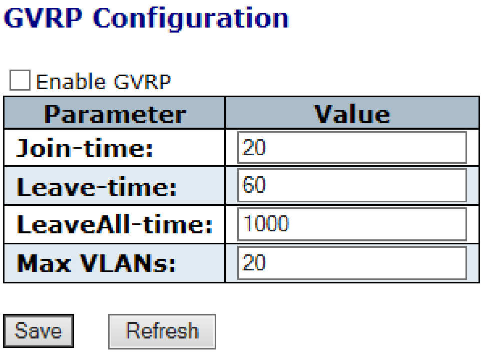
Port	The switch port number of the logical port.
Action	The currently configured port action.
Transmit	The currently configured port transmit mode.
Loops	The number of loops detected on this port.
Status	The current Loop Protection status of the port.
Loop	Whether a loop is currently detected on the port.
Time of Last Loop	The time of the last loop event detected.

4.22 GVRP Configuration

This section allows you to configure the global GVRP configuration settings that are commonly applied to all GVRP enabled ports. GVRP is an acronym for **G**ARP **V**LAN **R**egistration **P**rotocol. It is a protocol for dynamically registering VLANs on ports and is specified in IEEE 802.1Q-2005, clause 11. GVRP is an example of the use of GARP, hence the G in GVRP.

GARP is an acronym for **G**eneric **A**ttribute **R**egistration **P**rotocol. It is a generic protocol for registering attribute with other participants and is specified in IEEE 802.1D-2004, clause 12.

Web GUI: Configuration > GVRP > Global config



GVRP Configuration

☐ Enable GVRP

Parameter	Value
Join-time:	20
Leave-time:	60
LeaveAll-time:	1000
Max VLANs:	20

Figure 4-180: GVRP Configuration display

Table 4-172: GVRP Configuration parameters

GVRP Configuration	
Enable GVRP globally	The GVRP feature is globally enabled by setting the check mark in the checkbox named Enable GVRP and pressing the **Apply** button.
GVRP protocol timers	**Join-time** is a value in the range of 1-20cs, i.e., in units of one hundredth of a second. The default value is 20cs. **Leave-time** is a value in the range of 60-300cs, i.e., in units of one hundredth of a second. The default is 60cs. Leave All-time is a value in the range of 1000-5000cs, i.e., in units of one hundredth of a second. The default is 1000cs.
Max number of VLANs	When GVRP is enabled, a maximum number of VLANs supported by GVRP is specified. By default, this number is 20. This number can only be changed when GVRP is turned off.

4.23 sFlow Consideration

SFlow is an industry standard technology for monitoring switched networks through random sampling of packets on switch ports and time-based sampling of port counters. The sampled packets and counters (referred to as flow samples and counter samples, respectively) are sent as sFlow UDP datagrams to a central network traffic monitoring server. This central server is called an sFlow receiver or sFlow collector.

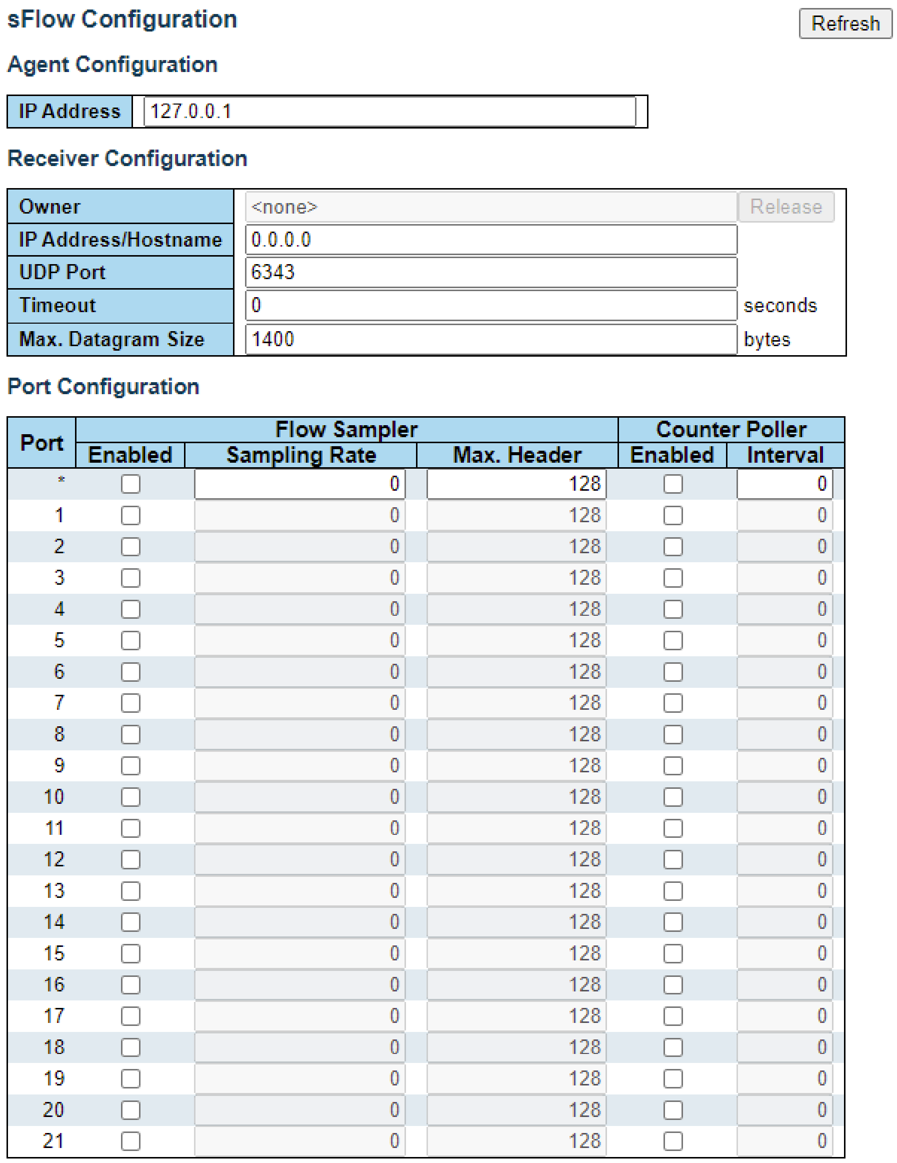
Additional information can be found at http://sflow.org.

4.23.1 sFlow Configuration displays

This sub-section allows configuring sFlow. The configuration is divided into two parts: Configuration of the sFlow receiver (a.k.a. sFlow collector) and configuration of per-port flow and counter samplers.

sFlow configuration is not persisted to non-volatile memory, which means that a reboot will disable sFlow sampling.

Web GUI: Configuration > sFlow



sFlow Configuration

Agent Configuration

IP Address	127.0.0.1

Receiver Configuration

Owner	<none>	
IP Address/Hostname	0.0.0.0	
UDP Port	6343	
Timeout	0	seconds
Max. Datagram Size	1400	bytes

Port Configuration

Port	Flow Sampler			Counter Poller	
	Enabled	Sampling Rate	Max. Header	Enabled	Interval
*	☐	0	128	☐	0
1	☐	0	128	☐	0
2	☐	0	128	☐	0
3	☐	0	128	☐	0
4	☐	0	128	☐	0
5	☐	0	128	☐	0
6	☐	0	128	☐	0
7	☐	0	128	☐	0
8	☐	0	128	☐	0
9	☐	0	128	☐	0
10	☐	0	128	☐	0
11	☐	0	128	☐	0
12	☐	0	128	☐	0
13	☐	0	128	☐	0
14	☐	0	128	☐	0
15	☐	0	128	☐	0
16	☐	0	128	☐	0
17	☐	0	128	☐	0
18	☐	0	128	☐	0
19	☐	0	128	☐	0
20	☐	0	128	☐	0
21	☐	0	128	☐	0

Figure 4-181: sFlow Configuration displays

Table 4-173: sFlow Configuration display parameters

This page allows for configuring sFlow. The configuration is divided into two parts: Configuration of the sFlow receiver (a.k.a. sFlow collector) and configuration of per-port flow and counter samplers. sFlow configuration is not persisted to non-volatile memory, which means that a reboot will disable sFlow sampling.

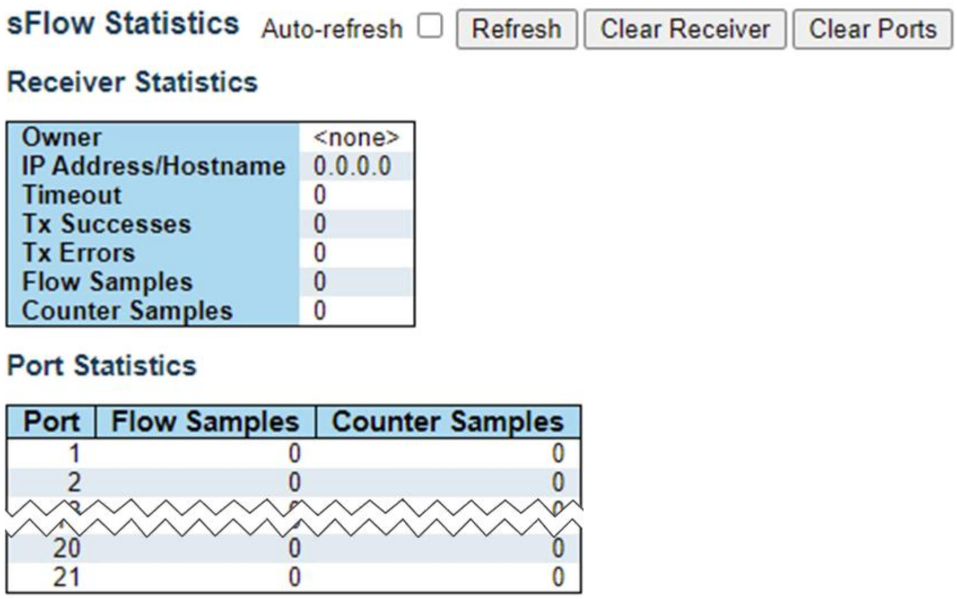
Agent Configuration	
IP Address	The IP address used as Agent IP address in sFlow datagrams. It serves as a unique key that will identify this agent over extended periods of time. Both IPv4 and IPv6 addresses are supported.
Receiver Configuration	
Owner	Basically, sFlow can be configured in two ways: Through local management using the Web or CLI interface or through SNMP. This read-only field shows the owner of the current sFlow configuration and assumes values as follows: • If sFlow is currently unconfigured/unclaimed, Owner contains <none>. • If sFlow is currently configured through Web or CLI, Owner contains <Configured through local management>. • If sFlow is currently configured through SNMP, Owner contains a string identifying the sFlow receiver. If sFlow is configured through SNMP, all controls - except for the Release-button - are disabled to avoid inadvertent reconfiguration. The **Release** button allows for releasing the current owner and disable sFlow sampling. The button is disabled if sFlow is currently unclaimed. If configured through SNMP, the release must be confirmed (a confirmation request will appear).
IP Address/Hostname	The IP address or hostname of the sFlow receiver. Both IPv4 and IPv6 addresses are supported.
UDP Port	The UDP port on which the sFlow receiver listens to sFlow datagrams. If set to 0 (zero), the default port (6343) is used.
Timeout	The number of seconds remaining before sampling stops and the current sFlow owner is released. While active, the current time left can be updated with a click on the Refresh-button. If locally managed, the timeout can be changed on the fly without affecting any other settings. Valid range is 0 to 2147483647 seconds.
Max. Datagram Size	The maximum number of data bytes that can be sent in a single sample datagram. This should be set to a value that avoids fragmentation of the sFlow datagrams. Valid range is 200 to 1468 bytes with default being 1400 bytes.

Port Configuration	
Port	The port number for which the configuration below applies.
Flow Sampler Enabled	Enables/disables flow sampling on this port.
Flow Sampler Sampling Rate:	The statistical sampling rate for packet sampling. Set to N to sample on average 1/Nth of the packets transmitted/received on the port. Not all sampling rates are achievable. If an unsupported sampling rate is requested, the switch will automatically adjust it to the closest achievable. This will be reported back in this field. Valid range is 1 to 32767.
Flow Sampler Max. Header	The maximum number of bytes that should be copied from a sampled packet to the sFlow datagram. Valid range is 14 to 200 bytes with default being 128 bytes. To have room for any frame, the maximum datagram size should be roughly 100 bytes larger than the maximum header size. If the maximum datagram size does not consider the maximum header size, samples may be dropped.
Counter Poller Enabled	Enables/disables counter polling on this port.
Counter Poller Interval	With counter polling enabled, this specifies the interval - in seconds - between counter poller samples. Valid range is 1 to 3600 seconds.

4.23.2 sFlow Statistics

This sub-section shows receiver and per-port sFlow statistics.

Web GUI: Monitor > sFlow



Receiver Statistics

Owner	<none>
IP Address/Hostname	0.0.0.0
Timeout	0
Tx Successes	0
Tx Errors	0
Flow Samples	0
Counter Samples	0

Port Statistics

Port	Flow Samples	Counter Samples
1	0	0
2	0	0
20	0	0
21	0	0

Figure 4-182: sFlow Statistics displays

Table 4-174: sFlow Statistics

Receiver Statistics	
Owner.	This field shows the current owner of the sFlow configuration. It assumes one of three values as follows: • If sFlow is currently unconfigured /unclaimed, Owner contains **<None>**. • If sFlow is currently configured through Web or CLI, Owner contains **<Configured through local management>**. • If sFlow is currently configured through SNMP, Owner contains a string identifying the sFlow receiver.
IP Address / Hostname	The IP address or hostname of the sFlow receiver
Timeout	The number of seconds remaining before sampling stops and the current sFlow owner is released.
Tx Successes	The number of UDP datagrams successfully sent to the sFlow receiver.
Tx Errors	The number of UDP datagrams that has failed transmission. The most common source of errors is invalid sFlow receiver IP/hostname configuration. To diagnose, paste the receiver's IP address/hostname into the Ping Web page (Diagnostics → Ping/Ping6).
Flow Sample	The total number of flow samples sent to the sFlow receiver.
Counter Samples	The total number of counter samples sent to the sFlow receiver.
Port Configuration	
Port	The port number for which the following statistics applies.
Flow Samples	The number of flow samples sent to the sFlow receiver originating from this port.
Counter Samples	The total number of counter samples sent to the sFlow receiver originating from this port.

4.24 UDLD Configuration

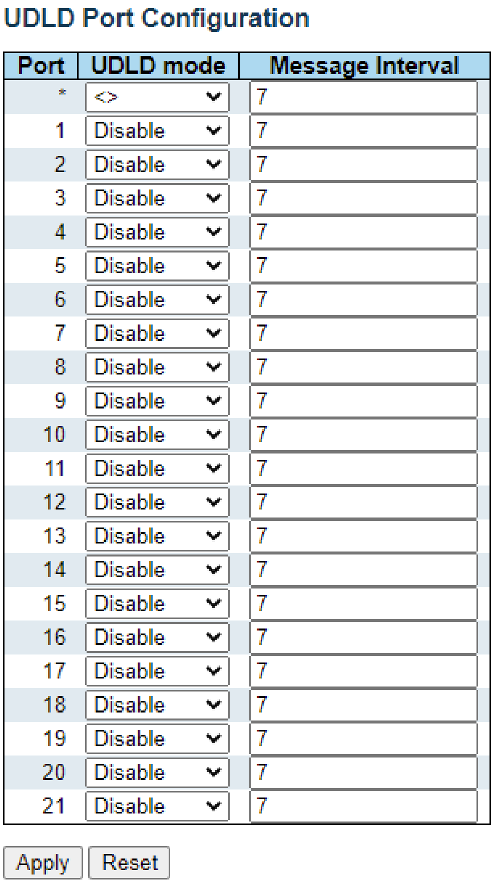
UDLD is an acronym for **U**ni **D**irectional **L**ink **D**etection. UDLD protocol monitors the physical configuration of the links between devices and ports that support UDLD. It detects the existence of unidirectional links. Its functionality is to provide mechanisms useful for detecting one-way connections before they create a loop or other protocol malfunction.

RFC 5171 specifies a way at data link layer to detect Uni directional link.

This section allows the user to inspect the current UDLD configurations, and possibly change them as well.

4.24.1 UDLD Port Configuration

Web GUI: Configuration > UDLD



UDLD Port Configuration

Port	UDLD mode	Message Interval
*	<>	7
1	Disable	7
2	Disable	7
3	Disable	7
4	Disable	7
5	Disable	7
6	Disable	7
7	Disable	7
8	Disable	7
9	Disable	7
10	Disable	7
11	Disable	7
12	Disable	7
13	Disable	7
14	Disable	7
15	Disable	7
16	Disable	7
17	Disable	7
18	Disable	7
19	Disable	7
20	Disable	7
21	Disable	7

Figure 4-183: UDLD Port Configuration display

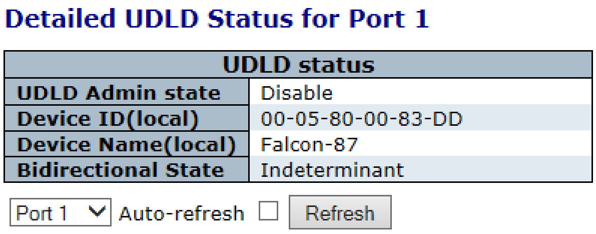
Table 4-175: UDLD Port Configuration parameters

UDLD Port Configuration	
Port	Port number of the switch.
UDLD Mode	Configure the UDLD mode on a port. Valid values are **Disable**, **Normal** and **Aggressive**. Default mode is **Disable**. **Disable:** In disabled mode, UDLD functionality doesn't exists on port. **Normal**: In normal mode, if the link state of the port was determined to be unidirectional, it will not affect the port state. **Aggressive**: In aggressive mode, unidirectional detected ports will get shutdown to bring back the ports up, need to disable UDLD on that port.
Message Interval	Configures the period of time between UDLD probe messages on ports that are in the advertisement phase and are determined to be bidirectional. The range is from 7 to 90 seconds (Default value is 7 seconds) (Currently default time interval is supported, due to lack of detailed information in RFC 5171).

4.24.2 Detailed UDLD Status for Port 1

This section displays the UDLD status of the selected port

Web GUI: Configuration > UDLD



Detailed UDLD Status for Port 1

UDLD status	
UDLD Admin state	Disable
Device ID(local)	00-05-80-00-83-DD
Device Name(local)	Falcon-87
Bidirectional State	Indeterminant

Figure 4-184: UDLD Status for Port 1

Table 4-176: UDLD Status for Port 1 parameters

UDLD Port Status	
UDLD Admin State	The current port state of the logical port, is Enabled if any of state (Normal, Aggressive) is **Enabled**.
Device ID (local)	The ID of Device.
Device Name (local)	Name of the Device.
Bidirectional State	The current state of the port.
Neighbor Status	
Port	The current port of neighbor device.
Device ID (local)	The ID of neighbor device.
Link Status	The current link status of neighbor port.
Device Name (local)	Name of the neighbor device.

5 Management

5.1 General Introduction

The R Class series can be remotely or locally managed via a variety of mechanisms/platforms with virtually no integration effort:

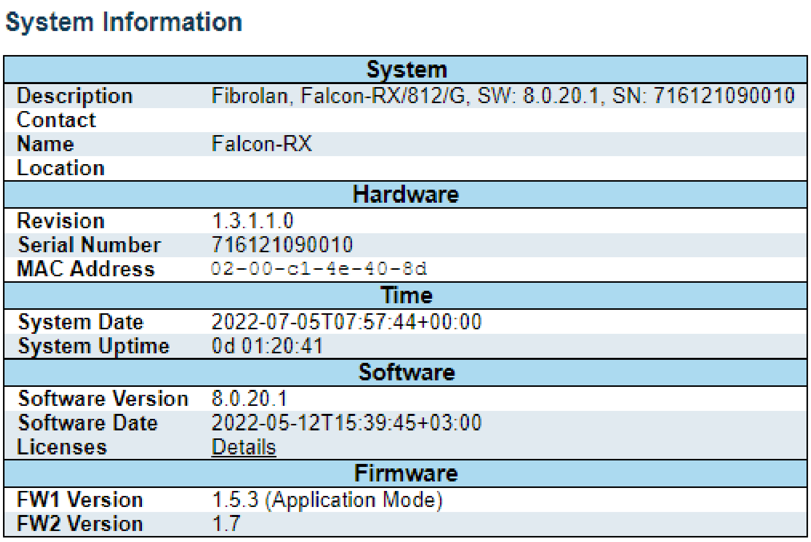
1. IP Based (in-band): SNMP (v1/v2/v3), Telnet (CLI), SSH, Web – HTTP/HTTPS.

2. Console (RJ-45): RS-232 (115200Bd) CLI (Cisco like).

5.1.1 System Information

This section provides general information about the system.

Web GUI: Monitor > System > Information



System Information

System	
Description	Fibrolan, Falcon-RX/812/G, SW: 8.0.20.1, SN: 716121090010
Contact	
Name	Falcon-RX
Location	
Hardware	
Revision	1.3.1.1.0
Serial Number	716121090010
MAC Address	02-00-c1-4e-40-8d
Time	
System Date	2022-07-05T07:57:44+00:00
System Uptime	0d 01:20:41
Software	
Software Version	8.0.20.1
Software Date	2022-05-12T15:39:45+03:00
Licenses	Details
Firmware	
FW1 Version	1.5.3 (Application Mode)
FW2 Version	1.7

Figure 5-1: System Information

Table 5-1: System Information Parameters

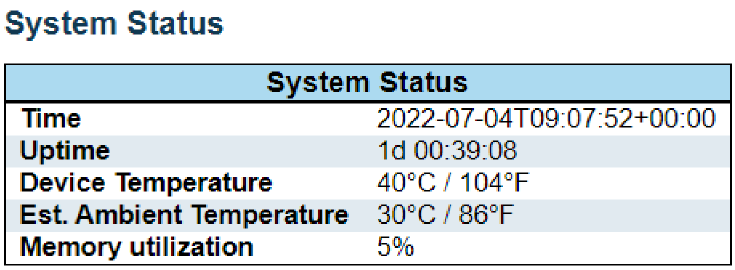
Contact	The system contact configured in Configuration | System | Information | System Contact.
Name	The system name configured in Configuration | System | Information | System Name.
Location	The system location configured in Configuration | System | Information | System Location
MAC Address	The MAC Address of this switch.
Chip ID	The Chip ID of this switch.
System Date	The current (GMT) system time and date. The system time is obtained through the Timing server running on the switch, if any.
System Uptime	The period of time the device has been operational.

Software Version	The software version of this switch.
Software Date	The date when the switch software was produced.
Code Revision	The version control identifier of the switch software.

5.1.2 System Status

The switch system status is provided here.

