Falcon Gen-3 M-Class

User Guide

nFalcon-M, Falcon-MX, µFalcon-MX

Software version 7.4.0

www.fibrolan.com

PROPRIETARY INFORMATION

Special Notes

The M-Class series includes Falcon-MX, µFalcon-MX, and nFalcon-M devices.

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 M-class devices.

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

Contents

1 Introduction

1.1 M-Class series overview

1.1.1 Falcon-MX

Falcon-MX is a high performance, *10G* service aggregation and demarcation *system* that *d*elivers carrier-grade services in compact form factor and designed for extended temperature range.

The **Falcon-MX** is equipped with up to 24 dual-rate FE/GE SFP ports, up to 4 tri-speed Copper ports and up to 4 10G SFP+ uplink ports. All ports can operate at full wire speed, with a total processing capacity of 160Gbps.

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

1.1.2 µFalcon-MX

µFalcon-MX is a high performance, 10G service demarcation and local aggregation device that delivers business-class access services in compact form factor, and designed for extended temperature ranges.

Among its unique capabilities is 2.5GE support, providing an intermediate step for high-speed access, and advanced timing functions, benefiting from Fibrolan's Timing portfolio and technology.

The **µFalcon-MX** series is equipped with 4x triple-rate SFP ports (100/1000/2500BaseX), 2x tri-speed Copper ports (10/100/1000BaseT) and 2x 1/2.5/10G SFP+ uplink ports. All ports can operate at full wire speed, with a total processing capacity of 34Gbps (non-blocking).

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

1.1.3 nFalcon-M

nFalcon-M is an ultra-compact, 2.5Gbps enabled service demarcation device. The nFalcon-M (nano Falcon M) creates an intermediate step between 1G and 10G, while delivering full performance and monitoring tools.

The nFalcon-M is equipped with 2 x triple-rate SFP ports (100/1000/2500BaseX) and 2 x tri-speed Copper ports (10/100/1000BaseT). All ports can operate at full wire speed, with a total processing capacity of 14Gbps (non-blocking).

The device offers advanced Quality of Service (QoS) features including classification and mapping based on layer 1 through layer 4 attributes, rate limiting per service, with highly flexible scheduling, queuing and shaping options (including HQoS).

All MEF defined services can be configured on the nFalcon-M series and can also be protected through the use of high-performance mechanisms, based on G.8031, G.8032 for the link, path, and ring resilience.

1.2 Interfaces

1.2.1 Falcon-MX

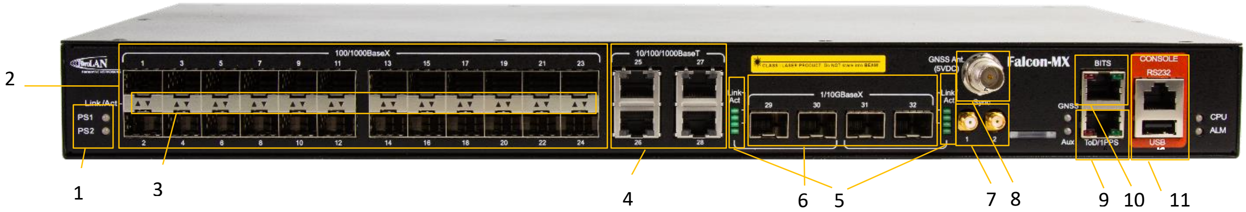


Figure 1-1: Falcon-MX front panel

Table 1-1: Falcon-MX Interface Capacity

	Description	Quantity	Notes
1	PS1/PS2	2	Power Supply indicators
2	100BaseFX/1000BaseX (SFP)	24	
3	LEDs indicators Link/Activity (per port)	24	
4	10/100/1000BaseT (RJ45)	4	
5	LEDs indicators Link/Activity (per port)	2x4	
6	1/2.5/10G (SFP+)	4	
7	Synchronization (SMA Connectors)	2	applicable to timing enabled models only
8	GNSS Receiver	1	
9	BITS output	1	
10	ToD/IPPS output	1	
11	Console port & USB port	1	RS232 serial management port