Web GUI: Monitor > System > Status



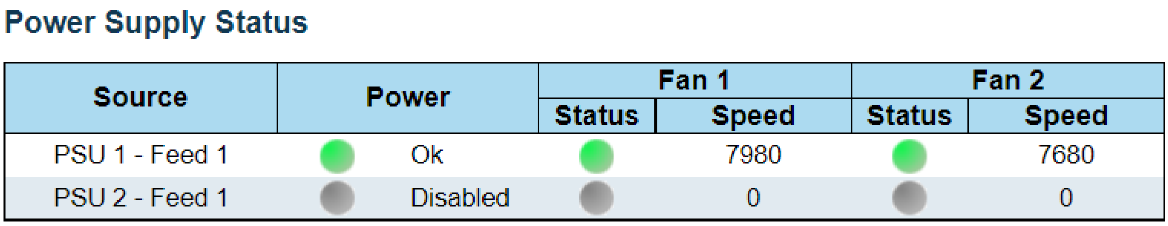
System Status

System Status	
Time	2022-07-04T09:07:52+00:00
Uptime	1d 00:39:08
Device Temperature	40°C / 104°F
Est. Ambient Temperature	30°C / 86°F
Memory utilization	5%

Figure 5-2: System Status

Table 5-2: System Status Parameters

System Status	
Time	The current (GMT) system time and date. The system time is obtained through the Timing server running on the switch, if any.
Uptime	The period the device has been operational.
Device Temperature	The device actual temperature.
Estimated Ambient Temperature	The estimated ambient temperature.
Memory utilization	Derived from the percent of available memory in use at a given moment.



Power Supply Status

Source	Power		Fan 1		Fan 2	
			Status	Speed	Status	Speed
PSU 1 - Feed 1	●	Ok	●	7980	●	7680
PSU 2 - Feed 1	●	Disabled	●	0	●	0

Figure 5-3: Power Supply Status

Table 5-3: Power Supply Status Parameters

Power Supply Status	
Source	Indicate which power supply is installed/not installed.
Power	Indicate if PS is up or disable.
Fan	Indicate the status of the Fan (if any).

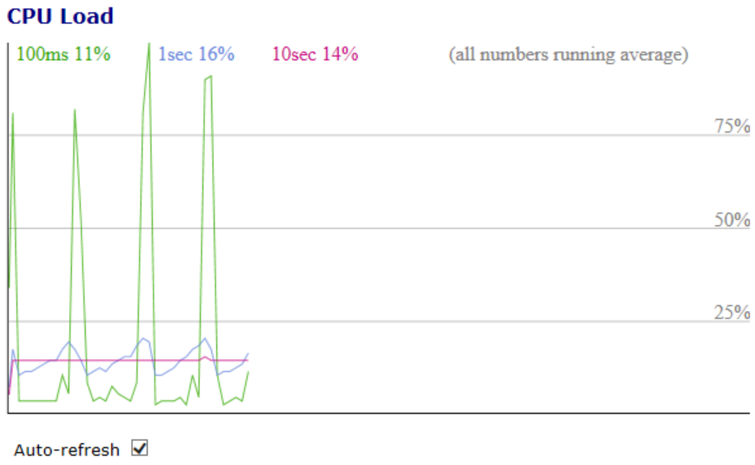
5.1.3 CPU Load

This page displays the CPU load, using an SVG graph.

The load is measured as averaged over the last 100ms, 1sec and 10 seconds intervals. The last 120 samples are graphed, and the last numbers are displayed as text as well.

To display the SVG graph, your browser must support the SVG format. Consult the SVG Wiki for more information on browser support. Specifically, at the time of writing, Microsoft Internet Explorer will need to have a plug-in installed to support SVG.

Web GUI: Monitor > System > CPU Load



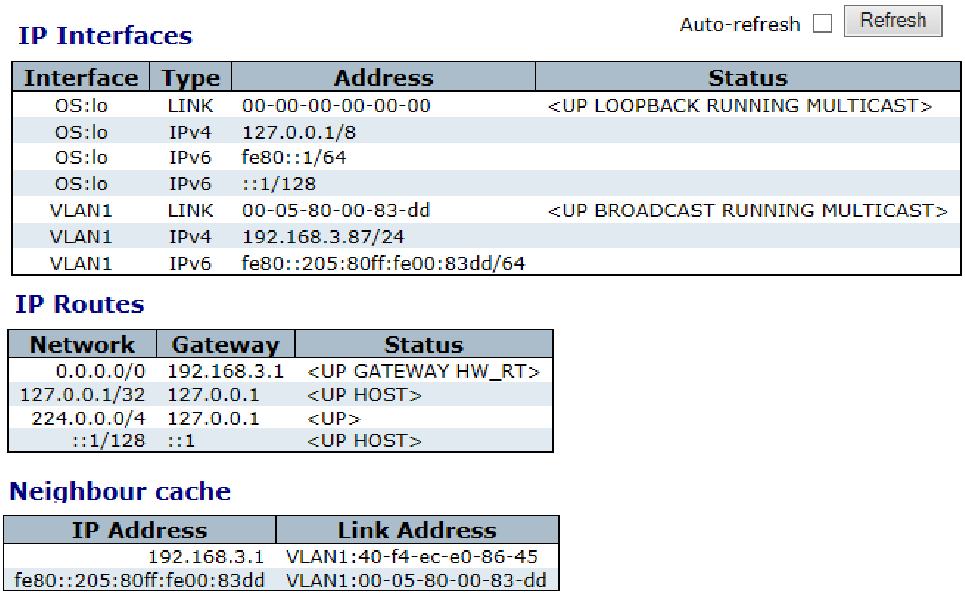
Auto-refresh ☑

Figure 5-4: CPU Load

5.1.4 IP Status

This section displays the status of the IP protocol layer. The status is defined by the IP interfaces, the IP routes and the neighbor cache (ARP cache) status.

Web GUI: Monitor > System > IP Status



IP Interfaces

Interface	Type	Address	Status
OS:lo	LINK	00-00-00-00-00-00	<UP LOOPBACK RUNNING MULTICAST>
OS:lo	IPv4	127.0.0.1/8	
OS:lo	IPv6	fe80::1/64	
OS:lo	IPv6	::1/128	
VLAN1	LINK	00-05-80-00-83-dd	<UP BROADCAST RUNNING MULTICAST>
VLAN1	IPv4	192.168.3.87/24	
VLAN1	IPv6	fe80::205:80ff:fe00:83dd/64	

IP Routes

Network	Gateway	Status
0.0.0.0/0	192.168.3.1	<UP GATEWAY HW_RT>
127.0.0.1/32	127.0.0.1	<UP HOST>
224.0.0.0/4	127.0.0.1	<UP>
::1/128	::1	<UP HOST>

Neighbour cache

IP Address	Link Address
192.168.3.1	VLAN1:40-f4-ec-e0-86-45
fe80::205:80ff:fe00:83dd	VLAN1:00-05-80-00-83-dd

Figure 5-5: IP Status displays

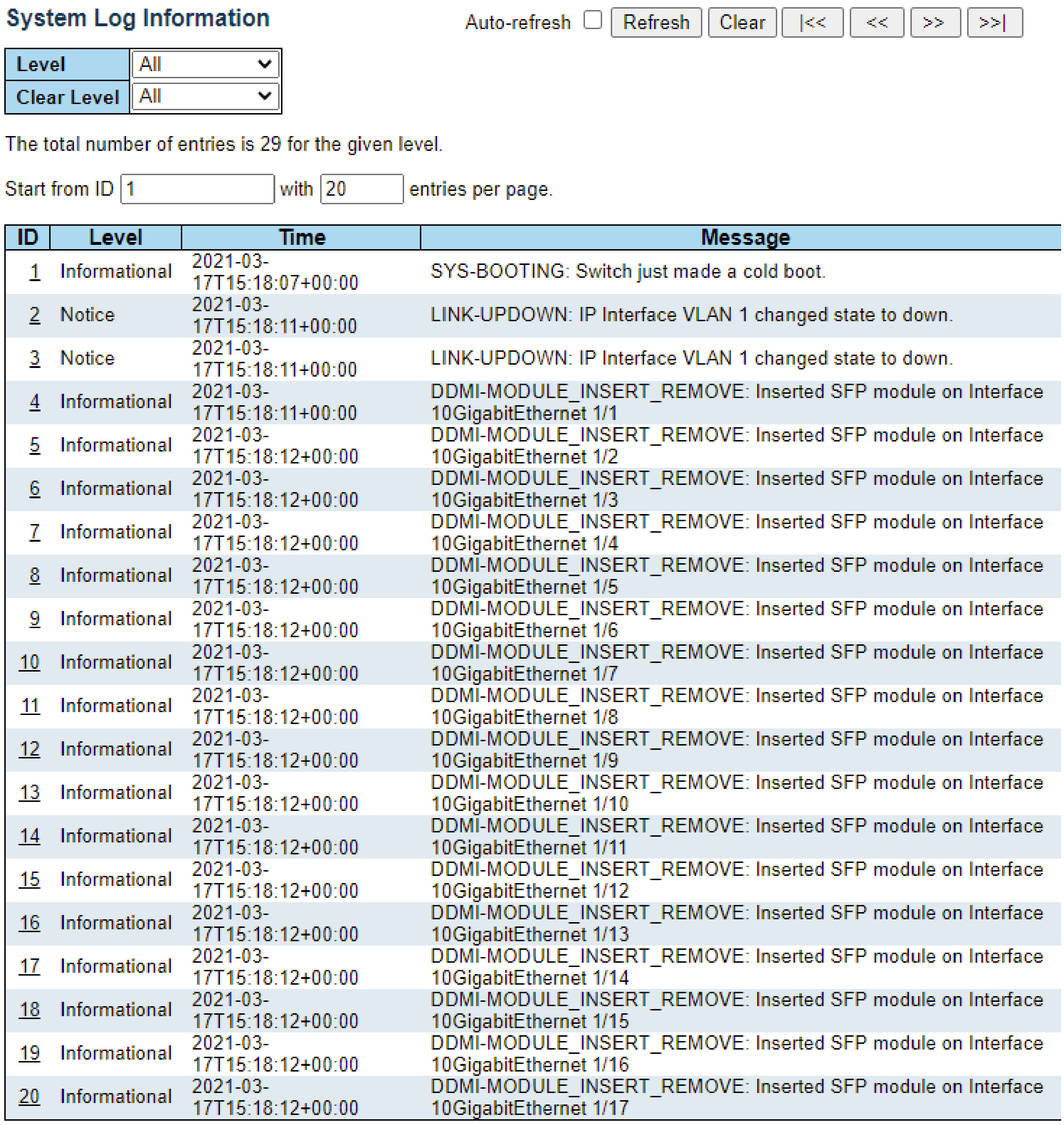
Table 5-4: IP Status displays Parameters

IP Interfaces	
Interface	The name of the interface.
Type	The address type of the entry. This may be **LINK**, **IPv4** or **IPv6**.
Address	The current address of the interface (of the given type).
Status	The status flags of the interface (and/or address).
IP Routes	
Network	The destination IP network or host address of this route.
Gateway	The gateway address of this route.
Status	The status flags of the route.
Neighbor cache	
IP Address	The IPv4/IPv6 address of the entry.
Link Address	Link (MAC) address for which a binding to the IP address given exist.

5.1.5 System Log Information

The switch system log information is provided here.

Web GUI: Monitor > System > Log



Level: All

Clear Level: All

The total number of entries is 29 for the given level.

Start from ID 1 with 20 entries per page.

ID	Level	Time	Message
1	Informational	2021-03-17T15:18:07+00:00	SYS-BOOTING: Switch just made a cold boot.
2	Notice	2021-03-17T15:18:11+00:00	LINK-UPDOWN: IP Interface VLAN 1 changed state to down.
3	Notice	2021-03-17T15:18:11+00:00	LINK-UPDOWN: IP Interface VLAN 1 changed state to down.
4	Informational	2021-03-17T15:18:11+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/1
5	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/2
6	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/3
7	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/4
8	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/5
9	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/6
10	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/7
11	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/8
12	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/9
13	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/10
14	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/11
15	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/12
16	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/13
17	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/14
18	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/15
19	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/16
20	Informational	2021-03-17T15:18:12+00:00	DDMI-MODULE_INSERT_REMOVE: Inserted SFP module on Interface 10GigabitEthernet 1/17

Figure 5-6: System log information

Table 5-5: System Log Information Parameters

System Log Information Entry Columns	
ID	The identification of the system log entry.
Level	The level of the system log entry. Info: The system log entry is belonged information level. Warning: The system log entry is belonged warning level. Error: The system log entry is belonged error level.
Time	The occurred time of the system log entry.
Message	The detail message of the system log entry.
Navigating the System Log Information Table	

Each page shows up to 999 table entries, selected through the "entries per page" input field. When first visited, the web page will show the beginning entries of this table. The **Level** input field is used to filter the display system log entries. The **Clear Level** input field is used to specify which system log entries will be cleared. To clear specific system log entries, select the clear level first then click the **Clear** button. The **Start from ID** input field allow the user to change the starting point in this table.

Clicking the **Refresh** button will update the displayed table starting from that or the closest next entry match.

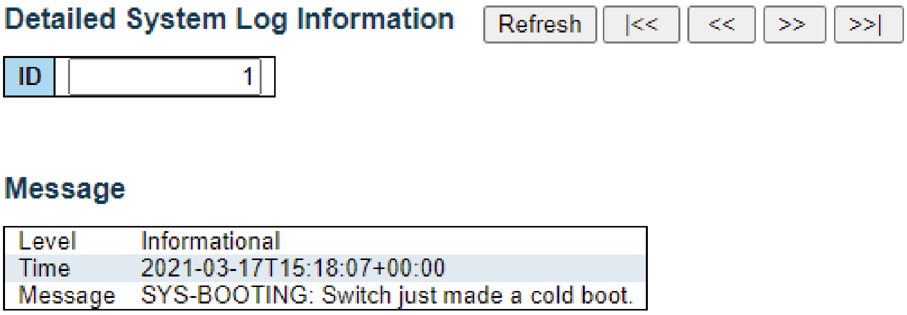
In addition, these input fields will upon a **Refresh** button click - assume the value of the first displayed entry, allowing for continuous refresh with the same start input field.

The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** to start over.

5.1.6 Detailed System Log Information

The switch system detailed log information is provided here.

Web GUI: Monitor > System > Detailed Log



Level	Informational
Time	2021-03-17T15:18:07+00:00
Message	SYS-BOOTING: Switch just made a cold boot.

Figure 5-7: Detailed system log information

Table 5-6: Detailed System Log Information Parameters

Detailed System Log Information	
Level	The severity level of the system log entry
ID	The ID (>= 1) of the system log entry.
Message	The detailed message of the system log entry.

5.2 DHCP (Dynamic Host Configuration Protocol)

DHCP is an acronym for **D**ynamic **H**ost **C**onfiguration **P**rotocol. It provides a complete description of a mathematical algorithm for encrypting (enciphering) and decrypting (deciphering) binary coded information.

DHCP used by networked computers (clients) to obtain IP addresses and other parameters such as the default gateway, subnet mask, and IP addresses of DNS servers from a DHCP server.

The DHCP server ensures that all IP addresses are unique, for example, no IP address is assigned to a second client while the first client's assignment is valid (its lease has not expired). Therefore, IP address pool management is done by the server and not by a human network administrator.

Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means that a new computer can be added to a network without the hassle of manually assigning it a unique IP address.

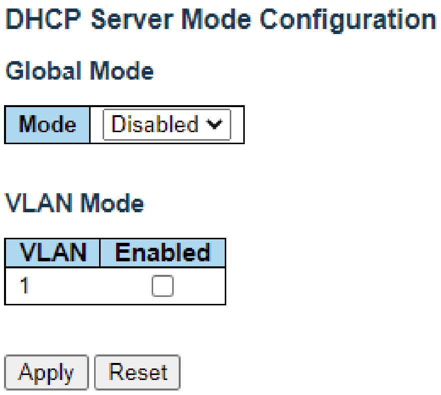
5.2.1 DHCP Server Mode Configuration

DHCP Server is used to allocate network addresses and deliver configuration parameters to dynamically configured hosts called DHCP client.

This section configures global mode and VLAN mode to enable/disable DHCP server per system and per VLAN.

DHCP Server is used to allocate network addresses and deliver configuration parameters to dynamically configured hosts called DHCP client.

Web GUI: Configuration > DHCP > Server > Mode



DHCP Server Mode Configuration

Global Mode

Mode	Disabled

VLAN Mode

VLAN	Enabled
1	☐

Figure 5-8: DHCP Server Mode Configuration

Table 5-7: DHCP Server Mode Configuration Parameters

Global Mode Configure operation mode to enable/disable DHCP server per system.	
Configure the operation mode per system. Possible modes are:.	
Enabled	Enable DHCP server per system.
Disabled	Disable DHCP server pre system
VLAN Mode Configure operation mode to enable/disable DHCP server per VLAN.	
VLAN Range	
Indicate the VLAN range in which DHCP server is enabled or disabled. The first VLAN ID must be smaller than or equal to the second VLAN ID. BUT, if the VLAN range contains only 1 VLAN ID, then you can just input it into either one of the first and second VLAN ID or both. On the other hand, if you want to disable existed VLAN range, then you can follow the steps: 1. Press **Add VLAN Range** to add a new VLAN range 2. Input the VLAN range that you want to disable 3. Choose Mode to be **Disabled**. 4. Press **Save** to apply the change Then, you will see the disabled VLAN range is removed from the DHCP Server mode configuration page.	
Mode	
Indicate the operation mode per VLAN. Possible modes are:	
Enabled	Enable DHCP server per VLAN.
Disabled	Disable DHCP server pre VLAN.
Buttons	**Add VLAN Range**: Click to add a new VLAN range.

5.2.2 DHCP Server Excluded IP Configuration

This section configures excluded IP addresses. DHCP server will not allocate these excluded IP addresses to DHCP client.

Web GUI: Configuration > DHCP > Server > Excluded IP

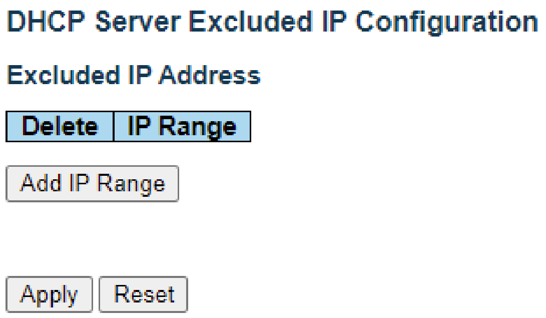


Figure 5-9: DHCP Server Excluded IP Configuration

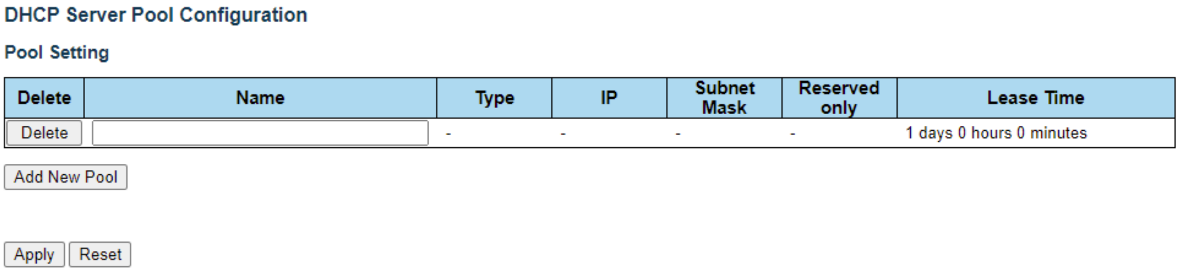
Table 5-8: DHCP Server Excluded IP Configuration Parameters

Excluded IP Address	
Configure excluded IP addresses.	
Delete	Delete Excluded Ip Address operation
IP Range	Define the IP Range to be excluded. The first excluded IP must be smaller than or equal to the second excluded IP. BUT, if the IP range contains only 1 excluded IP, then you can just input it to either one of the first and second excluded IP or both
Buttons	**Add IP Range**: Click to add anew exclude IP range.

5.2.3 DHCP Server Pool Configuration

This page manages DHCP pools. According to the DHCP pool, DHCP server will allocate IP address and deliver configuration parameters to DHCP client.

Web GUI: Configuration > DHCP > Server > Pool



DHCP Server Pool Configuration

Pool Setting

Delete	Name	Type	IP	Subnet Mask	Reserved only	Lease Time
Delete		-	-	-	-	1 days 0 hours 0 minutes

Figure 5-10: DHCP Server Pool Configuration

Table 5-9: DHCP Server Pool Configuration Parameters

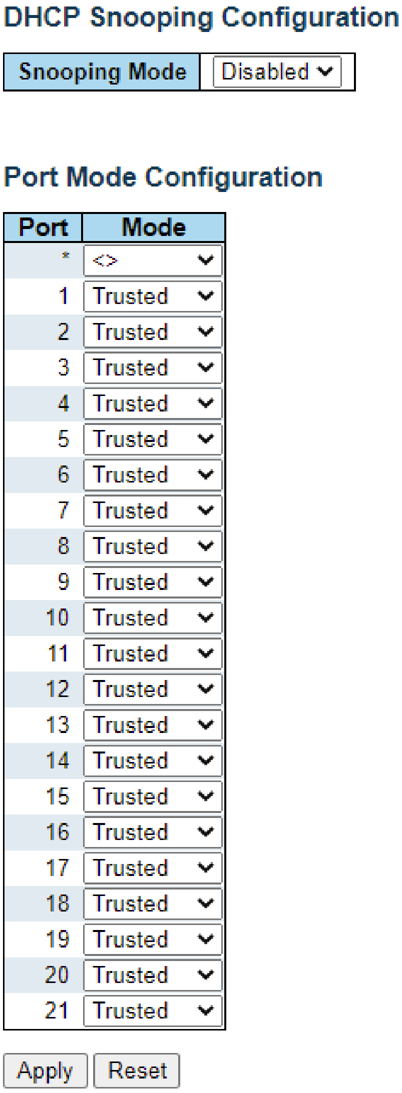
Pool Setting	
	Add or delete pools. Adding a pool and giving a name is to create a new pool with "default" configuration. If you want to configure all settings including type, IP subnet mask and lease time, you can click the pool name to go into the configuration page.
Name	Configure the pool name that accepts all printable characters, except white space. If you want to configure the detail settings, you can click the pool name to go into the configuration page.
Type	Display which types of pool is: • **Network**: the pool defines a pool of IP addresses to service more than one DHCP client. • **Host**: the pool services for a specific DHCP client identified by client identifier or hardware address. If "-" is displayed, it means not defined.
IP	Display network number of the DHCP address pool. If "-" is displayed, it means not defined.

Subnet Mask	Display subnet mask of the DHCP address pool. If "-" is displayed, it means not defined.
Reserved Only	If on, Ip addresses obtainable from the pool are limited to those entered into the reserved entries table.
Lease Time	Display lease time of the pool.

5.2.4 DHCP Snooping Configuration

Configure DHCP Snooping on this section.

Web GUI: Configuration > DHCP > Snooping


DHCP Snooping Configuration

Snooping Mode: Disabled

Port Mode Configuration

Port	Mode
*	<>
1	Trusted
2	Trusted
3	Trusted
4	Trusted
5	Trusted
6	Trusted
7	Trusted
8	Trusted
9	Trusted
10	Trusted
11	Trusted
12	Trusted
13	Trusted
14	Trusted
15	Trusted
16	Trusted
17	Trusted
18	Trusted
19	Trusted
20	Trusted
21	Trusted

Figure 5-11: Snooping Configuration

Table 5-10: Snooping Configuration Parameters

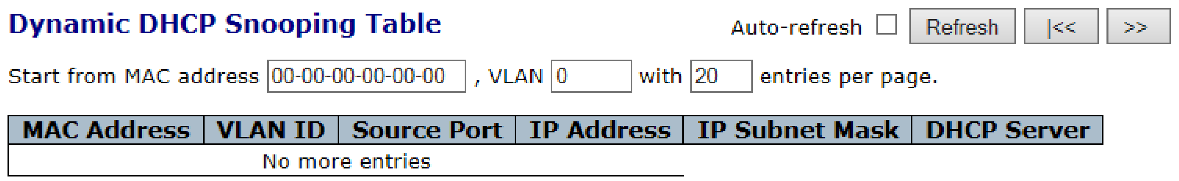
DHCP Snooping Configuration	
Snooping mode	Indicates the DHCP Snooping mode of operation. Possible modes are: **Enabled**: Enable DHCP snooping mode operation. When DHCP snooping mode operation is enabled, the DHCP request messages will be forwarded to trusted ports and only allow reply packets from trusted ports. **Disabled**: Disable DHCP snooping mode operation.
Port Mode Configuration	Indicates the DHCP snooping mode. Possible modes are: **Trusted**: Configures the port as trusted source of the DHCP messages. **Untrusted**: Configures the port as untrusted source of the DHCP messages.

5.2.5 Dynamic DHCP Snooping

This page display the dynamic IP assigned information after DHCP Snooping mode is disabled.

All DHCP clients obtained the dynamic IP address from the DHCP server will be listed in this table except for local VLAN interface IP addresses. Entries in the Dynamic DHCP snooping Table are shown on this section

Web GUI: Monitor > DHCP > Snooping Table



Start from MAC address 00-00-00-00-00-00 , VLAN 0 with 20 entries per page.

MAC Address	VLAN ID	Source Port	IP Address	IP Subnet Mask	DHCP Server
No more entries					

Figure 5-12: Dynamic DHCP Snooping Table

Table 5-11: Dynamic DHCP Snooping Table Parameters

Dynamic DHCP snoopingTable	
MAC Address	User MAC address of the entry
VLAN ID	VLAN-ID in which the DHCP traffic is permitted
Source Port	Switch Port Number for which the entries are displayed
IP Address	User IP address of the entry
IP Subnet Mask	User IP subnet mask of the entry
DHCP Server Address	DHCP Server address of the entry
Navigating the DHCP snooping Table Each page shows up to 99 entries from the, Dynamic DHCP snooping table, default being 20, selected through the “entries per page” input field. When first visited, the web page will show the first 20 entries from the beginning of the Dynamic DHCP snooping Table. The “MAC address” and “VLAN” input fields allows the user to select the starting point in the Dynamic DHCP snooping Table.	

Clicking the **Refresh** button will update the displayed table starting from that or the closest next MVR Channels (Groups) Information Table match.

In addition, the two input fields will – upon a **Refresh** button click – assume the value of the first displayed entry, allowing for continuous refresh with the same start address.

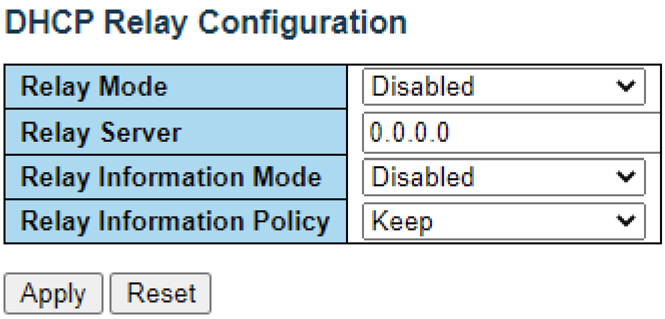
The **>>** will use the last entry of the currently displayed table as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<** button to start over.

5.2.6 DHCP Relay Configuration

A DHCP relay agent is used to forward and to transfer DHCP messages between the clients and the server when they are not in the same subnet domain.

It stores the incoming interface IP address in the GIADDR field of the DHCP packet. The DHCP server can use the value of GIADDR field to determine the assigned subnet. For such condition, please make sure the switch configuration of VLAN interface IP address and PVID (Port VLAN ID) correctly.

Web GUI: Configuration > DHCP > Relay



DHCP Relay Configuration

Relay Mode	Disabled
Relay Server	0.0.0.0
Relay Information Mode	Disabled
Relay Information Policy	Keep

Figure 5-13: DHCP Relay Configuration

Table 5-12: DHCP Relay Configuration Parameters

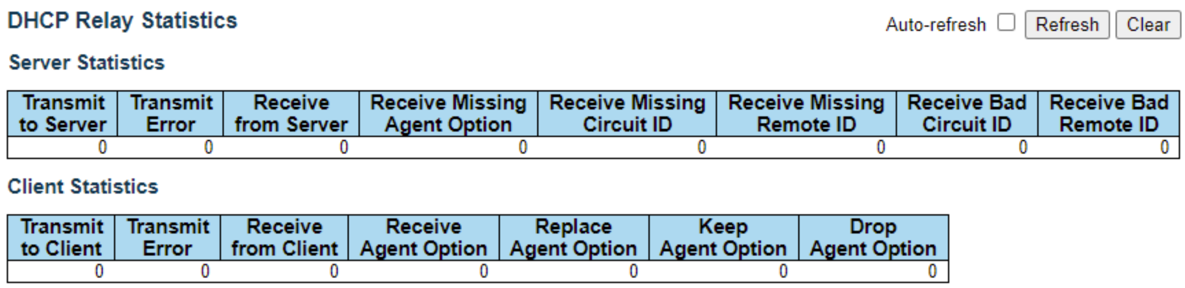
Relay Mode	Indicates the DHCP relay mode operation. Possible modes are: • **Enabled**: Enable DHCP relay mode operation. When DHCP relay mode operation is enabled, the agent forwards and transfers DHCP messages between the clients and the server when they are not in the same subnet domain. And the DHCP broadcast message won't be flooded for security considerations. • **Disabled**: Disable DHCP relay mode operation.
Relay Server	Indicates the DHCP relay server IP address.
Relay Information Mode	Indicates the DHCP relay information mode option operation. The option 82 circuit ID format as "[vlan_id][module_id][port_no]". The first four characters represent the VLAN ID, the fifth and sixth characters are the module ID (in standalone device it is always equal 0, in stackable device it means switch ID) and the last two characters are the port number. For example, "00030108" means the message receives form VLAN ID 3, switch ID 1, port No 8. And the option 82 remote ID value is equal the switch MAC address. Possible modes are:

	• **Enabled**: Enable DHCP relay information mode operation. When DHCP relay information mode operation is enabled, the agent inserts specific information (option 82) into a DHCP message when forwarding to DHCP server and removes it from a DHCP message when transferring to DHCP client. It only works when DHCP relay operation mode is enabled. • **Disabled**: Disable DHCP relay information mode operation.
Relay Information Policy	Indicates the DHCP relay information option policy. When DHCP relay information mode operation is enabled, if agent receives a DHCP message that already contains relay agent information it will enforce the policy. And it only works under DHCP if relay information operation mode is enabled. Possible policies are: Replace: Replace the original relay information when a DHCP message that already contains it is received. Keep: Keep the original relay information when a DHCP message that already contains it is received. Drop: Drop the package when a DHCP message that already contains relay information is received.
	Drop: Drop the package when a DHCP message that already contains relay information is received.

5.2.7 DHCP Relay Statistics

R Class series provide statistics for DHCP relay, which is used to forward and to transfer DHCP messages between the clients and the server when they are not on the same subnet domain. Note: for a detailed description of the DHCP Relay feature, go to DHCP Relay Configuration.

Web GUI: Monitor > DHCP > Relay Statistics



DHCP Relay Statistics

Server Statistics

Transmit to Server	Transmit Error	Receive from Server	Receive Missing Agent Option	Receive Missing Circuit ID	Receive Missing Remote ID	Receive Bad Circuit ID	Receive Bad Remote ID
0	0	0	0	0	0	0	0

Client Statistics

Transmit to Client	Transmit Error	Receive from Client	Receive Agent Option	Replace Agent Option	Keep Agent Option	Drop Agent Option
0	0	0	0	0	0	0

Figure 5-14: DHCP Relay Statistics

Table 5-13: DHCP Relay Statistics Parameters

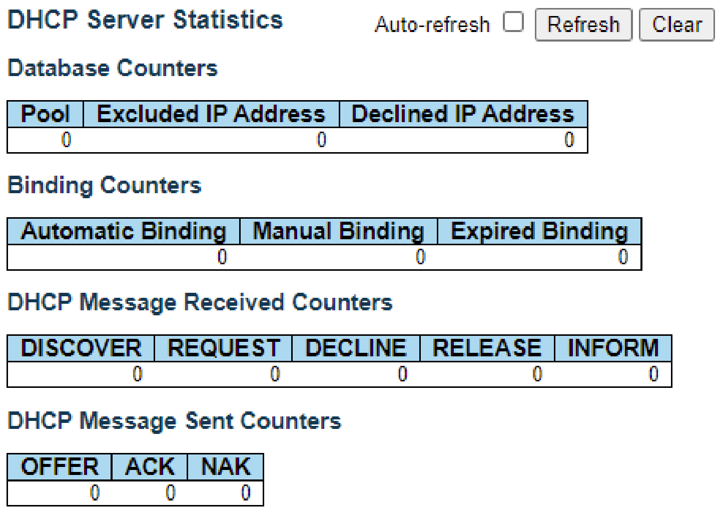
Server Statistics	
Transmit to Server	The number of packets that are relayed from client to server.
Transmit Error	The number of packets that resulted in errors while being sent to client
Receive from Server	The packets number received from server.
Receive Missing Agent Option	The number of packets received without agent information options.

Receive Missing Circuit ID	The number of packets received with the Circuit ID option missing.
Receive Missing Remote ID	The number of packets received with the remote ID option missing.
Receive Bad Circuit ID	The number of packets received with the Circuit ID option did not match known circuit ID.
Receive Bad Remote ID	The packets number of which the Remote ID option did not match known Remote ID.
Client Statistics	
Transmit to Client	The number of relayed packets from server to client.
Transmit Error	The number of packets that resulted in error while being sent to servers.
Receive from Client	The number of received packets from server.
Receive Agent Option	The number of received packets with relay agent information option.
Replace Agent Option	The number of received packets with relay agent information option.
Keep Agent option	The number of packets whose relay agent information was retained.
Drop Agent option	The number of packets that were dropped which were received with relay agent information.

5.2.8 DHCP Server Statistics

This section displays the database counters and the number of DHCP messages sent and received by DHCP server.

Web GUI: Monitor > DHCP > Server > Statistics



DHCP Server Statistics

Database Counters

Pool	Excluded IP Address	Declined IP Address
0	0	0

Binding Counters

Automatic Binding	Manual Binding	Expired Binding
0	0	0

DHCP Message Received Counters

DISCOVER	REQUEST	DECLINE	RELEASE	INFORM
0	0	0	0	0

DHCP Message Sent Counters

OFFER	ACK	NAK
0	0	0

Figure 5-15: DHCP Server Statistics

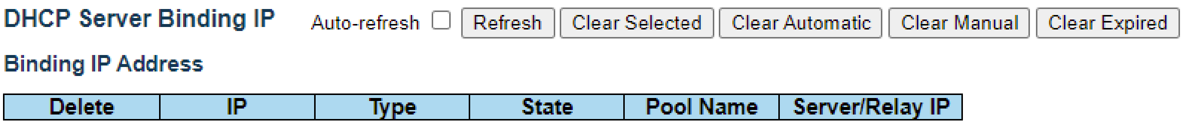
Table 5-14: DHCP Server Statistics Parameters

Database Counters	
Display counters of various databases.	
Pool	Number of pools
Excluded IP Address	Number of excluded IP address ranges
Declined IP Address	Number of declined IP addresses.
Binding Counters	
Display counters of various databases.	
Automatic Number Binding	Number of bindings with network-type pools.
Manual Binding	Number of bindings that administrator assigns an IP address to a client. That is, the pool is of host type.
Expired Binding	Number of bindings that their lease time expired, or they are cleared from Automatic/Manual type bindings.
DHCP Message Received Counters	
DISCOVER	Number of DHCP DISCOVER messages received.
REQUEST	Number of DHCP REQUEST messages received.
DECLINE	Number of DHCP DECLINE messages received.
RELEASE	Number of DHCP RELEASE messages received.
INFORM	Number of DHCP INFORM messages received.
DHCP Message Sent Counters	
OFFER	Number of DHCP OFFER messages sent.
ACK	Number of DHCP ACK messages sent.
NAK	Number of DHCP NAK messages sent.

5.2.9 DHCP Server Binding IP

This section displays bindings generated for DHCP clients.

Web GUI: Monitor > DHCP > Server > Binding



Delete	IP	Type	State	Pool Name	Server/Relay IP

Figure 5-16: DHCP Server Binding IP

Table 5-15: DHCP Server Binding IP Parameters

Binding IP Address	
IP	IP address allocated to DHCP client.
Type	Type of binding. Possible types are Automatic, Manual, Expired.
State	State of binding. Possible states are Committed, Allocated, Expired.
Pool Name	The pool that generates the binding.
Server/Relay IP	Either IP address of dhcp server or, in case of relayed binding, IP address of relay agent through which binding was negotiated.
Buttons	• **Clear Selected:** Click to clear selected bindings. If the selected binding is Automatic or Manual, then it is changed to be Expired. If the selected binding is Expired, then it is freed. • **Clear Automatic:** Click to clear all Automatic bindings and change them to Expired bindings. • **Clear Manual:** Click to clear all Manual bindings and change them to Expired bindings. • **Clear Expired:** Click to clear all Expired bindings and free them.

5.2.10 DHCP Server Declined IP

This section displays declined IP addresses.

Web GUI: Monitor > DHCP > Server > Declined IP

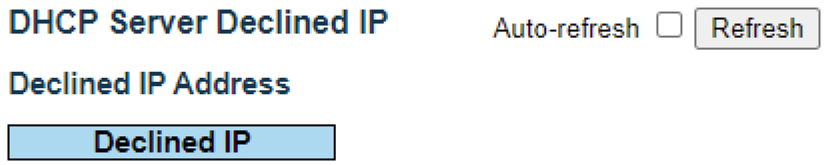


Figure 5-17: DHCP Server Declined IP

Table 5-16: DHCP Server Declined IP Parameters

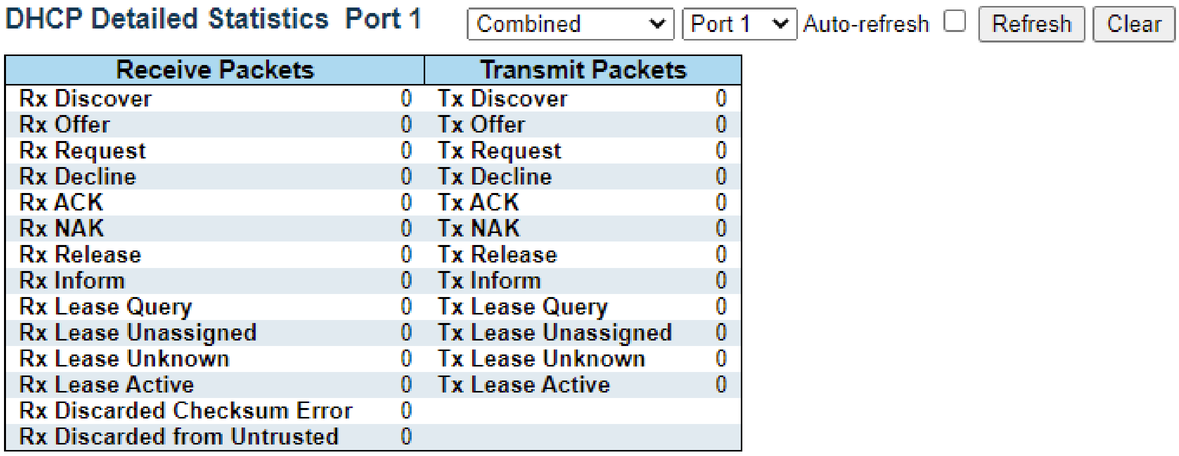
Declined IP Address	
Display IP addresses declined by DHCP clients.	
Declined IP	List of IP addresses declined.

5.2.11 DHCP Detailed Statistics Port 1

This page provides statistics for DHCP snooping.

Notice that the normal forward per-port TX statistics is not increased if the incoming DHCP packet is done by L3 forwarding mechanism. And clear the statistics on specific port may not take effect on global statistics since it gathers the different layer overview.

Web GUI: Monitor > DHCP > Detailed Statistics



Receive Packets		Transmit Packets	
Rx Discover	0	Tx Discover	0
Rx Offer	0	Tx Offer	0
Rx Request	0	Tx Request	0
Rx Decline	0	Tx Decline	0
Rx ACK	0	Tx ACK	0
Rx NAK	0	Tx NAK	0
Rx Release	0	Tx Release	0
Rx Inform	0	Tx Inform	0
Rx Lease Query	0	Tx Lease Query	0
Rx Lease Unassigned	0	Tx Lease Unassigned	0
Rx Lease Unknown	0	Tx Lease Unknown	0
Rx Lease Active	0	Tx Lease Active	0
Rx Discarded Checksum Error	0		
Rx Discarded from Untrusted	0		

Figure 5-18: DHCP Detailed Statistics Port 1

Table 5-17: DHCP Detailed Statistics Port 1

DHCP Detailed Statistics Port 1	
Rx and Tx Discover	The number of of discover (option 53 with value 1) packets received and transmitted.
Rx and Tx Offer	The number of offer (option 53 with value 2) packets received and transmitted.
Rx and Tx Request	The number of request (option 53 with value 3) packets received and transmitted.
Rx and Tx Decline	The number of of decline (option 53 with value 4) packets received and transmitted.
Rx and Tx ACK	The number of ACK (option 53 with value 5) packets received and transmitted.
Rx and Tx NAK	The number of NAK (option 53 with value 6) packets received and transmitted.
Rx and Tx Release	The number of release (option 53 with value 7) packets received and transmitted.
Rx and Tx Inform	The number of inform (option 53 with value 8) packets received and transmitted.
Rx and Tx Lease Query	The number of lease query (option 53 with value 10) packets received and transmitted.
Rx and Tx Lease Unassigned	The number of lease unassigned (option 53 with value 11) packets received and transmitted.
Rx and Tx Lease Unknown	The number of lease unknown (option 53 with value 12) packets received and transmitted.
Rx and Tx Lease Active	The number of lease active (option 53 with value 13) packets received and transmitted.

DHCP Detailed Statistics Port 1	
Rx Discarded checksum error	The number of discard packet that IP/UDP checksum is error.
Rx Discarded from Untrusted	The number of discarded packet that are coming from untrusted port.

5.3 Simple Network Management Protocol (SNMP)

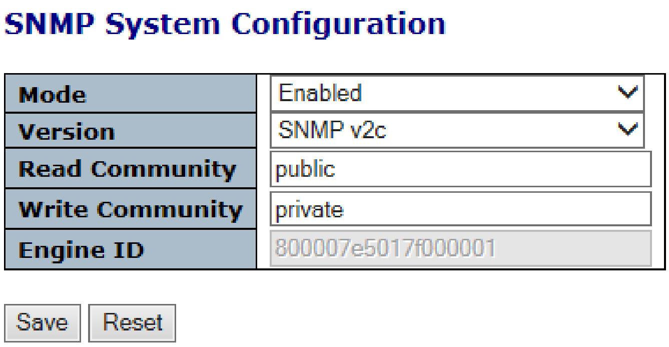
R Class series supports **SNMP** management, inspection and configuration.

The following screens are used to set SNMP System Configuration and SNMP Trap settings.

- SNMP System Configuration
- SNMPv3 Trap Configuration
- SNMPv3 Community Configuration
- SNMPv3 Users Configuration
- SNMPv3 Group Configuration
- SNMPv3 View Configuration
- SNMPv3 Access Configuration

5.3.1 SNMP System Configuration

Web GUI: Configuration > SNMP > System



SNMP System Configuration

Mode	Enabled
Version	SNMP v2c
Read Community	public
Write Community	private
Engine ID	800007e5017f000001

Figure 5-19: SNMP System Configuration display

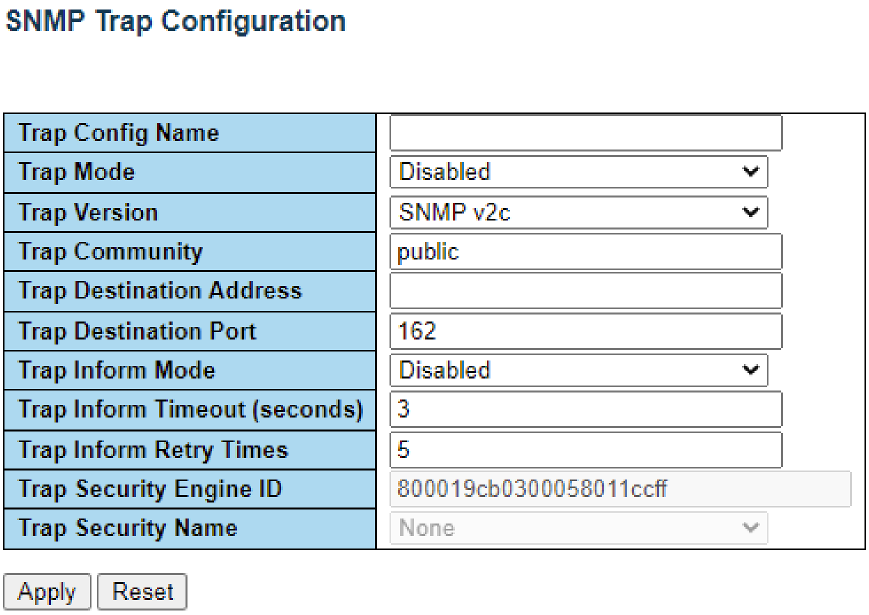
Table 5-18: SNMP System Configuration Parameters

SNMP System Configuration	
Mode	Indicate the SNMP mode operation. Possible modes are: • **Enabled**: Enable SNMP mode operation. • **Disabled**: Disable SNMP mode operation.
Engine ID	Indicates the SNMPv3 engine ID. The string must contain an even number (in hexadecimal format) with number of digits between 10 and 64, but all-zeros and all-'F's are not allowed. Change of the Engine ID will clear all original local users.