1.2.2 µFalcon-MX

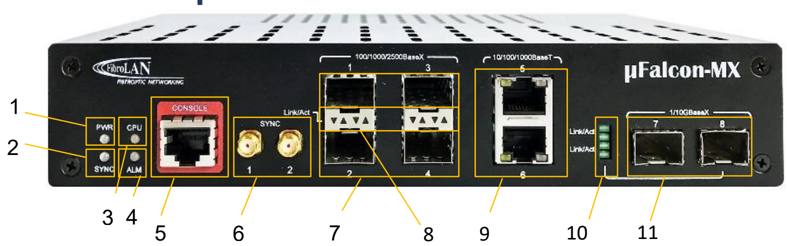


Figure 1-2: µFalcon-MX Interface Capacity

Table 1-2: µFalcon-MX Interface Capacity

	Description	**Quantity**	**Notes**
1	Power indicator LED	1	
2	Sync indicator LED	1	
3	CPU indicator LED	1	
4	Alarm indicator LED	1	
5	Console port	1	RS232 serial management port
6	Synchronization (SMA Connectors)	2	
7	100BaseFX/1000BaseX/2500BaseX (SFP)	4	UNI SFP ports
8	LEDs indicators Link/Activity (per port)	8	
9	10/100/1000BaseT (RJ45)	2	
10	LEDs indicators Link/Activity (per port)	4	
11	1/2.5/10G (SFP+)	2	Uplink ports acting as NNIs

1.2.3 nFalcon-M

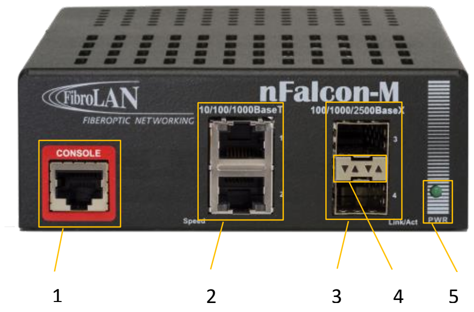


Figure 1-3: nFalcon-M Interface Capacity

Table 1-3: nFalcon-M Interface Capacity

	Description	Quantity	Notes
1	Console port	1	RS232 serial management port
2	10/100/1000BaseT (RJ45)	2 or 4	Model dependent
3	100BaseFX/1000BaseX (SFP)	2	UNI SFP ports
4	LEDs indicators Link/Activity (per port)	4	
5	Power indicator LED	1	

1.3 Models lists

Table 1-4: Falcon-MX models list

Model	Part #	Description
Falcon-MX/428/A	**7120**	Access Service Aggregator, 24x100/1000BaseX (SFP), 4x10/100/1000BaseT, 4x10GE (SFP+), 1 removable AC power supply (FPS10012/A), CE SW license
Falcon-MX/428/D	**7121**	Access Service Aggregator, 24x100/1000BaseX (SFP), 4x10/100/1000BaseT, 4x10GE (SFP+), 1 removable DC power supply (FPS10012/D), CE SW license
Falcon-MX/428/G/A	**7122**	Access Service Aggregator, 24x100/1000BaseX (SFP), 4x10/100/1000BaseT, 4x10GE (SFP+), advanced timing spec (w/ GNSS), 1 removable AC power supply (FPS10012/A), CE SW license
Falcon-MX/428/G/D	**7123**	Access Service Aggregator, 24x100/1000BaseX (SFP), 4x10/100/1000BaseT, 4x10GE (SFP+), advanced timing spec (w/ GNSS), 1 removable DC power supply (FPS10012/D), CE SW license
Falcon-MX/216/A	**7124**	Access Service Aggregator, 12x100/1000BaseX (SFP), 4x10/100/1000BaseT, 2x10GE (SFP+), 1 removable AC power supply (FPS10012/A), CE SW license
Falcon-MX/216/D	**7125**	Access Service Aggregator, 12x100/1000BaseX (SFP), 4x10/100/1000BaseT, 2x10GE (SFP+), 1 removable DC power supply (FPS10012/D), CE SW license
Falcon-MX/404/A	**7126**	Access Service Aggregator/EDD, 4x10/100/1000BaseT, 4x10GE (SFP+), 1 removable AC power supply (FPS10012/A), CE SW license
Falcon-MX/404/D	**7127**	Access Service Aggregator/EDD, 4x10/100/1000BaseT, 4x10GE (SFP+), 1 removable DC power supply (FPS10012/D), CE SW license