5.3.2 Trap Configuration

Configure the SNMP trap on this section.

Web GUI: Configuration > SNMP > System



SNMP Trap Configuration

Trap Config Name	
Trap Mode	Disabled
Trap Version	SNMP v2c
Trap Community	public
Trap Destination Address	
Trap Destination Port	162
Trap Inform Mode	Disabled
Trap Inform Timeout (seconds)	3
Trap Inform Retry Times	5
Trap Security Engine ID	800019cb0300058011ccff
Trap Security Name	None

Figure 5-20: SNMP Trap Configuration display

Table 5-19: SNMP Trap Configuration Parameters

SNMP Trap Detailed Configuration	
Config Name	Indicates which trap Configuration's name for configuring. The allowed string length is 1 to 32, and the allowed content is ASCII characters from 33 to 126.
Mode	Indicate the SNMP trap mode operation. Possible modes are: • **Enabled**: Enable SNMP trap mode operation. • **Disabled**: Disable SNMP trap mode operation.
Version	Indicate the SNMP trap version. Possible versions are: • **SNMP v1**: Set SNMP trap supported version 1. • **SNMP v2c**: Set SNMP supported version 2c. • **SNMP v3**: Set SNMP trap supported version 3.
Community	Indicates the community access string when sending SNMP trap packet. The allowed string length is 0 to 63, and the allowed content is ASCII characters from 33 to 126.

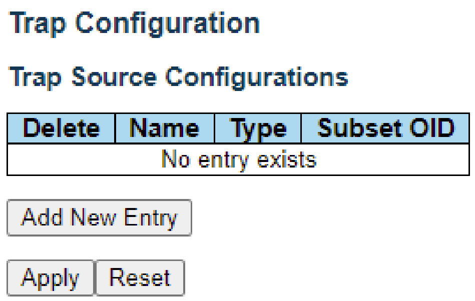
Destination Address	Indicates the SNMP trap destination address. It allows a valid IP address in dotted decimal notation ('x.y.z.w'). And it also allows a valid hostname. A valid hostname is a string drawn from the alphabet (A-Za-z), digits (0-9), dot (.), dash (-). Spaces are not allowed, the first character must be an alpha character, and the first and last characters must not be a dot or a dash. Indicates the SNMP trap destination IPv6 address. IPv6 address is in 128-bit records represented as eight fields of up to four hexadecimal digits with a colon separating each field (:). For example, 'fe80:: 215:c5ff:fe03:4dc7'. The symbol '::' is a special syntax that can be used as a shorthand way of representing multiple 16-bit groups of contiguous zeros; but it can appear only once. It can also represent a legally valid IPv4 address. For example, ':: 192.1.2.34'.
Destination port	Indicates the SNMP trap destination port SNMP Agent will send SNMP message via this port; the port range is 1~65535.
Inform Mode	Indicates the SNMP trap inform mode operation. Possible modes are: • **Enabled**: Enable SNMP trap inform mode operation. • **Disabled**: Disable SNMP trap inform mode operation.
Inform Timeout (seconds)	Indicates the SNMP trap inform timeout. The allowed range is 0 to 2147.
Inform Retry Times	Indicates the SNMP trap inform retry times. The allowed range is 0 to 255.
Security Engine ID	Indicates the SNMP trap security engine ID. SNMPv3 sends traps and informs using USM for authentication and privacy. A unique engine ID for these traps and informs is needed. The string must contain an even number (in hexadecimal format) with number of digits between 10 and 64, but all-zeros and all-'F's are not allowed.
Security Name	Indicates the SNMP trap security name. SNMPv3 traps and informs using USM for authentication and privacy. A unique security name is needed when traps and informs are enabled.
Trap Event	
Configure SNMP trap on this page.	
System	Enable/disable that the Interface group's traps. Possible traps are: • **Warm Start**: Enable/disable Warm Start trap. • **Cold Start**: Enable/disable Cold Start trap.
Interface	Indicates that the Interface group's traps. Possible traps are: Indicates that the SNMP entity is permitted to generate authentication failure traps. Possible modes are: • **Link Up**: Enable/disable Link up trap. • **Link Down**: Enable/disable Link down trap. • **LLDP**: Enable/disable LLDP trap.
Authentication	Indicates that the authentication group's traps. Possible traps are: SNMP Authentication Fail: Enable/disable SNMP trap authentication failure trap.

Switch	Indicates that the Switch group's traps. Possible traps are: • **STP**: Enable/disable STP trap. • **RMON**: Enable/disable RMON trap.

5.3.3 Trap Source Configurations

This page provides SNMP trap source configurations. A trap is sent for the given trap source if at least one filter with filter type included matches the filter, and no filters with filter type excluded matches.

Web GUI: Configuration > SNMP > Trap > Source



Trap Configuration

Trap Source Configurations

Delete	Name	Type	Subset OID
No entry exists			

v

Figure 5-21: SNMP Trap Source Configuration display

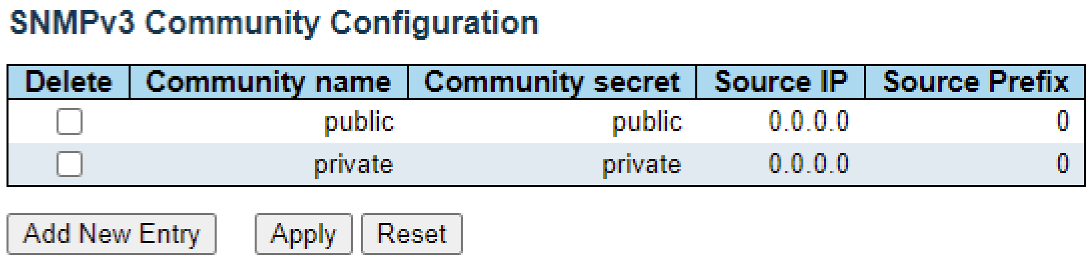
Table 5-20: SNMP Trap Source Configuration Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
Name	Indicates the name for the entry.
Type	The filter type for the entry. Possible types are: • **Included**: An optional flag to indicate a trap is sent for the given trap source is matched. • **Excluded**: An optional flag to indicate a trap is not sent for the given trap source is matched.
Subset OID	The subset OID for the entry. The value should depend on what kind of trap name. For example, the ifIdex is the subset OID of linkUp and linkDown. A valid subset OID is one or more digital number (0-4294967295) or asterisk (*) which are separated by dots(.). The first character must not begin with asterisk (*) and the maximum of OID count must not exceed 128

5.3.4 SNMPv3 Community Configuration

Configure SNMPv3 community table. The entry index key is "**Community".**

Web GUI: Configuration > SNMP > Communities



SNMPv3 Community Configuration

Delete	Community name	Community secret	Source IP	Source Prefix
☐	public	public	0.0.0.0	0
☐	private	private	0.0.0.0	0

Figure 5-22: SNMPv3 Community Configuration

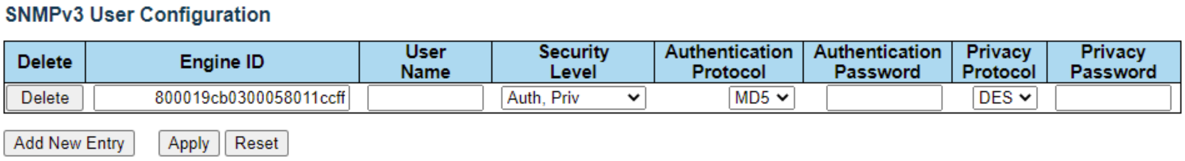
Table 5-21: SNMPv3 Community Configuration Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
Community Name	Indicates the security name to map the community to the SNMP Groups configuration. The allowed string length is 1 to 32, and the allowed content is ASCII characters from 33 to 126.
Community Secret	Indicates the community secret (access string) to permit access using SNMPv1 and SNMPv2c to the SNMP agent. The allowed string length is 1 to 32, and the allowed content is ASCII characters from 33 to 126.
Source IP	Indicates the SNMP access source address. A particular range of source addresses can be used to restrict source subnet when combined with source prefix.
Source Prefix	Indicates the SNMP access source address prefix.

5.3.5 SNMPv3 User Configuration

Configure **SNMP**v3 user table. The entry index keys are **Engine ID** and **Username.**

Web GUI: Configuration > SNMP > Users



SNMPv3 User Configuration

Delete	Engine ID	User Name	Security Level	Authentication Protocol	Authentication Password	Privacy Protocol	Privacy Password
Delete	800019cb0300058011ccff		Auth, Priv	MD5		DES	

Figure 5-23: SNMPv3 User Configuration

Table 5-22: SNMPv3 User Configuration Parameters

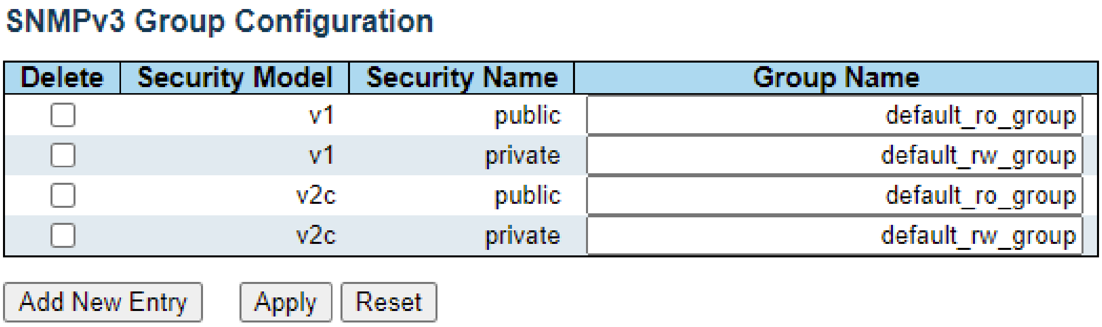
SNMPv3 User Configuration	
Delete	Check to delete the entry. It will be deleted during the next save.
Engine ID	An octet string identifying the engine ID that this entry should belong to. The string must contain an even number between 10 and 64 hexadecimal digits, but all-zeros and all-'F's are not allowed. The SNMPv3 architecture uses the User-based Security Model (USM) for message security and the View-based Access Control Model (VACM) for access control. For the USM entry, the usmUserEngineID and usmUserName are the entry's keys. In a simple agent, usmUserEngineID is always that agent's own snmpEngineID value. The value can also take the value of the snmpEngineID of a remote SNMP engine with which this user can communicate. In other words, if user engine ID equal system engine ID then it is local user; otherwise it's remote user.
Username	A string identifying the username that this entry should belong to. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.

SNMPv3 User Configuration	
Security Level	Indicates the security model that this entry should belong to. Possible security models are: - **NoAuth**, **NoPriv**: No authentication and no privacy. - **Auth**, **NoPriv**: Authentication and no privacy. - **Auth**, **Priv**: Authentication and privacy. The value of security level cannot be modified if the entry already exists. This means that must first ensure that the value is set correctly.
Authentication Protocol	Indicates the authentication protocol that this entry should belong to. Possible authentication protocol are: - **None**: None authentication protocol. - **MD5**: An optional flag to indicate that this user is using MD5 authentication protocol. - **SHA**: An optional flag to indicate that this user is using SHA authentication protocol. The value of security level cannot be modified if the entry already exists. That means must first ensure that the value is set correctly.
Authentication Password	A string identifying the authentication password phrase. For MD5 authentication protocol, the allowed string length is 8 to 32. For SHA authentication protocol, the allowed string length is 8 to 40. The allowed content is ASCII characters from 33 to 126.
Privacy Protocol	Indicates the privacy protocol that this entry should belong to. Possible privacy protocols are: - **None**: None privacy protocol. - **DES**: An optional flag to indicate that this user is using DES encryption standard - **AES**: An optional flag to indicate that this user uses AES authentication protocol.
Privacy Password	A string identifying the privacy password phrase. The allowed string length is 8 to 32, and the allowed content is the ASCII characters from 33 to 126.
Buttons	**Add New Entry**: Click to add a new user entry.

5.3.6 SNMPv3 Group Configuration

Configure **SNMPv3** groups table. The entry index keys are **Security Model** and **Security Name.**

Web GUI: Configuration > SNMP > Groups


SNMPv3 Group Configuration

Delete	Security Model	Security Name	Group Name
☐	v1	public	default_ro_group
☐	v1	private	default_rw_group
☐	v2c	public	default_ro_group
☐	v2c	private	default_rw_group

Figure 5-24: SNMPv3 Group Configuration

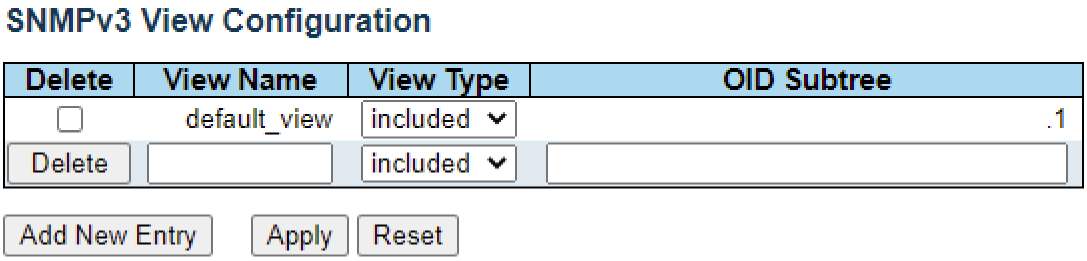
Table 5-23: SNMPv3 Group Configuration Parameters

SNMPv3 Group Configuration	
Delete	Check the box to delete the entry. It will be deleted during the next save.
Security Model	Indicates the security model that this entry should belong to. Possible security models are: • **v1**: Reserved for SNMPv1. • **v2c**: Reserved for SNMPv2c. • **usm**: User-based Security Model (USM).
Security Name	A string identifying the security name that this entry should belong to. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.
Group Name	A string identifying the group name that this entry should belong to. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.

5.3.7 SNMPv3 View Configuration

Configure **SNMPv3** views table. The entry index keys are **View Name** and **OID Subtree**.

Web GUI: Configuration > SNMP > Views


SNMPv3 View Configuration

Delete	View Name	View Type	OID Subtree
☐	default_view	included	.1
Delete		included	

Figure 5-25: SNMPv3 View Configuration

Table 5-24: SNMPv3 View Configuration Parameters

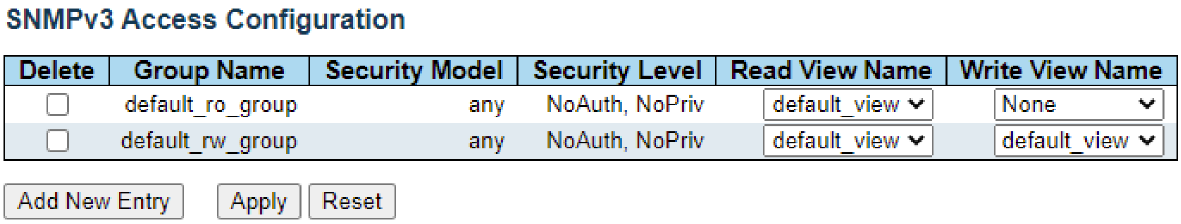
SNMPv3 View Configuration	
Delete	Check to delete the entry. It will be deleted during the next save.

View Name	A string identifying the view name that this entry should belong to. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.
View Type	Indicates the view type that this entry should belong to. Possible view type is: • **Included**: An optional flag to indicate that this subtree view should be included. • **Excluded:** An optional flag to indicate that this subtree view should be excluded. ***Note:*** *In general, if a view entry's view type is 'excluded', there should be another view entry existing with view type as 'included' and its OID subtree should overstep the 'excluded' view entry.*
OID Subtree	The OID defining the root of the sub tree to be added to the named view. The allowed OID length is 1 to 128. The allowed string content is a digital number or an asterisk (*).

5.3.8 SNMPv3 Access Configuration

Configure **SNMP**v3 accesses table. The entry index keys are **Group Name**, **Security Model** and **Security Level**.

Web GUI: Configuration > SNMP > Access



SNMPv3 Access Configuration

Delete	Group Name	Security Model	Security Level	Read View Name	Write View Name
☐	default_ro_group	any	NoAuth, NoPriv	default_view	None
☐	default_rw_group	any	NoAuth, NoPriv	default_view	default_view

Figure 5-26: SNMPv3 Access Configuration

Table 5-25: SNMPv3 Access Configuration Parameters

SNMPv3 Access Configuration	
Delete	Check to delete the entry. It will be deleted during the next save.
Group Name	A string identifying the group name that this entry should belong to. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.
Security Model	Indicates the security model that this entry should belong to. Possible security models are: • **Any:** Any security model accepted (v1|v2c|usm). • **v1**: Reserved for SNMPv1. • **V2c**: Reserved for SNMPv2c. • **Usm**: User-based Security Model (USM).

Security Level	Indicates the security model that this entry should belong to. Possible security models are: • **NoAuth, NoPriv:** No authentication and no privacy. • **Auth, NoPriv:** Authentication and no privacy. • **Auth**, **Priv**: Authentication and privacy.
Read View Name	The name of the MIB view, defining the MIB objects for which this request may request the current values. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.
Write View Name	The name of the MIB view, defining the MIB objects for which this request may potentially SET new values. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126.

5.4 Supported SNMP MIBs

The R Class series support a variety of MIBs. Future software versions will extend this list adding support for new features.

Note: In order to retrieve the required MIB, you must access Fibrolan Web site/Support section.

To download the complete Falcon RX MIB pack refer to the Resources section in the Fibrolan web site.

5.5 Command Line Interface (CLI)

CLI commands are used to manage the R Class series for displaying and modifying configuration of the various elements within the system.

Use one of the following methods to open a CLI session with the R Class series:

- Connect the switch console port to a management station. For information about connecting to the console port, refer to Console Connection and Configuration.
- Open a Telnet session from a remote management station. The switch must have network IP connectivity with this remote management station.

Changes made by one Telnet user are reflected in all other Telnet sessions.

To Access R Class series via Telnet

Use any Telnet client application. The following example relates to Windows OS.

Start the “Run” option and in the command line enter:

“telnet XX.XX.XX.XX" (IP address of the R Class series)

The Telnet screen prompts for a username and password.

Username: moose

Password: 1234

5.5.1 SSH Configuration

Secure Shell or SSH is a network protocol that allows exchange of data between two networked devices using a secure channel. SSH has been designed to replace Telnet and other insecure remote applications. The encryption deployed by SSH provides integrity of data.

Configure SSH in this section. See SSH Configuration.

5.5.2 HTTP Secure (HTTPS)

The R Class series supports secured web interface sessions using the HTTPS (HTTP over SSL) protocol.

HTTP is an acronym for **H**ypertext **T**ransfer **P**rotocol over **S**ecure Socket Layer. It is used to indicate a secure HTTP connection.

HTTPS provide authentication and encrypted communication and is widely used on the World Wide Web for security-sensitive communication such as payment transactions and corporate logons.

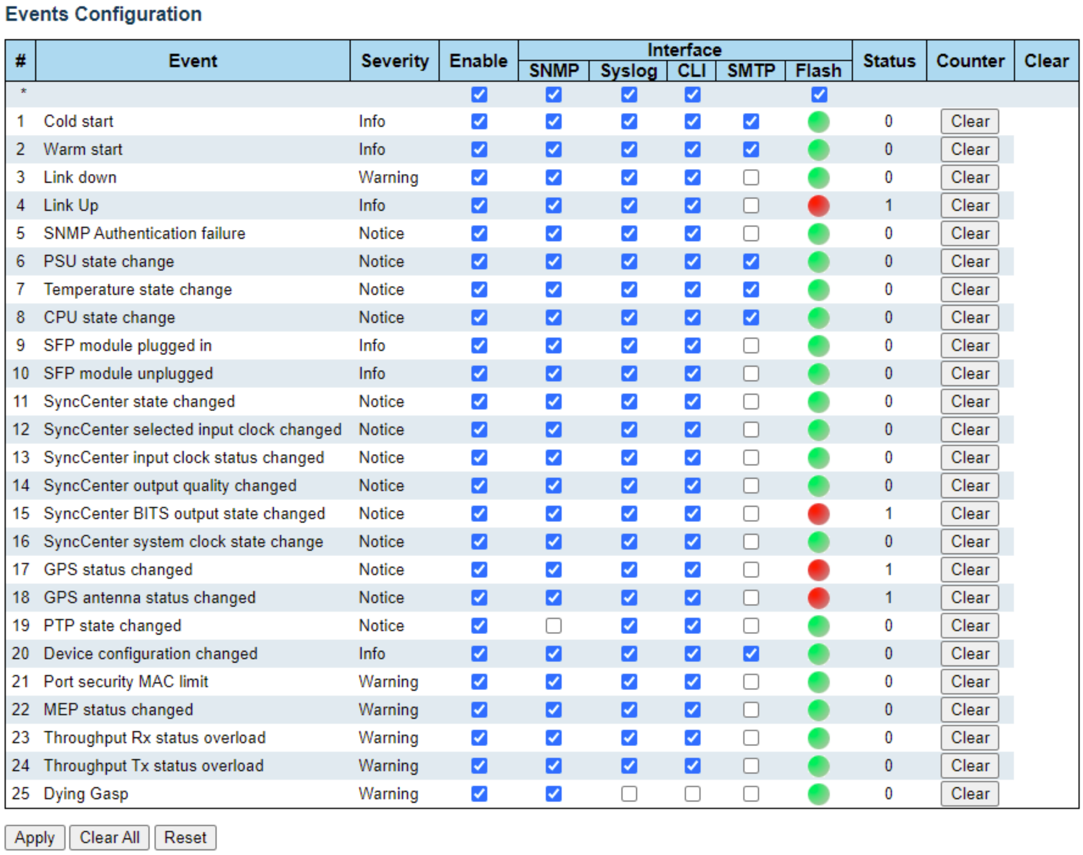
See HTTPS Configuration.

5.6 Events Configuration

In this section, the user may change (enable/disable) the current events configuration.

5.6.1 Events Configuration table

Web GUI: Configuration > System > Events



Events Configuration

#	Event	Severity	Enable	Interface					Status	Counter	Clear
				SNMP	Syslog	CLI	SMTP	Flash			
*			☑	☑	☑	☑		☑			
1	Cold start	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
2	Warm start	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
3	Link down	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
4	Link Up	Info	☑	☑	☑	☑	☐	🔴	1	Clear	
5	SNMP Authentication failure	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
6	PSU state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
7	Temperature state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
8	CPU state change	Notice	☑	☑	☑	☑	☑	🟢	0	Clear	
9	SFP module plugged in	Info	☑	☑	☑	☑	☐	🟢	0	Clear	
10	SFP module unplugged	Info	☑	☑	☑	☑	☐	🟢	0	Clear	
11	SyncCenter state changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
12	SyncCenter selected input clock changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
13	SyncCenter input clock status changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
14	SyncCenter output quality changed	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
15	SyncCenter BITS output state changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
16	SyncCenter system clock state change	Notice	☑	☑	☑	☑	☐	🟢	0	Clear	
17	GPS status changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
18	GPS antenna status changed	Notice	☑	☑	☑	☑	☐	🔴	1	Clear	
19	PTP state changed	Notice	☑	☐	☑	☑	☐	🟢	0	Clear	
20	Device configuration changed	Info	☑	☑	☑	☑	☑	🟢	0	Clear	
21	Port security MAC limit	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
22	MEP status changed	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
23	Throughput Rx status overload	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
24	Throughput Tx status overload	Warning	☑	☑	☑	☑	☐	🟢	0	Clear	
25	Dying Gasp	Warning	☑	☑	☐	☐	☐	🟢	0	Clear	

Figure 5-27: Events Configuration

Table 5-26 Events Configuration Parameters

Events Configuration	
#	Event Index.
Event	Unique Name of the Event.
Severity	The severity level of the listed events. The following severity types are supported: • **Informational**: Information level of the system log. • **Warning**: Warning level of the system log. • **Notice**: Made to help the memory.
Enable	Disable/Enable Event (Change will take effect on all checked interfaces: SNMP, syslog, cli).
Interface	Distribute event on a given interface: SNMP, SYSLOG, CLI, FLASH.
Status	Indication whether an event occurred or not.
Counter	The number of occurrences of the event since last Clear operation.
Clear	Clear event occurred indication.

5.7 Web Interface

To Access the R Class series through the Web Browse use the IP address of the device as described in the Getting Started chapter.

When accessing the R-Class series via the Web interface, the R-Class series Port State Overview window is displayed. Same event with the R-Class series.

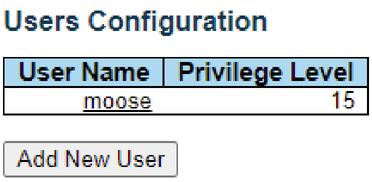
5.7.1 Port Configuration

The various R Class devices ports can be configured using the procedure described in the Port Configuration and Monitoring.

5.7.2 User Configuration & Edit User

This subsection provides an overview of the current users. Currently the only way to login as another user on the web server is to close and reopen the browser.

Web GUI: Configuration > Security > Switch > Users



Users Configuration

User Name	Privilege Level
moose	15

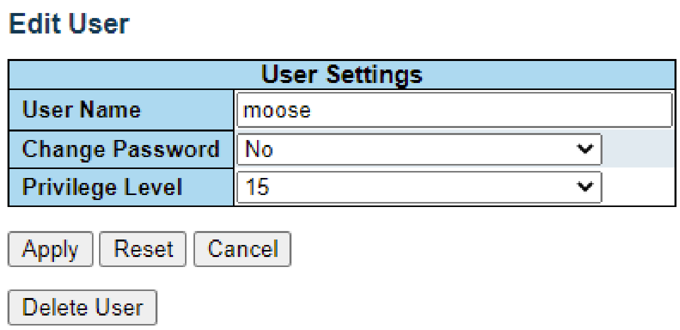
Figure 5-28: Users Configuration

Table 5-27: Users Configuration Parameters

Username	The name identifying the user. This is also a link to Add/Edit User display**.**
Privilege level	The privilege level of the user. The allowed range is **1** to **15**. If the privilege level value is 15, it can access all groups, i.e., that is granted the fully control of the device. But others value must refer to each group privilege level. User's privilege should be same or greater than the group privilege level to have the access of that group. By default setting, most groups privilege level 5 has the read-only access and privilege level 10 has the read-write access. And the system maintenance (software upload, factory defaults etc.) need user privilege level 15. Generally, the privilege level 15 can be used for an administrator account, privilege level 10 for a standard user account and privilege level 5 for a guest account.

By clicking on the “moose” word in the above Users Configuration display, you access the following display, which allows you to edit a user

Web GUI: Configuration > Security > Switch > Users | Click one of the users under the User Name column



Edit User

User Settings	
User Name	moose
Change Password	No
Privilege Level	15

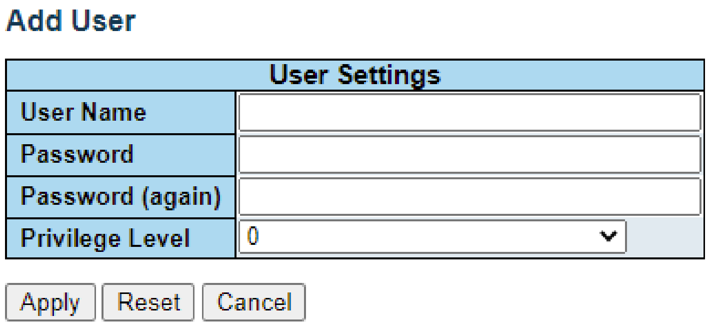
Figure 5-29: Edit User Configuration

Table 5-28: Edit Users Configuration Parameters

Username	A string identifying the username that this entry should belong to. The allowed string length is **1** to **31**. The valid username is a combination of letters, numbers and underscores.
Password	The password of the user. The allowed string length is **0** to **31**.
Privilege level	The privilege level of the user. The allowed range is **1** to **15**. If the privilege level value is 15, it can access all groups, i.e., that is granted the fully control of the device. But others value must refer to each group privilege level. User's privilege should be same or greater than the group privilege level to have the access of that group. By default setting, most groups privilege level 5 has the read-only access and privilege level 10 has the read-write access. And the system maintenance (software upload, factory defaults etc.) need user privilege level 15. Generally, the privilege level 15 can be used for an administrator account, privilege level 10 for a standard user account and privilege level 5 for a guest account.

By clicking "Add New User" you get the: Add User" display to add a new user.

Web GUI: Configuration > Security > Switch > Users | Add New User



Add User

User Settings	
User Name	
Password	
Password (again)	
Privilege Level	0

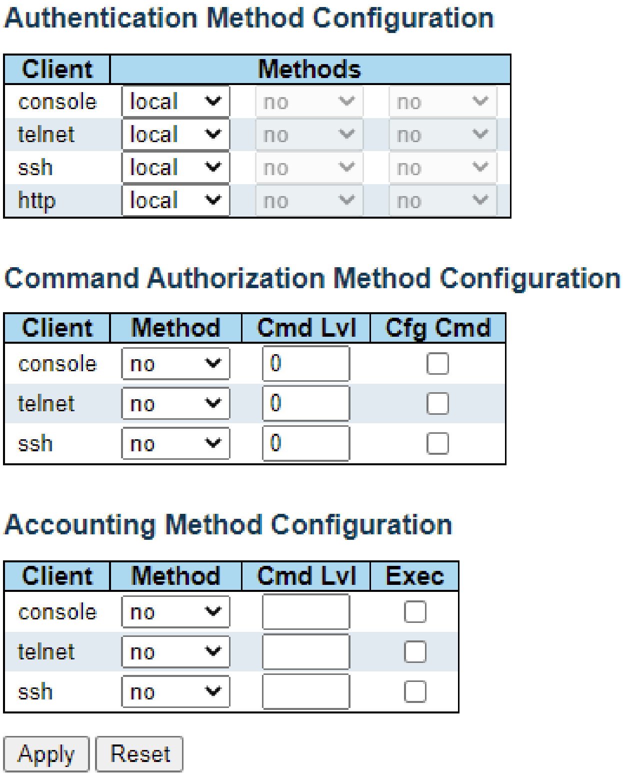
Figure 5-30: Add User Configuration

The Parameters are the same as reported in the above table.

5.7.3 Authentication Method Configuration

The R Class series support multiple methods for user login authentication. The configured authentication method is applied to all user interfaces (console, Telnet/SSH and Web). The available methods in current version are shown in the following display:

Web GUI: Configuration > Security > Switch > Auth Method



Authentication Method Configuration

Client	Methods		
console	local	no	no
telnet	local	no	no
ssh	local	no	no
http	local	no	no

Command Authorization Method Configuration

Client	Method	Cmd Lvl	Cfg Cmd
console	no	0	☐
telnet	no	0	☐
ssh	no	0	☐

Accounting Method Configuration

Client	Method	Cmd Lvl	Exec
console	no		☐
telnet	no		☐
ssh	no		☐

Figure 5-31: Authentication Method Configuration

To access the related setup, go to: Authentication Method Configuration.

5.7.4 Authentication Servers Configuration

This section allows the user to configure the different RADIUS Authentication Servers

To access this section, go to Authentication Server Configuration (AAA).

5.7.5 Access Management Configuration

In this section, you may configure the access management configuration

The maximum number of entries is **16**. If the application types match any one of the access management entries, it will allow access to the switch.

To configure the Access Management Configuration, go to: Access Management Configuration.

5.8 RMON Overview

The RMON Overview includes the following displays:

- RMON Statistics Status Overview
- RMON History Overview
- RMON Alarm Overview
- RMON Event Overview

5.8.1 RMON Statistics Status Overview

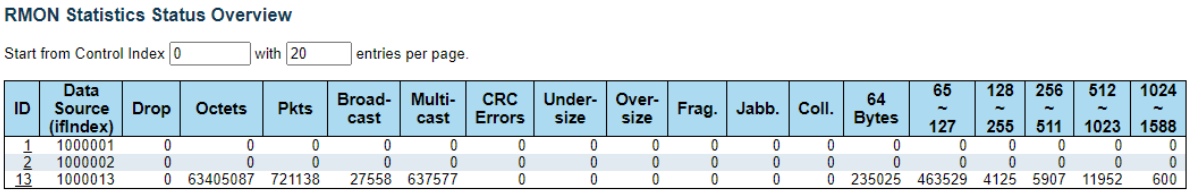
This page provides an overview of RMON Statistics entries.

Each page shows up to 99 entries from the Event table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the Event table. The first displayed will be the one with the lowest Event Index and Log Index found in the Event table. The "Start from Event Index and Log Index" allows the user to select the starting point in the Event table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest Event table match.

The **>>**will use the last entry of the currently displayed entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table.

Use the **<<**: button to start over.

Web GUI: Monitor > RMON > Statistics



RMON Statistics Status Overview

Start from Control Index 0 with 20 entries per page.

ID	Data Source (ifIndex)	Drop	Octets	Pkts	Broad-cast	Multi-cast	CRC Errors	Under-size	Over-size	Frag.	Jabb.	Coll.	64 Bytes	65 ~ 127	128 ~ 255	256 ~ 511	512 ~ 1023	1024 ~ 1588
1	1000001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1000002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1000013	0	63405087	721138	27558	637577	0	0	0	0	0	0	235025	463529	4125	5907	11952	600

Figure 4-5-32: Rmon Statistics Status Overview

Table 5-29: Rmon Statistics Status Overview Parameters

RMON Statistics Status Overview	
ID	Indicates the index of History control entry.
Data Source (ifIndexif (Index)	The port ID which must be monitored.
Drop	The value of sysUpTime at the start of the interval over which this sample was measured.
Octets	The total number of events in which packets were dropped by the probe due to lack of resources.
Pkts	The total number of packets (including bad packets, broadcast packets, and multicast packets) received.

Broadcast	The total number of good packets received that were directed to the broadcast address.
Multicast	The total number of good packets received that were directed to the multicastaddress.
CEC Errors	The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)
Under size	The total number of packets received that were less than 64 octets.
Over size	The total number of packets received that were longer than 1518 octets.
Frag.	The number of frames of a size lesser than 64 octets received with invalid CRC.
Jabb.	The number of frames which size is larger than 64 octets received with invalid CRC.
Coll.	The total number of octets of data (including those in bad packets) received on the network.
64	The total number of packets (including bad packets) received that were 64 octets in length.
65~127	The total number of packets (including bad packets) received that were between 65 to 127 octets in length.
128~255	The total number of packets (including bad packets) received that were between 128 to 255 octets in length.
256~511	The total number of packets (including bad packets) received that were between 256 to 511 octets in length.
512~1023	The total number of packets (including bad packets) received that were between 512 to 1023 octets in length.
1024~1588	The total number of packets (including bad packets) received that were between 1024 to 1588 octets in length

5.8.2 RMON History Overview

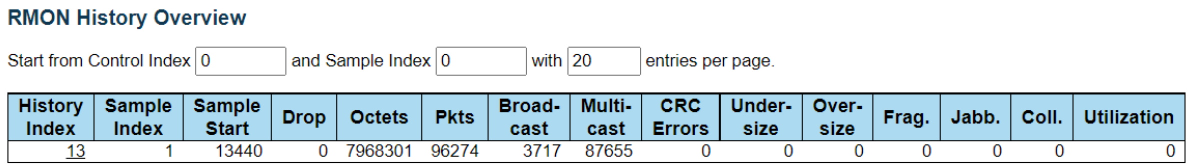
This section provides an overview of RMON History entries. Each page shows up to 99 entries from the Event table, default being 20, selected through the "entries per page" input field.

When first visited, the web page will show the first 20 entries from the beginning of the Event table. The first displayed will be the one with the lowest Event Index and Log Index found in the Event table.

The "Start from Event Index and Log Index" allows the user to select the starting point in the Event table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest Event table match.

The **>>** will use the last entry of the currently displayed entry as a basis for the next lookup When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<**: button to start over.

Web GUI: Monitor > RMON > History



RMON History Overview

Start from Control Index 0 and Sample Index 0 with 20 entries per page.

History Index	Sample Index	Sample Start	Drop	Octets	Pkts	Broad-cast	Multi-cast	CRC Errors	Under-size	Over-size	Frag.	Jabb.	Coll.	Utilization
13	1	13440	0	7968301	96274	3717	87655	0	0	0	0	0	0	0

Figure 5-33: Rmon History Overview

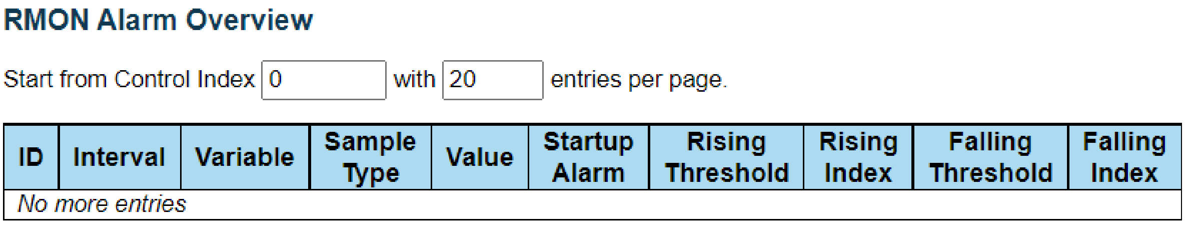
Table 5-30: Rmon History Overview Parameters

RMON History Overview	
History Index	Indicates the index of History control entry.
Sample Index	Indicates the index of. the data entry associated with the control entry.
Sample Start	The value of sysUpTime at the start of the interval over which this sample was measured.
Drop	The total number of events in which packets were dropped by the probe due to lack of resources.
Octets	The total number of octets of data (including those in bad packets) received on the network.
Pkts	The total number of packets (including bad packets, broadcast packets, and multicast packets) received.
Broadcast	The total number of good packets received that were directed to the broadcast address.
Multicast	The total number of good packets received that were directed to a multicast address.
CECErrors	The total number of packets received that had a length (excluding framing bits but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).
Undersize	The total number of packets received that were less than 64 octets.
Oversize	The total number of packets received that were longer than 1518 octets.
Frag.	The number of frames which size is less than 64 octets received with invalid CRC.
Jabb.	The number of frames which size is larger than 64 octets received with invalid CRC.
Coll.	The best estimate of the total number of collisions on this Ethernet segment.
Utilization	The best estimate of the mean physical layer network utilization on this interface during this sampling interval, in hundredths of a percent.

5.8.3 RMON Alarm Overview

This section provides an overview of RMON Alarm entries.

Web GUI: Monitor > RMON > Alarm



RMON Alarm Overview

Start from Control Index 0 with 20 entries per page.

ID	Interval	Variable	Sample Type	Value	Startup Alarm	Rising Threshold	Rising Index	Falling Threshold	Falling Index
No more entries									

Figure 5-34: Rmon Alarm Overview

Table 5-31: Rmon Alarm Overview Parameters

RMON Alarm Overview	
ID	Indicates the index of Alarm control entry.
Interval	Indicates the interval in seconds for sampling and comparing the rising and falling threshold.
Variable	Indicates the particular variable to be sampled
Sample Type	The method of sampling the selected variable and calculating the value to be compared against the thresholds.
Value	The value of the statistic during the last sampling period.
Startup Alarm	The alarm that may be sent when this entry is first set to valid.
Rising Threshold	Rising threshold value.
Rising Index	Rising event index
Falling Threshold	Falling threshold value
Falling Index	Falling event index
Each page shows up to 99 entries from the Event table, default being 20, selected through the "entries per page" input field. When first visited, the web page will show the first 20 entries from the beginning of the Event table. The "Start from Event Index and Log Index" allows the user to select the starting point in the Event table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest Event table match. The **>>** will use the last entry of the currently displayed entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<:** button to start over.	

5.8.4 RMON Event Overview

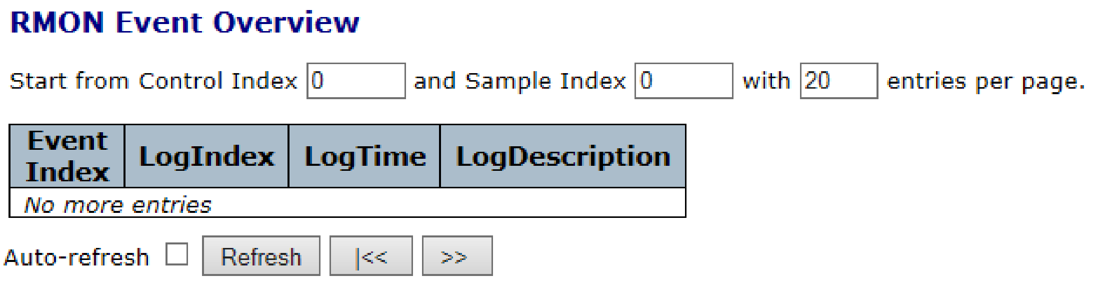
This section provides an overview of RMON Event table entries. Each page shows up to 99 entries from the Event table, default being 20, selected through the "entries per page" input field.

When first visited, the web page will show the first 20 entries from the beginning of the Event table. The first displayed will be the one with the lowest Event Index and Log Index found in the Event table.

The "Start from Event Index and Log Index" allows the user to select the starting point in the Event table. Clicking the **Refresh** button will update the displayed table starting from that or the next closest Event table match.

The **>>** will use the last entry of the currently displayed entry as a basis for the next lookup. When the end is reached the text "No more entries" is shown in the displayed table. Use the **<<:** button to start over.

Web GUI: Monitor > RMON > Event



RMON Event Overview

Start from Control Index 0 and Sample Index 0 with 20 entries per page.

Event Index	LogIndex	LogTime	LogDescription
No more entries			

Figure 5-35: Rmon Event Overview

Table 5-32: Rmon Alarm Overview Parameters

RMON Event Overview	
Event Index	Indicates the index of the event entry.
Log Index	Indicates the index of the log entry.
Log Time	Indicates Event log time
Log Description	Indicates the Event description

6 Diagnostics

Diagnostics include the following procedures:

- Ping
- Ping6
- Link OAM MIB Retrieval
- Copper Link Test
- RFC2544
- Falcon Report Configuration

6.1.1 Ping IPv4

This section allows the user to issue ICMP PING packets to troubleshoot IP connectivity issues.

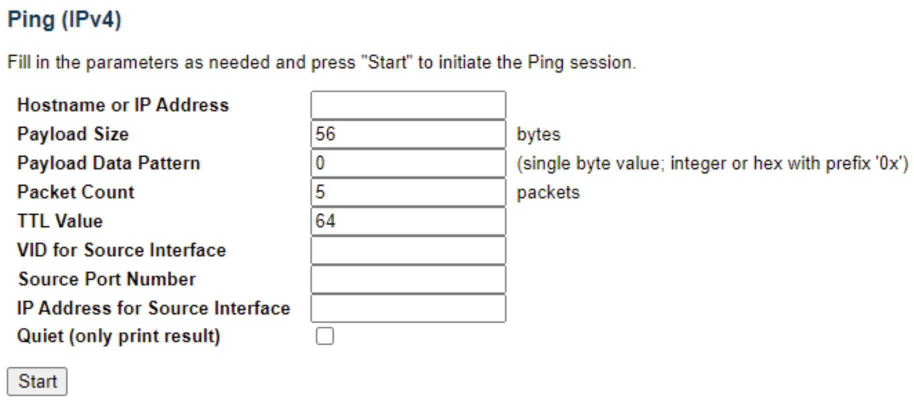
After you press, Start ICMP packets are transmitted, and the sequence number and round-trip time are displayed upon reception of a reply. The amount of data received inside of an IP packet of type ICMP ECHO_REPLY will always be 8 bytes more than the requested data space (the ICMP header). The page refreshes automatically until responses to all packets are received, or until a timeout occurs.

```
PING server 10.10.132.20, 56 bytes of data.

64 bytes from 10.10.132.20: icmp_seq=0, time=0ms
64 bytes from 10.10.132.20: icmp_seq=1, time=0ms
64 bytes from 10.10.132.20: icmp_seq=2, time=0ms
64 bytes from 10.10.132.20: icmp_seq=3, time=0ms
64 bytes from 10.10.132.20: icmp_seq=4, time=0ms
Sent 5 packets, received 5 OK, 0 bad
```

The IP Address and Ping Size Parameters of the issued ICMP packets (for ICMP Ping) can be configured.

Web GUI: Diagnostics > Ping (IPv4)



Ping (IPv4)

Fill in the parameters as needed and press "Start" to initiate the Ping session.