Table 1-5: µFalcon-MX models list

Model	Part #	Description
µFalcon-MX/A	**7083**	Access Service Gateway, 4x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, 2x 1/10GE (SFP+), internal AC power supply ,CE SW license
µFalcon-MX/D	**7084**	Access Service Gateway, 4x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, 2x 1/10GE (SFP+), internal DC (20-60VDC) power supply, CE SW license
µFalcon-MX/S/A	**7085**	Access Service Gateway, 4x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, 2x 1/10GE (SFP+), Advanced Timing, internal AC power supply, CE SW license
µFalcon-MX/S/D	**7086**	Access Service Gateway, 4x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, 2x 1/10GE (SFP+), Advanced Timing, internal DC (20-60VDC) power supply, CE SW license

Table 1-6: nFalcon-M models list

Model	Part #	Description
nFalcon-M/A	**7130**	Compact demarcation device, 2x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, internal AC power supply
nFalcon-M/D	**7131**	Compact demarcation device, 2x100/1000/2500BaseX (SFP), 2x10/100/1000BaseT, internal DC power supply
nFalcon-M4/A	**7132**	Compact demarcation device, 2x100/1000/2500BaseX (SFP), 4x10/100/1000BaseT, internal AC power supply
nFalcon-M4/D	**7133**	Compact demarcation device, 2x100/1000/2500BaseX (SFP), 4x10/100/1000BaseT, internal DC power supply