Hostname or IP Address		
Payload Size	56	bytes
Payload Data Pattern	0	(single byte value; integer or hex with prefix '0x')
Packet Count	5	packets
TTL Value	64	
VID for Source Interface		
Source Port Number		
IP Address for Source Interface		
Quiet (only print result)	☐	

Figure 6-1: ICMP PING Configuration

Table 6-1 Ping (IPv4)

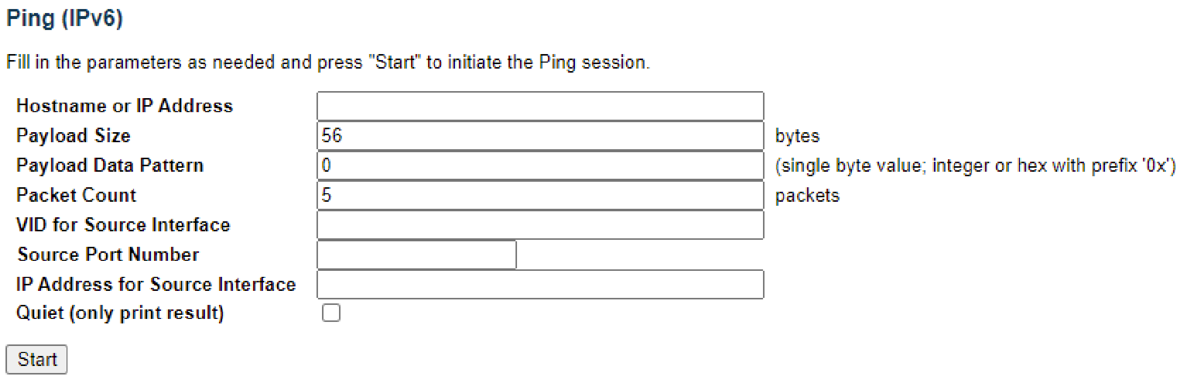
Hostname or IP Address	The address of the destination host, either as a symbolic hostname or an IP Address.
Payload Size	Determines the size of the ICMP data payload in bytes (excluding the size of Ethernet, IP and ICMP headers). The default value is 56 bytes. The valid range is 2-1452 bytes.
Payload Data Pattern	Determines the pattern used in the ICMP data payload. The default value is 0. The valid range is 0-255.
Packet Count	Determines the number of PING requests sent. The default value is 5. The valid range is 1-60.
TTL Value	Determines the Time-To-Live /TTL) field value in the IPv4 header. The default value is 64. The valid range is 1-255.
VID for Source Interface	This field can be used to force the test to use a specific local VLAN interface as the source interface. Leave this field empty for automatic selection based on routing configuration. *Note: You may only specify either the VID or the IP Address for the source interface.*
Source Port Number	This field can be used to force the test to use a specific local interface with the specified port number as the source interface. The specified port must be configured with a suitable IP address. Leave this field empty for automatic selection based on routing configuration. Note: You may only specify either the Source Port Number or the IP Address for the source interface.
Address for Source Interface	This field can be used to force the test to use a specific local interface with the specified IP address as the source interface. The specified IP address must be configured on a local interface. Leave this field empty for automatic selection based on routing configuration. Note: You may only specify either the VID or the IP Address for the source interface.

Quiet (only print result)	Checking this option will not print the result of each ping request but will only show the final result. After you press , ICMP packets are transmitted, and the sequence number and round trip time are displayed upon reception of a reply. The amount of data received inside of an IP packet of type ICMP ECHO_REPLY will always be 8 bytes more than the requested payload data size (the difference is the ICMP header). The page refreshes automatically until responses to all packets are received, or until a timeout occurs. The output from the command will look like the following: PING 172.16.1.1 (172.16.1.1) from 172.16.1.10: 56 data bytes 64 bytes from 172.16.1.1: seq=0 ttl=64 time=2.034 ms 64 bytes from 172.16.1.1: seq=1 ttl=64 time=1.729 ms 64 bytes from 172.16.1.1: seq=2 ttl=64 time=1.954 ms 64 bytes from 172.16.1.1: seq=3 ttl=64 time=1.699 ms 64 bytes from 172.16.1.1: seq=4 ttl=64 time=1.916 ms --- 172.16.1.1 ping statistics --- 5 packets transmitted, 5 packets received, 0% packet loss round-trip min/avg/max = 1.699/1.866/2.034 ms

6.1.2 Ping IPv6

R Class series allow you to issue ICMPv6 PING packets to troubleshoot IPv6 connectivity issues. After you press Start, ICMPv6 packets are transmitted, and the sequence number and roundtrip time are displayed upon reception of a reply. The page refreshes automatically until responses to all packets are received, or until a timeout occurs

Web GUI: Diagnostics > Ping (IPv6)



Ping (IPv6)

Fill in the parameters as needed and press "Start" to initiate the Ping session.

Hostname or IP Address		
Payload Size	56	bytes
Payload Data Pattern	0	(single byte value; integer or hex with prefix '0x')
Packet Count	5	packets
VID for Source Interface		
Source Port Number		
IP Address for Source Interface		
Quiet (only print result)	☐	

Figure 6-2: ICMPv6 PING Configuration

```
PING6 server ff02::2, 56 bytes of data.

64 bytes from fe80::219:5bff:fe2f:b47: icmp_seq=0, time=10ms
64 bytes from fe80::215:58ff:feed:69dd: icmp_seq=0, time=10ms
64 bytes from fe80::219:5bff:fe2f:b47: icmp_seq=1, time=0ms
64 bytes from fe80::215:58ff:feed:69dd: icmp_seq=1, time=0ms
64 bytes from fe80::219:5bff:fe2f:b47: icmp_seq=2, time=0ms
64 bytes from fe80::215:58ff:feed:69dd: icmp_seq=2, time=0ms
```

```
64 bytes from fe80::219:5bff:fe2f:b47: icmp_seq=3, time=0ms
64 bytes from fe80::215:58ff:feed:69dd: icmp_seq=3, time=0ms
64 bytes from fe80::219:5bff:fe2f:b47: icmp_seq=4, time=0ms
64 bytes from fe80::215:58ff:feed:69dd: icmp_seq=4, time=0ms

Sent 5 packets, received 10 OK, 0 bad
```

You can configure the following properties of the issued ICMP packets

Table 6-2: ICMP PING Parameters

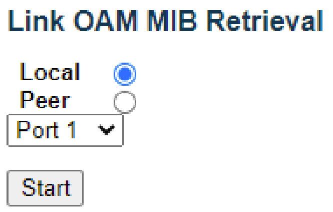
IP Address	The destination IP Address.
Ping Length	The payload size of the ICMP packet. Values range from 2 bytes to 1452 bytes.
Ping Count	The count of the ICMP packet. Values range from 1 time to 60 times.
Ping Interval	The interval of the ICMP packet. Values range from 0 second to 30 seconds.
Egress Interface (Only for IPv6)	The VLAN ID (VID) of the specific egress IPv6 interface which ICMP packet goes. The given VID ranges from 1 to 4094 and will be effective only when the corresponding IPv6 interface is valid. When the egress interface is not given, PING6 finds the best match interface for destination. Do not specify egress interface for loopback address. Do specify egress interface for link-local or multicast address.
Buttons	**Start**: Click to start transmitting ICMP packets. **New Ping**: Click to re-start diagnostics with PING.

6.1.3 Link OAM MIB Retrieval

This procedure allows the user to retrieve the local or remote OAM MIB variable data on a particular port.

1. Select the appropriate radio button and enter the port number of the switch to retrieve the content of interest.
2. Click on **Start** to retrieve the content.
3. Click on **New Retrieval** to retrieve another content of interest.

Web GUI: Diagnostics > Link OAM > MIB Retrieval



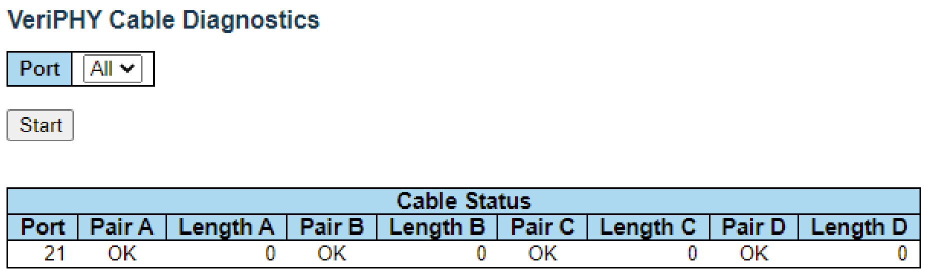
Local ●
Peer ○
Port 1

Figure 6-3: Link OAM MIB Retrieval display.

6.1.4 VeriPHY Cable Diagnostics

This section is used for running the VeriPHY Cable Diagnostics for 10/100 and 1G copper ports.

Web GUI: Diagnostics > VeriPHY



Port: All

Cable Status								
Port	Pair A	Length A	Pair B	Length B	Pair C	Length C	Pair D	Length D
21	OK	0	OK	0	OK	0	OK	0

Figure 6-4: Copper Link Test Cable Status Diagnostics

Press **Start** to run the diagnostics. This will take approximately 5 seconds. If all ports are selected, this can take approximately 15 seconds. When completed, the page refreshes automatically, and you can view the cable diagnostics results in the cable status table.

Note that VeriPHY is only accurate for cables of length 7 — 140 meters.

10 and 100 Mbps ports will be linked down while running VeriPHY. Therefore, running VeriPHY on a 10 or 100 Mbps management port will cause the switch to stop responding until VeriPHY is complete

Table 6-3: Copper Link Test Cable Diagnostics Parameters

Port	The port where the Cable Diagnostics is requested.
Cable Status	“**Port**”: Port number. **“Pair”**: The status of the cable pair. OK - Correctly terminated pair Open - Open pair Short - Shorted pair Short A - Cross-pair short to pair A Short B - Cross-pair short to pair B Short C - Cross-pair short to pair C Short D - Cross-pair short to pair D

	Cross A - Abnormal cross-pair coupling with pair A Cross B - Abnormal cross-pair coupling with pair B Cross C - Abnormal cross-pair coupling with pair C Cross D - Abnormal cross-pair coupling with pair D “Length”: The length (in meters) of the cable pair. The resolution is 3 meters

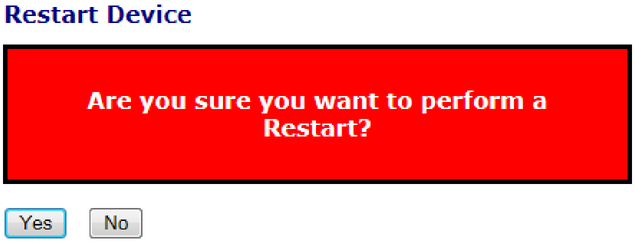
7 Maintenance

The Maintenance includes the following procedure:

- Restart Device
- Factory Default
- System Update
- Configuration (Save/Upload)

7.1 Restart Device

You can restart the switch here. After restart, the switch will boot normally. **Web GUI: Maintenance > Restart Device**



Restart Device

Are you sure you want to perform a Restart?

Figure 7-1: Restart Device Screen

Table 7-1: Restart Device Parameters

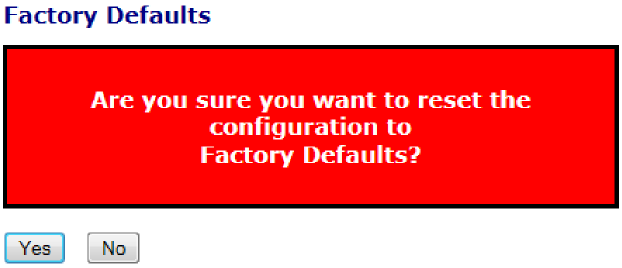
Yes:	Click to restart device.
No:	Click to return to the Port State page without restarting.

7.2 Factory Defaults

You can reset the configuration of the switch. Only the IP configuration is retained.

The new configuration is available immediately, which means that no restart is necessary.

Web GUI: Maintenance > Factory Defaults



Factory Defaults

Are you sure you want to reset the configuration to Factory Defaults?

Figure 7-2: Restore to Factory Defaults Screen

Table 7-2: Restore to Factory Defaults Parameters

Yes:	Click to reset the configuration to Factory Defaults.
No:	Click to return to the Port State screen without resetting the configuration.

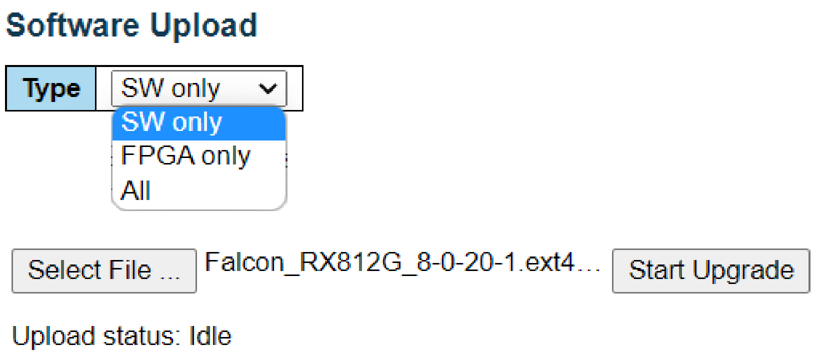
Note: Restoring factory default can also be performed by making a physical loopback between port 1 and port 2 within the first minute from switch reboot. In the first minute after boot, 'loopback' packets will be transmitted at port 1. If a 'loopback' packet is received at port 2 the switch will do a restore to default

---

7.3 Software Management

This section facilitates an update of the firmware controlling the switch.

Web GUI: Maintenance > Software > Upload



Software Upload

Type: SW only

Falcon_RX812G_8-0-20-1.ext4...

Upload status: Idle

Figure 7-3: Software Upload

Table 7-3: Software Upload Parameters

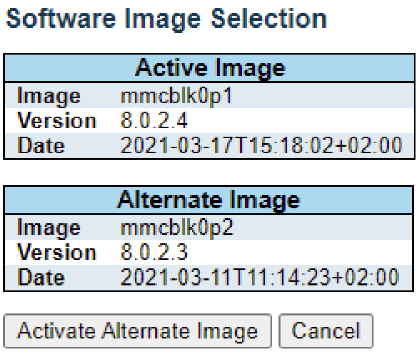
Type:	Select the type of image file to upload: - SW only: ASIC image only (file_name.gz) - FPGA only: FPGA image only (file_name.rbf) - All: a combined file
Select File:	Browse to the location of the image file and click **Select**.
Start Upgrade	Click to start the upgrade
After the image is uploaded, a page announces that the firmware update is initiated. After a few moments, the software/firmware is updated and the switch restarts.	

Warning: *While the firmware is being updated, Web access appears to be defunct. The front LED flashes Green/Off with a frequency of 10 Hz while the firmware update is in progress.* ***Do not restart or power off the device at this time*** *or the switch may fail to function afterwards.*

7.3.1 Software Image Select

This section provides information about the active and alternate (backup) firmware images in the device and allows you to revert to the alternate image. The web page displays two tables with information about the active and alternate firmware images.

Web GUI: Maintenance > Software > Image Select



Software Image Selection

Active Image	
Image	mmcblk0p1
Version	8.0.2.4
Date	2021-03-17T15:18:02+02:00

Alternate Image	
Image	mmcblk0p2
Version	8.0.2.3
Date	2021-03-11T11:14:23+02:00

Figure 7-4: Software Image Selection

Table 7-4: Software Image Selection Parameters

Image	The file name of the firmware image, from when the image was last updated.
Version	The version of the firmware image.
Date	The date where the firmware was produced.
Buttons	**Activate Alternate Image**: Click to use the alternate image. This button may be disabled depending on system state. **Cancel:** Cancel activating the backup image. Navigates away from this page.

7.4 Configuration Management

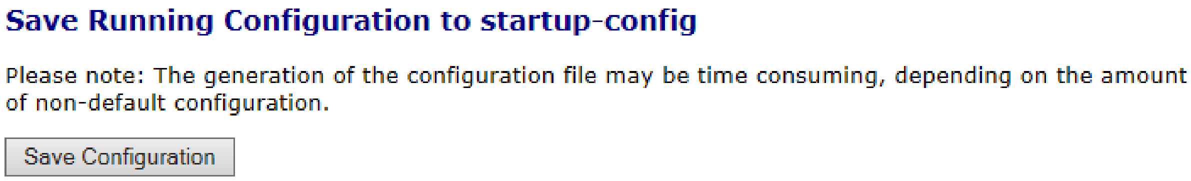
The switch stores its configuration in several text files in CLI format. The files are either virtual (RAM-based) or stored in flash on the switch. The available files are:

- ***Running-config***: A virtual file that represents the currently active configuration on the switch. This file is volatile.
- ***Startup-config***: The startup configuration for the switch, read at boot time. If this file doesn't exist at boot time, the switch will start up in default configuration
- ***Default-config***: A read-only file with vendor-specific configuration. This file is read when the system is restored to default settings
- **Up to 31 other files**, typically used for configuration backups or alternative configurations.

7.4.1 Save startup configuration

This copies *running-config* to *startup-config*, thereby ensuring that the currently active configuration will be used at the next reboot.

Web GUI: Maintenance > Configuration > Save Startup Config



Save Running Configuration to startup-config

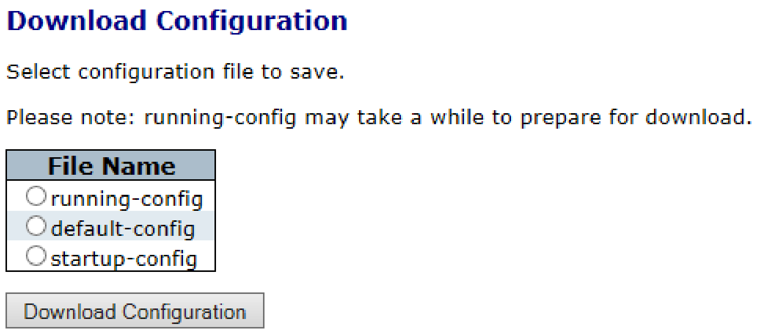
Please note: The generation of the configuration file may be time consuming, depending on the amount of non-default configuration.

Figure 7-5: Save Startup Configuration File

7.4.2 Download Configuration

It is possible to download any of the files on the switch to the web browser. Select the file and click **Download Configuration**. Download of *running-config* may take a little while to complete, as the file must be prepared for download.

Web GUI: Maintenance > Configuration > Download



Download Configuration

Select configuration file to save.

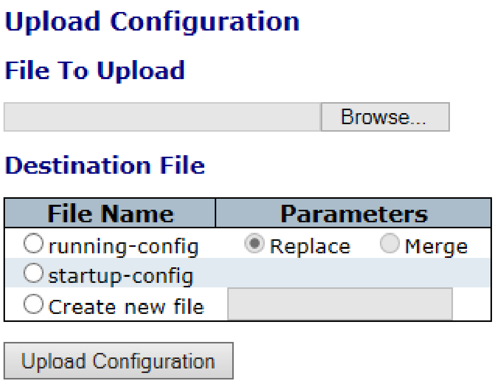
Please note: running-config may take a while to prepare for download.

File Name
○ running-config
○ default-config
○ startup-config

Figure 7-6: Download Configuration

7.4.3 Upload Configuration

Web GUI: Maintenance > Configuration > Upload



Upload Configuration

File To Upload

Destination File

File Name	Parameters
○ running-config	● Replace ○ Merge
○ startup-config	
○ Create new file	

Figure 7-7: Upload Configuration

It is possible to upload a file from the web browser to all the files on the switch, except *default-config* which is read-only. Select the file to upload, select the destination file on the target, then click **Upload Configuration**. If the destination is *running config*, the file will be applied to the switch configuration. This can be done in two ways:

- **Replace mode**: The current configuration is fully replaced with the configuration in the uploaded file.
- **Merge mode:** The uploaded file is merged into *running-config*.

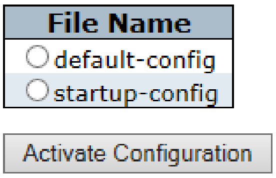
If the flash file system is full (i.e., contains *default-config* and 32 other files, usually including *startup-config*), it is not possible to create new files. Instead, an existing file must be overwritten or another file must be deleted.

7.4.4 Activate

It is possible to activate any of the configuration files present on the switch, except for *running-config* which represents the currently active configuration.

Select the file to activate and click **Activate Configuration**. This will initiate the process of completely replacing the existing configuration with that of the selected file.

Web GUI: Maintenance > Configuration > Activate



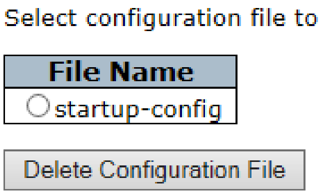
File Name
○ default-config
○ startup-config

Figure 7-8: Activate Configuration

7.4.5 Delete

It is possible to delete any of the writable files stored in flash, including *startup-config*. If this is done and the switch is rebooted without a prior Save operation, this effectively resets the switch to default configuration.

Web GUI: Maintenance > Configuration > Delete



Select configuration file to delete.

File Name
○ startup-config

Figure 7-9: Delete Configuration

7.5 Power Supply Overview

Warning

ONLY the Fibrolan Power Supply (AC or DC) is suitable to be used with the R Class series unit.

Any other PS module (Fibrolan products or other), even if mechanically matching, may cause irreversible damage to the system.

IN SUCH CASES THIS WILL VOID ANY WARRANTY!

Warning

NEVER OPEN THE DEVICE WHEN IT IS CONNECTED TO POWER LINES!

Caution

When connecting a device to an AC (DC) power outlet, always:

1. First connect the power cord to the device (ensure that it is securely fastened).
2. Only after connecting the power cord to the device, it should be plugged into the wall outlet. Make sure to use grounded (3 way) outlets (for AC models).

Note: For most countries Fibrolan ships an appropriate power supply cord which is safety approved in accordance with the country's National Electric Code.

For certain countries Products are shipped without power cords. In such cases, locally purchased safety approved power cords (in accordance with that country's National Electric Code) may be used.

7.5.1 AC Power Supply

Connect AC line voltage using the power supply cords provided (alternatively you may use other 18AWG three wire cord). R Class devices will accept any line voltage from 100 to 240 VAC, 50-60 Hz. There is no ON/OFF switch on the device. When the power is connected to the device, the device is ON. This will be indicated by the Power (PWR) LED lit green on the front panel. The PS is rated for ambient temperature of: -10°C ÷ +50°C.

125VDC Connection: In this case, the supplied AC cable allows the connection to an external DC source of 125VDC.

7.5.2 DC Power Supplies

Connect DC line voltage using the power supply cords provided (alternatively you may use other 18AWG three wire cord). R Class devices will accept any line voltage from 20 to–60VDCThere is no ON/OFF switch on the device. When the power is connected to the device, the device is ON. This will be indicated by the Power (PWR) LED lit green on the front panel.

Note: The earthen conductor of power cord must be grounded.

–20 to – 60VDC Power Connection

The rear panel is equipped with a suitable screw connection (ST connector).

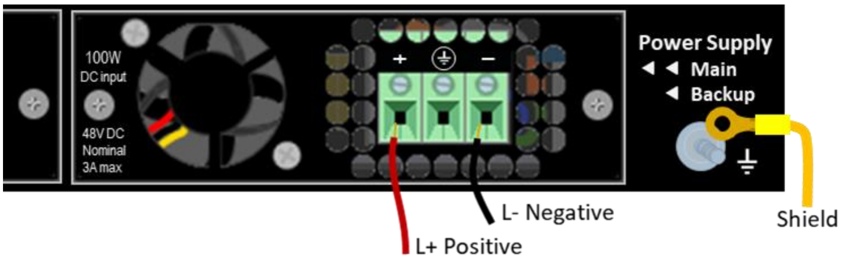


Figure 7-10: Falcon-RX series DC PS rear panel ST connector

DC powered models**:** Required current rating = 2A

CAUTION DOUBLE POLE FUSING

Verify that the DC-Mains provide a 2 Amp double pole circuit breaker. Required power conductor size = at least 0.75mm² for flexible cable or 1mm² for non-flexible. Power Consumption (AC and DC Power Supplies):

- Falcon-RX
    - Maximum <12W
    - Typical: <10W
- nFalcon-R:
    - Maximum <20W
    - Typical: <15W
- Falcon-RX:
    - Maximum <60W
    - Typical: <50W

Falcon-RX device include Dual redundant, hot swappable power supplies

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7.6 Laser Safety

Laser Warning 	CAUTION! Radiation emitted from fiber optic ports may be hazardous to human vision. Therefore, the following rules must be strictly observed: All single-mode (SM) models are CLASS I LASER PRODUCT that may endanger your eyes and must be handled with special care. When not in use, keep the fiber optic connector closed using its protective cover. Never stare directly into the fiber optic connector of a powered device or into the end of a fiber connected to it.
Laser Safety	The emissions produced by the end products described in this guide are under Class 1 emission level according to IEC 60825-1 2007 These products shall not be installed in an optical network handling above Class 1 level

8 Warranty Information

8.1 Warranty Limitation

Fibrolan warrants the equipment to be free from defects in material and workmanship, under normal and proper use and in its unmodified condition for 24 months (**unless otherwise agreed upon**) starting on the date of delivery from Fibrolan to its distributor.

Fibrolan's sole obligation under this warranty shall be to furnish parts and labor for the repair or replacement of products found by Fibrolan to be defective in material or workmanship during the warranty period. Warranty repairs will be performed at the point of manufacture.

Following an authorized repair, the device shall be under warranty throughout its original period but not less than 3 months. Warranty shall be void in case where unauthorized attempts to repair or disassemble/modify the device are evident.

You must claim repairs or replacements under this warranty only from the reseller from which you have purchased the device, however you may refer directly to Fibrolan Ltd. To claim the warranty, you should provide a reasonable proof that the reseller ceased operation and/or unreasonably refused to provide you with the service.

In such case report to Fibrolan the serial number of the device, date purchased, full details of reseller from whom the device was purchase and a copy of an invoice or another proof of the purchase.

Note: This document and the information contained herein are proprietary of the manufacturer and are furnished to the recipient for use in operating, maintaining and repairing manufacturer equipment. The information within may not be utilized for any purpose except as stated herein and may not be disclosed to third parties without the written permission from the manufacturer.

The manufacturer reserves the right to make changes to any technical specifications in order to improve reliability, function and design.

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9 Glossary of Terms

9.1 General Glossary of Terms

9.2 General Glossary of Terms

Acronym	Description
ACL	Access Control List
AIS	Alarm Indication Signal
ALD	Autonomous Link Discovery
ARP	Address Resolution Protocol
BPDU	Bridge Protocol Data Unit
CBWFQ	Frame Lost Weighted Fair Queuing
CC	Continuity Check
CCM	Continuity Check Message
CDP	Cisco Discovery Protocol
CE	Customer Edge (Equipment)
CFM	Connectivity Fault Management (IEEE 802.1ag)
CIR	Committed Insured Rate
CLI	Command Line Interface
CLNP	Connectionless Network Protocol
CMIP	Common Management Info Protocol
CoS	Class of Service
CPE	Customer Premises Equipment
CSF	Client Signal Fail
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
DES	Data Encryption Standard
DHCP	Dynamic Host Configuration Protocol
DM	Delay measurement
DMAC	Destination MAC address
DMM	Delay Measurement Message

9.2 General Glossary of Terms

Acronym	Description
DMR	Delay Measurement Reply
DNS	Domain Name System
DSCP	Differentiated Services Code Point
EAP	Extensible Authentication Protocol
ECFM	Ethernet Connectivity Fault Management
EEC	Synchronous Ethernet Equipment clock
EFM	Ethernet in the First Mile
EMS	Element Management System
ELPS	Ethernet Linear Protection Switching
ERPS	Ethernet Ring Protection Switching
EVC	Ethernet Virtual Connection
EVPL	Ethernet Virtual Private Line
FD	Frame Delay
FDV	Frame delay variation
FDX	Full Duplex
FEF	Far End Fault
FP	Fault Propagation
FTP	File Transfer Protocol
FTTB	Broadband Access Over Fiber
FTTB MDU	Broadband Access Over Fiber Multi Dwelling Unit
Gbps	Gigabits per second
HDLC	High-Level Data Link Control
HDX	Half Duplex
FDX	Full Duplex
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol over Secure Socket Layer
ICMP	Internet Control Message Protocol
IEEE	Institute of Electronic and Electronic Engineers developing the standards for communications and networks. IEEE Number

9.2 General Glossary of Terms

Acronym	Description
	IEEE 802 standards Number and Description 802.1d – Spanning Tree Protocol 802.1w – Rapid Spanning Tree 802.1s – Multiple Instance Spanning Tree 802.1q – VLAN Frame Tagging 802.2 – Logical Link Control 802.3 – Ethernet (CSMA/CD) 802.3u – Fast Ethernet 802.3z – Gigabit Ethernet 802.1ab – LLDP= Link Layer Discovery Protocol 802.3ad – LACP=Link Aggregation Control Protocol 802.3ah – Link OAM
IETF	Internet Engineering Task Force
ITU-T	International Telecommunication Union Telecommunication
IEEE 802.1X	IEEE Standard for port based Network Access Control
MLD	Interior Gateway Media Protocol Internet Group Management Protocol
MLD Querier	A router sends MLD query messages over a particular link. This router is called the Querier.
IP	Internet Protocol
IPX	Internetwork Packet Exchange
ISO	International Standardization Organization
LAG	Link Aggregation Group
LAN	Local Area Network
LACP	Link Aggregation Control Protocol
Last Gasp – Dying Gasp	Remote Device Power Failure
LB	Loop-Back
LBM	Loop-back Message
LBR	Loop-back reply
LCK	Locked Signal

9.2 General Glossary of Terms

Acronym	Description
LDP	Label Distribution Protocol
LLC	Logical Link Control
LLDP	Link Layer Discovery Protocol
LM	Loss measurement
LOC	Loss of continuity
LMM	Loss Measurement Message
LMR	Loss Measurement Reply
LTM	Link Trace Message
LTR	Link Trace Reply
LOS	Loss of Signal
LST	Link Segmentation Test
LTM	Link Trace Message
LTR	Link Trace Reply
MA	Media Access & Maintenance Association
MAC	Media Access Control
MAC Address	Media Access Control Address (hardware address, MAC-layer address, physical address)
MA	Maintenance Association
MA™	Micro Agent (an on-chip management system facilitating the management and maintenance of remote access devices)
MAID	Maintenance Association Identifier
MAU	Media Attachment Unit
MD	Maintenance Domain
MDU	Multi Dwelling Unit
MEF	Metro Ethernet Forum
MEG	Maintenance Entity Group
MEL	MEG Level
MEP	Maintenance Entity Point
MIB	Management information base
MIP	Maintenance Immediate Point
MNCP	Maximum Number of Cells Packed

9.2 General Glossary of Terms

Acronym	Description
MPLS	Multi-Protocol Label Switching
MPLS-TP	MPLS Transport Profile
MTTR	Mean time to repair
MTU	Maximum Transmission Unit
MTU-s	Multi Tenant Unit- switch
NCP	Netware Core Protocol
NetBIOS	Network Basic Input/Output System
NFS	Network File System
NGN	Next Generation Network
NGN Access	Next Generation Network Access
NIC	Network Interface Card
NMS	Network Management System
NTP	Network Time Protocol
NTU	Network Termination Unit
NU	Node Unit
OA	Operation and Administration,
OAM	Operation, Administration, Management
ODI	Open Data-link Interface
OpEx	Operating Expenditures
Optional TLVs	A LLDP frame contains multiple TLVs
OSI	Open System Interconnection
OSPF	Open Shortest Path First
OUI	Organization Unique Identifier
PE	Provider Edge
PM	Performance monitoring
PRC	Primary Reference Clock
PIR	Peak Information Rate
Policer	A Policer can limit the bandwidth of received frames. It is located in front of the ingress queue
POST	Power-on Self Test

9.2 General Glossary of Terms

Acronym	Description
PPP	Point-to-Point Protocol
Private VLAN	In a private VLAN, communication between ports in that private VLAN is not permitted. A VLAN can be configured as a private VLAN
PW	Pseudowire
QCE	Quality of Service Control List Entries
QCL	Quality of Service Control List
Q-in-Q	Selective Q-in-Q per IEEE802.1ad Provider Bridging
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
RARP	Reverse Address Resolution Protocol
RDI	Remote Defect Indication
RIP	Routing Information Protocol
RMON	Remote Monitoring
RSTP	Rapid Spanning Tree Protocol (IEEE 802.1w)
Rx	Receive
SFP	Small Form-factor Pluggable
SLA	Service Level Management
SLE	Subscriber Link Emulation
SMAC	Source MAC address
SNMP	Simple Network Management Protocol
SPX	Sequenced Packet Exchange
SSH	An acronym for **S**ecure **Sh**ell. It is a network protocol that allows data to be exchanged using a secure channel between two networked devices.
SSM	Synchronization Status Messages
STA	Spanning Tree Algorithm
STP	Spanning Tree Protocol
SU	Subscriber Unit
SyncE	Is an abbreviation for Synchronous Ethernet. This functionality is used to make a network 'clock frequency' synchronized. Not to be confused with real time clock synchronized (IEEE 1588)
TACACS+	Terminal Access Controller Access Control System Plus

9.2 General Glossary of Terms

Acronym	Description
TCM	Three Color Marker
TCO	Total cost of ownership
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
Telnet	Standard terminal emulation protocol in the TCP/IP protocol stack
TFTP	It is an acronym for **T**rivial **F**ile **T**ransfer **P**rotocol. It is transfer protocol that uses the User Datagram Protocol (UDP) and provides file writing and reading,
TLV	It is an acronym for **T**ype **L**ength **V**alue. A LLDP frame can contain multiple pieces of information. Each of these pieces of information is known as TLV
ToS	It is an acronym for **T**ype **o**f **S**ervice. It is implemented as the IPv4 ToS priority control. It is fully decoded to determine the priority from the 6-bit ToS field in the IP header.
TrTCM	Two rate Three Color Marker
TTL	Time To Live
TST	Test PDU
Tx	Transmit
UI	User Interface
UNI	User Network Interface
UPnP	It is an acronym for **U**niversal **P**lug and **P**lay. The goals of UPnP are to allow devices to connect seamlessly and to simplify the implementation of networks in the home (data sharing, communications, and entertainment) and in corporate environments for simplified installation of computer components
UTC	Coordinated Universal Time/International Atomic Time
VLAN	Virtual Local Area Network
VLAN ID	VLAN Identifier
WAN	Wide Area Network
WDM	Wavelength-division multiplexing

9.3 Alphabetical Glossary of Terms

ACE

ACE is an acronym for Access Control Entry. It describes access permission associated with a particular ACE ID.

There are three ACE frame types (Ethernet Type, ARP, and IPv4) and two ACE actions (permit and deny). The ACE also contains many detailed, different parameter options that are available for individual application.

ACL

ACL is an acronym for **A**ccess **C**ontrol **L**ist. It is the list table of ACEs, containing access control entries that specify individual users or groups permitted or denied to specific traffic objects, such as a process or a program.

Each accessible traffic object contains an identifier to its ACL. The privileges determine whether there are specific traffic object access rights.

ACL implementations can be quite complex, for example, when the ACEs are prioritized for the various situation. In networking, the ACL refers to a list of service ports or network services that are available on a host or server, each with a list of hosts or servers permitted or denied to use the service. ACL can generally be configured to control inbound traffic, and in this context, they are similar to firewalls.

There are 3 web-pages associated with the manual ACL configuration:

- ACL|Access Control List: The web page shows the ACEs in a prioritized way, highest (top) to lowest (bottom). Default the table is empty. An ingress frame will only get a hit on one ACE even though there are more matching ACEs. The first matching ACE will take action (permit/deny) on that frame and a counter associated with that ACE is incremented. An ACE can be associated with a Policy, 1 ingress port, or any ingress port (the whole switch). If an ACE Policy is created then that Policy can be associated with a group of ports under the "Ports" web-page. There are number of Parameters that can be configured with an ACE. Read the Web page help text to get further information for each of them. The maximum number of ACEs is 64.
- ACL|Ports: The ACL Ports configuration is used to assign a Policy ID to an ingress port. This is useful to group ports to obey the same traffic rules. Traffic Policy is created under the "Access Control List" - page. You can you also set up specific traffic properties (Action / Rate Limiter / Port copy, etc) for each ingress port. They will though only apply if the frame gets past the ACE matching without getting matched. In that case a counter associated with that port is incremented. See the Web page help text for each specific port property
- ACL|Rate Limiters: Under this page you can configure the rate limiters. There can be 15 different rate limiters, each ranging from 1-1024K packets per seconds. Under "Ports" and "Access Control List" web-pages you can assign a Rate Limiter ID to the ACE(s) or ingress port(s).

AES

AES is an acronym for Advanced Encryption Standard. The encryption key protocol is applied in 802.1i standard to improve WLAN security. It is an encryption standard by the U.S. government, which will replace DES and 3DES. AES has a fixed block size of 128 bits and a key size of 128, 192, or 256 bits.

AMS

AMS is an acronym for Auto Media Select. AMS is used for dual media ports (ports supporting both copper (cu) and fiber (SFP) cables. AMS automatically determines if a SFP or a CU cable is inserted and switches to the corresponding media. If both SFP and cu cables are inserted, the port will select the prefered media.

APS

APS is an acronym for Automatic Protection Switching. This protocol is used to secure that switching is done bidirectional in the two ends of a protection group, as defined in G.8031.

Aggregation

Using multiple ports in parallel to increase the link speed beyond the limits of a port and to increase the redundancy for higher availability.

(Also Port Aggregation, Link Aggregation).

ARP

ARP is an acronym for Address Resolution Protocol. It is a protocol that used to convert an IP address into a physical address, such as an Ethernet address. ARP allows a host to communicate with other hosts when only the Internet address of its neighbors is known. Before using IP, the host sends a broadcast ARP request containing the Internet address of the desired destination system.

ARP Inspection

ARP Inspection is a secure feature. Several types of attacks can be launched against a host or devices connected to Layer 2 networks by "poisoning" the ARP caches. This feature is used to block such attacks. Only valid ARP requests and responses can go through the switch device.

Auto-Negotiation

Auto-negotiation is the process where two different devices establish the mode of operation and the speed settings that can be shared by those devices for a link.

CC

CC is an acronym for Continuity Check. It is a MEP functionality that is able to detect loss of continuity in a network by transmitting CCM frames to a peer MEP.

CCM

CCM is an acronym for Continuity Check Message. It is a OAM frame transmitted from a MEP to it's peer MEP and used to implement CC functionality.

CDP

CDP is an acronym for Cisco Discovery Protocol.

DEI

DEI is an acronym for Drop Eligible Indicator. It is a 1-bit field in the VLAN tag.

DES

DES is an acronym for Data Encryption Standard. It provides a complete description of a mathematical algorithm for encrypting (enciphering) and decrypting (deciphering) binary coded information.

Encrypting data converts it to an unintelligible form called cipher. Decrypting cipher converts the data back to its original form called plaintext. The algorithm described in this standard specifies both enciphering and deciphering operations which are based on a binary number called a key.

DHCP

DHCP is an acronym for Dynamic Host Configuration Protocol. It is a protocol used for assigning dynamic IP addresses to devices on a network.

DHCP used by networked computers (clients) to obtain IP addresses and other Parameters such as the default gateway, subnet mask, and IP addresses of DNS servers from a DHCP server.

The DHCP server ensures that all IP addresses are unique, for example, no IP address is assigned to a second client while the first client's assignment is valid (its lease has not expired). Therefore, IP address pool management is done by the server and not by a human network administrator.

Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means that a new computer can be added to a network without the hassle of manually assigning it a unique IP address.

DHCP Relay

DHCP Relay is used to forward and to transfer DHCP messages between the clients and the server when they are not on the same subnet domain.

The DHCP option 82 enables a DHCP relay agent to insert specific information into a DHCP request packets when forwarding client DHCP packets to a DHCP server and remove the specific information from a DHCP reply packets when forwarding server DHCP packets to a DHCP client. The DHCP server can use this information to implement IP address or other assignment policies. Specifically the option works by setting two sub-options: Circuit ID (option 1) and Remote ID (option2). The Circuit ID sub-option is supposed to include information specific to which circuit the request came in on. The Remote ID sub-option was designed to carry information relating to the remote host end of the circuit.

The definition of Circuit ID in the switch is 4 bytes in length and the format is "vlan_id" "module_id" "port_no". The parameter of "vlan_id" is the first two bytes represent the VLAN ID. The parameter of "module_id" is the third byte for the module ID (in standalone switch it always equal 0, in stackable switch it means switch ID). The parameter of "port_no" is the fourth byte and it means the port number.
The Remote ID is 6 bytes in length, and the value is equal the DHCP relay agents MAC address.

DHCP Snooping

DHCP Snooping is used to block intruder on the untrusted ports of the switch device when it tries to intervene by injecting a bogus DHCP reply packet to a legitimate conversation between the DHCP client and server.

DNS

DNS is an acronym for Domain Name System. It stores and associates many types of information with domain names. Most importantly, DNS translates human-friendly domain names and computer hostnames into computer-friendly IP addresses. For example, the domain name www.example.com might translate to 192.168.0.1.

DoS

DoS is an acronym for Denial of Service. In a denial-of-service (DoS) attack, an attacker attempts to prevent legitimate users from accessing information or services. By targeting at network sites or network connection, an attacker may be able to prevent network users from accessing email, web sites, online accounts (banking, etc.), or other services that rely on the affected computer.

Dotted Decimal Notation

Dotted Decimal Notation refers to a method of writing IP addresses using decimal numbers and dots as separators between octets. An IPv4 dotted decimal address has the form x.y.z.w, where x, y, z, and w are decimal numbers between 0 and 255.

Drop Precedence Level

Every incoming frame is classified to a Drop Precedence Level (DP level), which is used throughout the device for providing congestion control guarantees to the frame according to what was configured for that specific DP level. A DP level of 0 (zero) corresponds to 'Committed' (Green) frames and a DP level of 1 or higher corresponds to 'Discard Eligible' (Yellow) frames.

DSCP

DSCP is an acronym for Differentiated Services Code Point. It is a field in the header of IP packets for packet classification purposes.

EEE

EEE is an abbreviation for Energy Efficient Ethernet defined in IEEE 802.3az.

EPS

EPS is an abbreviation for Ethernet Protection Switching defined in ITU/T G.8031.

Ethernet Type

Ethernet Type, or EtherType, is a field in the Ethernet MAC header, defined by the Ethernet networking standard. It is used to indicate which protocol is being transported in an Ethernet frame.

FTP

FTP is an acronym for File Transfer Protocol. It is a transfer protocol that uses the Transmission Control Protocol (TCP) and provides file writing and reading. It also provides directory service and security features.

Fast Leave

Multicast snooping Fast Leave processing allows the switch to remove an interface from the forwarding-table entry without first sending out group specific queries to the interface. The VLAN interface is pruned from the multicast tree for the multicast group specified in the original leave message. Fast-leave processing ensures optimal bandwidth management for all hosts on a switched network, even when multiple multicast groups are in use simultaneously. This processing applies to MLD and MLD.

HTTP

HTTP is an acronym for Hypertext Transfer Protocol. It is a protocol that used to transfer or convey information on the World Wide Web (WWW).

HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands. For example, when you enter a URL in your browser, this actually sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page. The other main standard that controls how the World Wide Web works is HTML, which covers how Web pages are formatted and displayed.

Any Web server machine contains, in addition to the Web page files it can serve, an HTTP daemon, a program that is designed to wait for HTTP requests and handle them when they arrive. The Web browser is an HTTP client, sending requests to server machines. An HTTP client initiates a request by establishing a Transmission Control Protocol (TCP) connection to a particular port on a remote host (port 80 by default). An HTTP server listening on that port waits for the client to send a request message.

HTTPS

HTTPS is an acronym for Hypertext Transfer Protocol over Secure Socket Layer. It is used to indicate a secure HTTP connection.

HTTPS provide authentication and encrypted communication and is widely used on the World Wide Web for security-sensitive communication such as payment transactions and corporate logons.

HTTPS is really just the use of Netscape's Secure Socket Layer (SSL) as a sublayer under its regular HTTP application layering. (HTTPS uses port 443 instead of HTTP port 80 in its interactions with the lower layer, TCP/IP.) SSL uses a 40-bit key size for the RC4 stream encryption algorithm, which is considered an adequate degree of encryption for commercial exchange.

ICMP

ICMP is an acronym for Internet Control Message Protocol. It is a protocol that generated the error response, diagnostic or routing purposes. ICMP messages generally contain information about routing difficulties or simple exchanges such as time-stamp or echo transactions. For example, the PING command uses ICMP to test an Internet connection.

IEEE 802.1X

IEEE 802.1X is an IEEE standard for port-based Network Access Control. It provides authentication to devices attached to a LAN port, establishing a point-to-point connection or preventing access from that port if authentication fails. With 802.1X, access to all switch ports can be centrally controlled from a server, which means that authorized users can use the same credentials for authentication from any point within the network.

MLD

MLD is an acronym for Internet Group Management Protocol. It is a communications protocol used to manage the membership of Internet Protocol multicast groups. MLD is used by IP hosts and adjacent multicast routers to establish multicast group memberships. It is an integral part of the IP multicast specification, like ICMP for unicast connections. MLD can be used for online video and gaming and allows more efficient use of resources when supporting these uses.

MLD Querier

A router sends MLD Query messages onto a particular link. This router is called the Querier.

IMAP

IMAP is an acronym for Internet Message Access Protocol. It is a protocol for email clients to retrieve email messages from a mail server.

IMAP is the protocol that IMAP clients use to communicate with the servers, and SMTP is the protocol used to transport mail to an IMAP server.

The current version of the Internet Message Access Protocol is IMAP4. It is similar to Post Office Protocol version 3 (POP3), but offers additional and more complex features. For example, the IMAP4 protocol leaves your email messages on the server rather than downloading them to your computer. If you wish to remove your messages from the server, you must use your mail client to generate local folders, copy messages to your local hard drive, and then delete and expunge the messages from the server.

IP

IP is an acronym for Internet Protocol. It is a protocol used for communicating data across an internet network.

IP is a "best effort" system, which means that no packet of information sent over is assured to reach its destination in the same condition it was sent. Each device connected to a Local Area Network (LAN) or Wide Area Network (WAN) is given an Internet Protocol address, and this IP address is used to identify the device uniquely among all other devices connected to the extended network.

The current version of the Internet protocol is IPv4, which has 32-bits Internet Protocol addresses allowing for in excess of four billion unique addresses. This number is reduced drastically by the practice of webmasters taking addresses in large blocks, the bulk of which remain unused. There is a rather substantial movement to adopt a new version of the Internet Protocol, IPv6, which would have 128-bits Internet Protocol addresses. This number can be represented roughly by a three with thirty-nine zeroes after it. However, IPv4 is still the protocol of choice for most of the Internet.

IPMC

IPMC is an acronym for IP MultiCast.

IPMC supports IPv4 and IPv6 multicasting. IPMCv4 denotes multicast for IPv4. IPMCv6 denotes multicast for IPv6.

IP Source Guard

IP Source Guard is a secure feature used to restrict IP traffic on DHCP snooping untrusted ports by filtering traffic based on the DHCP Snooping Table or manually configured IP Source Bindings. It helps prevent IP spoofing attacks when a host tries to spoof and use the IP address of another host.

LACP

LACP is an IEEE 802.3ad standard protocol. The **L**ink **A**ggregation **C**ontrol **P**rotocol, allows bundling several physical ports together to form a single logical port.

LLC

The IEEE 802.2 **L**ogical **L**ink **C**ontrol (LLC) protocol provides a link mechanism for upper layer protocols. It is the upper sub-layer of the Data Link Layer and provides multiplexing mechanisms that make it possible for several network protocols (IP, IPX) to coexist within a multipoint network. LLC header consists of 1-byte DSAP (Destination Service Access Point), 1 byte SSAP (Source Service Access Point), 1 or 2 bytes Control field followed by LLC information.

LLDP

LLDP is an IEEE 802.1ab standard protocol.

The **L**ink **L**ayer **D**iscovery **P**rotocol (LLDP) specified in this standard allows stations attached to an IEEE 802 LAN to advertise, to other stations attached to the same IEEE 802 LAN, the major capabilities provided by the system incorporating that station, the management address or addresses of the entity or entities that provide management of those capabilities, and the identification of the stations point of attachment to the IEEE 802 LAN required by those management entity or entities. The information distributed via this protocol is stored by its recipients in a standard Management Information Base (MIB), making it possible for the information to be accessed by a Network Management System (NMS) using a management protocol such as the Simple Network Management Protocol (SNMP).

LLDP-MED

LLDP-MED is an extension of IEEE 802.1ab and is defined by the telecommunication industry association (TIA-1057).

LOC

LOC is an acronym for Loss Of Connectivity and is detected by a MEP and is indicating lost connectivity in the network. Can be used as a switch criteria byEPS

MAC Table

Switching of frames is based upon the DMAC address contained in the frame. The switch builds up a table that maps MAC addresses to switch ports for knowing which ports the frames should go to (based upon the DMAC address in the frame). This table contains both static and dynamic entries. The static entries are configured by the network administrator if the administrator wants to do a fixed mapping between the DMAC address and switch ports.

The frames also contain a MAC address (SMAC address), which shows the MAC address of the equipment sending the frame. The SMAC address is used by the switch to automatically update the MAC table with these dynamic MAC addresses. Dynamic entries are removed from the MAC table if no frame with the corresponding SMAC address have been seen after a configurable age time.

MEP

MEP is an acronym for Maintenance Entity Endpoint and is an endpoint in a Maintenance Entity Group (ITU-T Y.1731).

MD5

MD5 is an acronym for Message-Digest algorithm 5. MD5 is a message digest algorithm, used cryptographic hash function with a 128-bit hash value. It was designed by Ron Rivest in 1991. MD5 is officially defined in RFC 1321 - The MD5 Message-Digest Algorithm.

Mirroring

For debugging network problems or monitoring network traffic, the switch system can be configured to mirror frames from multiple ports to a mirror port. (In this context, mirroring a frame is the same as copying the frame.)

Both incoming (source) and outgoing (destination) frames can be mirrored to the mirror port.

MLD

MLD is an acronym for **M**ulticast **L**istener **D**iscovery for IPv6. MLD is used by IPv6 routers to discover multicast listeners on a directly attached link, much as MLD is used in IPv4. The protocol is embedded in ICMPv6 instead of using a separate protocol.

MVR

Multicast VLAN Registration (MVR) is a protocol for Layer 2 (IP)-networks that enables multicast-traffic from a source VLAN to be shared with subscriber-VLANs.

The main reason for using MVR is to save bandwidth by preventing duplicate multicast streams being sent in the core network, instead the stream(s) are received on the MVR-VLAN and forwarded to the VLANs where hosts have requested it/them(Wikipedia).

NAS

NAS is an acronym for Network Access Server. The NAS is meant to act as a gateway to guard access to a protected source. A client connects to the NAS, and the NAS connects to another resource asking whether the client's supplied credentials are valid. Based on the answer, the NAS then allows or disallows access to the protected resource. An example of a NAS implementation is IEEE 802.1X.

NetBIOS

NetBIOS is an acronym for Network Basic Input/Output System. It is a program that allows applications on separate computers to communicate within a Local Area Network (LAN), and it is not supported on a Wide Area Network (WAN).

The NetBIOS giving each computer in the network both a NetBIOS name and an IP address corresponding to a different host name, provides the session and transport services described in the Open Systems Interconnection (OSI) model.

NFS

NFS is an acronym for Network File System. It allows hosts to mount partitions on a remote system and use them as though they are local file systems.

NFS allows the system administrator to store resources in a central location on the network, providing authorized users continuous access to them, which means NFS supports sharing of files, printers, and other resources as persistent storage over a computer network.

NTP

NTP is an acronym for Network TimeProtocol, a network protocol for synchronizing the clocks of computer systems. NTP uses UDP (datagrams) as transport layer.

OAM

OAM is an acronym for Operation Administration and Maintenance.

It is a protocol described in ITU-T Y.1731 used to implement carrier ethernet functionality. MEP functionality like CC and RDI is based on this

Optional TLVs

A LLDP frame contains multiple TLVs

For some TLVs it is configurable if the switch shall include the TLV in the LLDP frame. These TLVs are known as optional TLVs. If an optional TLVs is disabled the corresponding information is not included in the LLDP frame.

OUI

OUI is the organizationally unique identifier. An OUI address is a globally unique identifier assigned to a vendor by IEEE. You can determine which vendor a device belongs to according to the OUI address which forms the first 24 bits of a MAC address.

PCP

PCP is an acronym for Priority Code Point. It is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as User Priority.

PD

PD is an acronym for Powered Device. In a PoE system the power is delivered from a PSE (power sourcing equipment) to a remote device. The remote device is called a PD.

PHY

PHY is an abbreviation for Physical Interface Transceiver and is the device that implement the Ethernet physical layer (IEEE-802.3).

PING

ping is a program that sends a series of packets over a network or the Internet to a specific computer in order to generate a response from that computer. The other computer responds with an acknowledgment that it received the packets. Ping was created to verify whether a specific computer on a network or the Internet exists and is connected.

ping uses Internet Control Message Protocol (ICMP) packets. The PING Request is the packet from the origin computer, and the PING Reply is the packet response from the target.

PoE

PoE is an acronym for Power Over Ethernet.

Power Over Ethernet is used to transmit electrical power, to remote devices over standard Ethernet cable. It could for example be used for powering IP telephones, wireless LAN access points and other equipment, where it would be difficult or expensive to connect the equipment to main power supply.

Policer

A policer can limit the bandwidth of received frames. It is located in front of the ingress queue.

POP3

POP3 is an acronym for Post Office Protocol version 3. It is a protocol for email clients to retrieve email messages from a mail server.

POP3 is designed to delete mail on the server as soon as the user has downloaded it. However, some implementations allow users or an administrator to specify that mail be saved for some period of time. POP can be thought of as a "store-and-forward" service.

An alternative protocol is Internet Message Access Protocol (IMAP). IMAP provides the user with more capabilities for retaining e-mail on the server and for organizing it in folders on the server. IMAP can be thought of as a remote file server.

POP and IMAP deal with the receiving of e-mail and are not to be confused with the Simple Mail Transfer Protocol (SMTP). You send e-mail with SMTP, and a mail handler receives it on your recipient's behalf. Then the mail is read using POP or IMAP. IMAP4 and POP3 are the two most prevalent Internet standard protocols for e-mail retrieval. Virtually all modern e-mail clients and servers support both.

PPPoE

PPPoE is an acronym for Point-to-Point Protocol over Ethernet.

It is a network protocol for encapsulating Point-to-Point Protocol (PPP) frames inside Ethernet frames. It is used mainly with ADSL services where individual users connect to the ADSL transceiver (modem) over Ethernet and in plain Metro Ethernet networks (Wikipedia).

Private VLAN

In a private VLAN, PVLANs provide layer 2 isolation between ports within the same broadcast domain. Isolated ports configured as part of PVLAN cannot communicate with each other. Member ports of a PVLAN can communicate with each other.

PTP

PTP is an acronym for Precision TimeProtocol, a network protocol for synchronizing the clocks of computer systems.

QCE

QCE is an acronym for QoS Control Entry. It describes QoS class associated with a particular QCE ID.

There are six QCE frame types: Ethernet Type, VLAN, UDP/TCP Port, DSCP, TOS, and Tag Priority. Frames can be classified by one of 4 different QoS classes: "Low", "Normal", "Medium", and "High" for individual application.

QCL

QCL is an acronym for QoS Control List. It is the list table of QCEs, containing QoS control entries that classify to a specific QoS class on specific traffic objects.

Each accessible traffic object contains an identifier to its QCL. The privileges determine specific traffic object to specific QoS class.

QL

QL In SyncE this is the Quality Level of a given clock source. This is received on a port in a SSM indicating the quality of the clock received in the port.

QoS

QoS is an acronym for Quality of Service. It is a method to guarantee a bandwidth relationship between individual applications or protocols.

A communications network transports a multitude of applications and data, including high-quality video and delay-sensitive data such as real-time voice. Networks must provide secure, predictable, measurable, and sometimes guaranteed services.

Achieving the required QoS becomes the secret to a successful end-to-end business solution. Therefore, QoS is the set of techniques to manage network resources.

QoS class

Every incoming frame is classified to a QoS class, which is used throughout the device for providing queuing, scheduling and congestion control guarantees to the frame according to what was configured for that specific QoS class. There is a one to one mapping between QoS class, queue and priority. A QoS class of 0 (zero) has the lowest priority.

RARP

RARP is an acronym for Reverse Address Resolution Protocol. It is a protocol that is used to obtain an IP address for a given hardware address, such as an Ethernet address. RARP is the complement of ARP.

RADIUS

RADIUS is an acronym for Remote Authentication DialIn User Service. It is a networking protocol that provides centralized access, authorization and accounting management for people or computers to connect and use a network service.

RDI

RDI is an acronym for Remote Defect Indication. It is a OAM functionallity that is used by a MEP to indicate defect detected to the remote peer MEP

Router Port

A router port is a port on the Ethernet switch that leads switch towards the Layer 3 multicast device.

RSTP

In 1998, the IEEE with document 802.1w introduced an evolution of STP: the Rapid Spanning Tree Protocol, which provides for faster spanning tree convergence after a topology change. Standard IEEE 802.1D-2004 now incorporates RSTP and obsoletes STP, while at the same time being backwards-compatible with STP.

SAMBA

Samba is a program running under UNIX-like operating systems that provides seamless integration between UNIX and Microsoft Windows machines. Samba acts as file and print servers for Microsoft Windows, IBM OS/2, and other SMB client machines. Samba uses the Server Message Block (SMB) protocol and Common Internet File System (CIFS), which is the underlying protocol used in Microsoft Windows networking.

Samba can be installed on a variety of operating system platforms, including Linux, most common Unix platforms, OpenVMS, and IBM OS/2.

Samba can also register itself with the master browser on the network so that it would appear in the listing of hosts in Microsoft Windows "Neighborhood Network".

SHA

SHA is an acronym for Secure Hash Algorithm. It designed by the National Security Agency (NSA) and published by the NIST as a U.S. Federal Information Processing Standard. Hash algorithms compute a fixed-length digital representation (known as a message digest) of an input data sequence (the message) of any length.

Shaper

A shaper can limit the bandwidth of transmitted frames. It is located after the ingress queues.

SMTP

SMTP is an acronym for Simple Mail Transfer Protocol. It is a text-based protocol that uses the Transmission Control Protocol (TCP) and provides a mail service modeled on the FTP file transfer service. SMTP transfers mail messages between systems and notifications regarding incoming mail.

SNAP

The **S**ub**N**etwork **A**ccess **P**rotocol (SNAP) is a mechanism for multiplexing, on networks using IEEE 802.2 LLC, more protocols than can be distinguished by the 8-bit 802.2 Service Access Point (SAP) fields. SNAP supports identifying protocols by Ethernet type field values; it also supports vendor-private protocol identifier.

SNMP

SNMP is an acronym for Simple Network Management Protocol. It is part of the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol for network management. SNMP allow diverse network objects to participate in a network management architecture. It enables network management systems to learn network problems by receiving traps or change notices from network devices implementing SNMP.

SNTP

SNTP is an acronym for Simple Network TimeProtocol, a network protocol for synchronizing the clocks of computer systems. SNTP uses UDP (datagrams) as transport layer.

SPROUT

Stack Protocol using ROUting Technology. An advanced protocol for almost instantaneous discovery of topology changes within a stack as well as election of a master switch. SPROUT also calculates Parameters for setting up each switch to perform shortest path forwarding within the stack.

SSID

Service Set Identifier is a name used to identify the particular 802.11 wireless LANs to which a user wants to attach. A client device will receive broadcast messages from all access points within range advertising their SSIDs, and can choose one to connect to based on pre-configuration, or by displaying a list of SSIDs in range and asking the user to select one (wikipedia).

SSH

SSH is an acronym for Secure SHell. It is a network protocol that allows data to be exchanged using a secure channel between two networked devices. The encryption used by SSH provides confidentiality and integrity of data over an insecure network. The goal of SSH was to replace the earlier rlogin, TELNET and rsh protocols, which did not provide strong authentication or guarantee confidentiality (Wikipedia).

SSM

SSM In SyncE this is an abbreviation for Synchronization Status Message and is containing a QL indication.

STP

Spanning Tree Protocol is an OSI layer-2 protocol which ensures a loop free topology for any bridged LAN. The original STP protocol is now obsolete by RSTP.

Switch ID

Switch IDs (1-16) are used to uniquely identify the switches within a stack. The Switch ID of each switch is shown on the display on the front of the switch and is used widely in the web pages as well as in the CLI commands.

SyncE

SyncE Is an abbreviation for Synchronous Ethernet. This functionality is used to make a network 'clock frequency' synchronized. Not to be confused with real time clock synchronized (IEEE 1588).

sFlow

sFlow is an acronym for sample Flow. This protocol is used to monitor the sampled traffic on the switch. The sFlow Agent configures the sampling rate at which the samples have to collected. The sFlow collector is configured to send the sample data to the external traffic monitoring application.

TACACS+

TACACS+ is an acronym for Terminal Acess Controller AccessControl System Plus. It is a networking protocol which provides access control for routers, network access servers and other networked computing devices via one or more centralized servers. TACACS+ provides separate authentication, authorization and accounting services.

Tag Priority

Tag Priority is a 3-bit field storing the priority level for the 802.1Q frame.

TCP

TCP is an acronym for Transmission Control Protocol. It is a communications protocol that uses the Internet Protocol (IP) to exchange the messages between computers.

The TCP protocol guarantees reliable and in-order delivery of data from sender to receiver and distinguishes data for multiple connections by concurrent applications (for example, Web server and e-mail server) running on the same host.

The applications on networked hosts can use TCP to create connections to one another. It is known as a connection-oriented protocol, which means that a connection is established and maintained until such time as the message or messages to be exchanged by the application programs at each end have been exchanged. TCP is responsible for ensuring that a message is divided into the packets that IP manages and for reassembling the packets back into the complete message at the other end.

Common network applications that use TCP include the World Wide Web (WWW), e-mail, and File Transfer Protocol (FTP).

TELNET

TELNET is an acronym for TELetype NETwork. It is a terminal emulation protocol that uses the Transmission Control Protocol (TCP) and provides a virtual connection between TELNET server and TELNET client.

TELNET enables the client to control the server and communicate with other servers on the network. To start a Telnet session, the client user must log in to a server by entering a valid username and password. Then, the client user can enter commands through the Telnet program just as if they were entering commands directly on the server console.

TFTP

TFTP is an acronym for Trivial File Transfer Protocol. It is transfer protocol that uses the User Datagram Protocol (UDP) and provides file writing and reading, but it does not provide directory service and security features.

ToS

ToS is an acronym for Type of Service. It is implemented as the IPv4 ToS priority control. It is fully decoded to determine the priority from the 6-bit ToS field in the IP header. The most significant 6 bits of the ToS field are fully decoded into 64 possibilities, and the singular code that results is compared against the corresponding bit in the IPv4 ToS priority control bit (0~63).

TLV

TLV is an acronym for Type Length Value. A LLDP frame can contain multiple pieces of information. Each of these pieces of information is known as TLV.

TKIP

TKIP is an acronym for Temporal Key Integrity Protocol. It used in WPA to replace WEP with a new encryption algorithm. TKIP comprises the same encryption engine and RC4 algorithm defined for WEP. The key used for encryption in TKIP is 128 bits and changes the key used for each packet.

U

UDP

UDP is an acronym for User Datagram Protocol. It is a communications protocol that uses the Internet Protocol (IP) to exchange the messages between computers.

UDP is an alternative to the Transmission Control Protocol (TCP) that uses the Internet Protocol (IP). Unlike TCP, UDP does not provide the service of dividing a message into packet datagrams, and UDP does not provide reassembling and sequencing of the packets. This means that the application program that uses UDP must be able to make sure that the entire message has arrived and is in the right order. Network applications that want to save processing time because they have very small data units to exchange may prefer UDP to TCP.

UDP provides two services not provided by the IP layer. It provides port numbers to help distinguish different user requests and, optionally, a checksum capability to verify that the data arrived intact.

Common network applications that use UDP include the Domain Name System (DNS), streaming media applications such as IPTV, Voice over IP (VoIP), and Trivial File Transfer Protocol (TFTP).

UPnP

UPnP is an acronym for Universal Plug and Play. The goals of UPnP are to allow devices to connect seamlessly and to simplify the implementation of networks in the home (data sharing, communications, and entertainment) and in corporate environments for simplified installation of computer components

User Priority

User Priority is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as PCP.

VLAN

Virtual LAN. A method to restrict communication between switch ports. VLANs can be used for the following applications:

VLAN unaware switching: This is the default configuration. All ports are VLAN unaware with Port VLAN ID 1 and members of VLAN 1. This means that MAC addresses are learned in VLAN 1, and the switch does not remove or insert VLAN tags.

VLAN aware switching: This is based on the IEEE 802.1Q standard. All ports are VLAN aware. Ports connected to VLAN aware switches are members of multiple VLANs and transmit tagged frames. Other ports are members of one VLAN, set up with this Port VLAN ID, and transmit untagged frames.

Provider switching: This is also known as Q-in-Q switching. Ports connected to subscribers are VLAN unaware, members of one VLAN, and set up with this unique Port VLAN ID. Ports connected to the service provider are VLAN aware, members of multiple VLANs, and set up to tag all frames. Untagged frames received on a subscriber port are forwarded to the provider port with a single VLAN tag. Tagged frames received on a subscriber port are forwarded to the provider port with a double VLAN tag.

VLAN ID

VLAN ID is a 12-bit field specifying the VLAN to which the frame belongs.

Voice VLAN

Voice VLAN is VLAN configured specially for voice traffic. By adding the ports with voice devices attached to voice VLAN, we can perform QoS-related configuration for voice data, ensuring the transmission priority of voice traffic and voice quality.

WEP

WEP is an acronym for Wired Equivalent Privacy. WEP is a deprecated algorithm to secure IEEE 802.11 wireless networks. Wireless networks broadcast messages using radio, so are more susceptible to eavesdropping than wired networks. When introduced in 1999, WEP was intended to provide confidentiality comparable to that of a traditional wired network (Wikipedia).

WiFi

WiFi is an acronym for Wireless Fidelity. It is meant to be used generically when referring of any type of 802.11 network, whether 802.11b, 802.11a, dual-band, etc. The term is promulgated by the Wi-Fi Alliance.

WPA

WPA is an acronym for Wi-Fi Protected Access. It was created in response to several serious weaknesses researchers had found in the previous system, Wired Equivalent Privacy (WEP). WPA implements the majority of the IEEE 802.11i standard and was intended as an intermediate measure to take the place of WEP while 802.11i was prepared. WPA is specifically designed to also work with pre-WPA wireless network interface cards (through firmware upgrades), but not necessarily with first generation wireless access points. WPA2 implements the full standard but will not work with some older network cards (Wikipedia).

WPA-PSK

WPA-PSK is an acronym for Wi-Fi Protected Access - Pre Shared Key. WPA was designed to enhance the security of wireless networks. There are two flavors of WPA: enterprise and personal. Enterprise is meant for use with an IEEE 802.1X authentication server, which distributes different keys to each user. Personal WPA utilizes less scalable 'pre-shared key' (PSK) mode, where every allowed computer is given the same passphrase. In PSK mode, security depends on the strength and secrecy of the passphrase. The design of WPA is based on a Draft 3 of the IEEE 802.11i standard (Wikipedia).

WPA-Radius

WPA-Radius is an acronym for Wi-Fi Protected Access - Radius (802.1X authentication server). WPA was designed to enhance the security of wireless networks. There are two flavors of WPA: enterprise and personal. Enterprise is meant for use with an IEEE 802.1X authentication server, which distributes different keys to each user. Personal WPA utilizes less scalable 'pre-shared key' (PSK) mode, where every allowed computer is given the same passphrase. In PSK mode, security depends on the strength and secrecy of the passphrase. The design of WPA is based on a Draft 3 of the IEEE 802.11i standard (Wikipedia).

WPS

WPS is an acronym for Wi-Fi Protected Setup. It is a standard for easy and secure establishment of a wireless home network. The goal of the WPS protocol is to simplify the process of connecting any home device to the wireless network (Wikipedia).

WRED

WRED is an acronym for Weighted Random Early Detection. It is an active queue management mechanism that provides preferential treatment of higher priority frames when traffic builds up within a queue. A frame's DP level is used as input to WRED. A higher DP level assigned to a frame results in a higher probability that the frame is dropped during times of congestion.

WTR

WTR is an acronym for Wait To Restore. This is the time a failure on a resource must be 'not active' before restoration back to this (previously failing) resource is done.