1.4 Typical Applications

1.4.1 Falcon-MX Typical Application - Business Ethernet

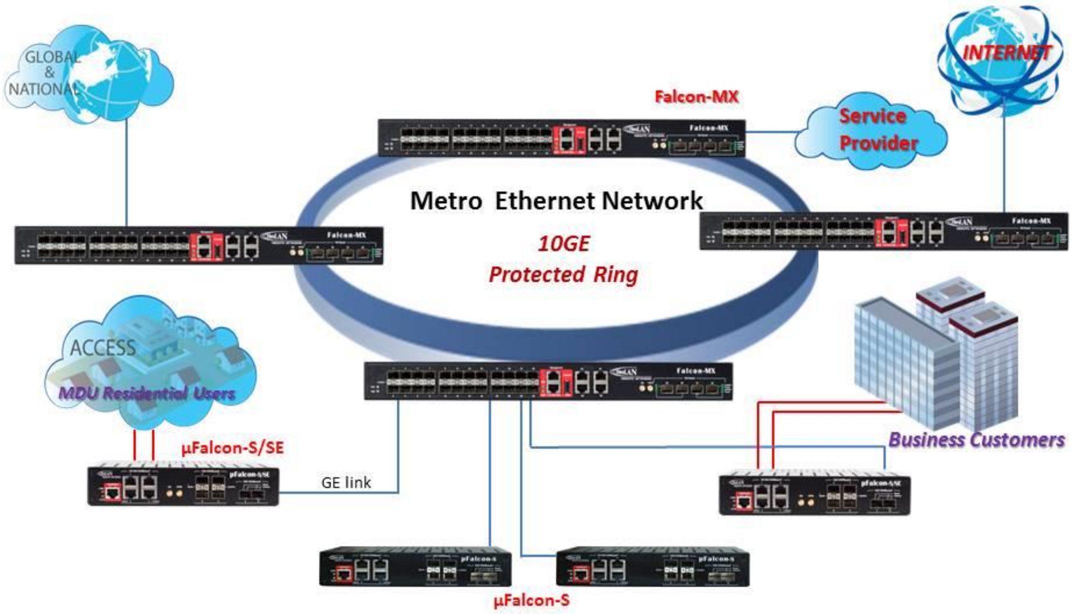


Figure 1-4: Falcon-MX typical application in ring topology

1.4.2 µFalcon-MX Typical Application in Fixed Mobile Convergence

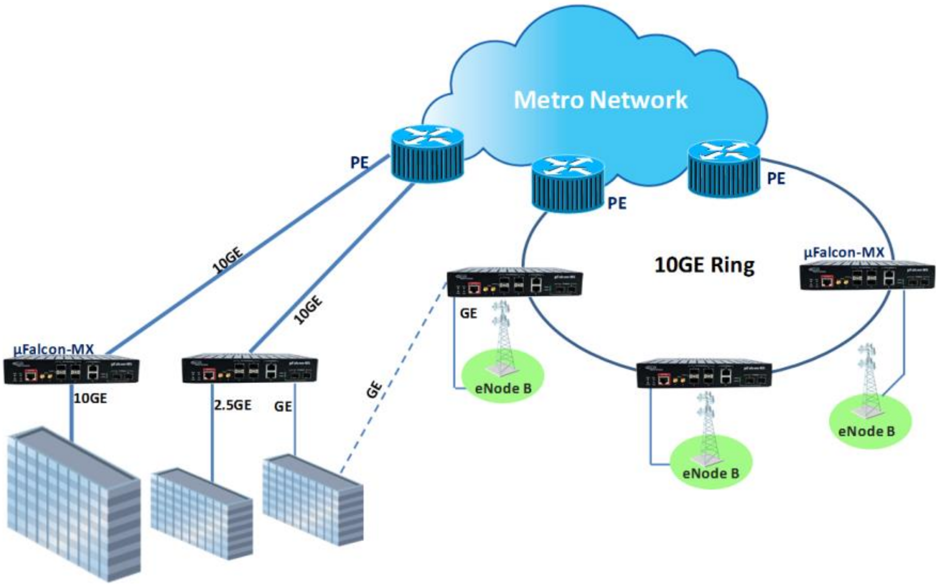


Figure 1-5: Falcon-MX typical applications in ring topology and as demarcation device

1.4.3 nFalcon-M Typical Application in Business Access

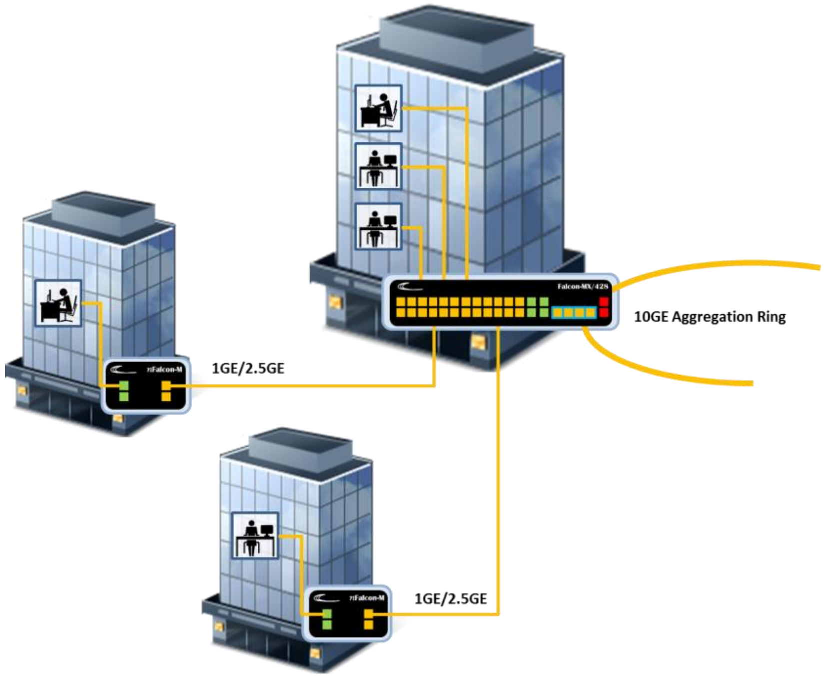


Figure 1-6: nFalcon-MX typical application

1.5 Scalability

The M-Class series provides multiple means of remote field upgrades that result in high levels of scalability, flexibility and future proofing:

- Upgrades for enhancements and new features both on the management and control level, and wire speed packet processing level.
- Scalable and field-upgradable UpLink ports.

These field upgrades enable:

- Support for future standards.
- Support for enhanced and tailored services.

2 System Description

2.1 Block Diagram

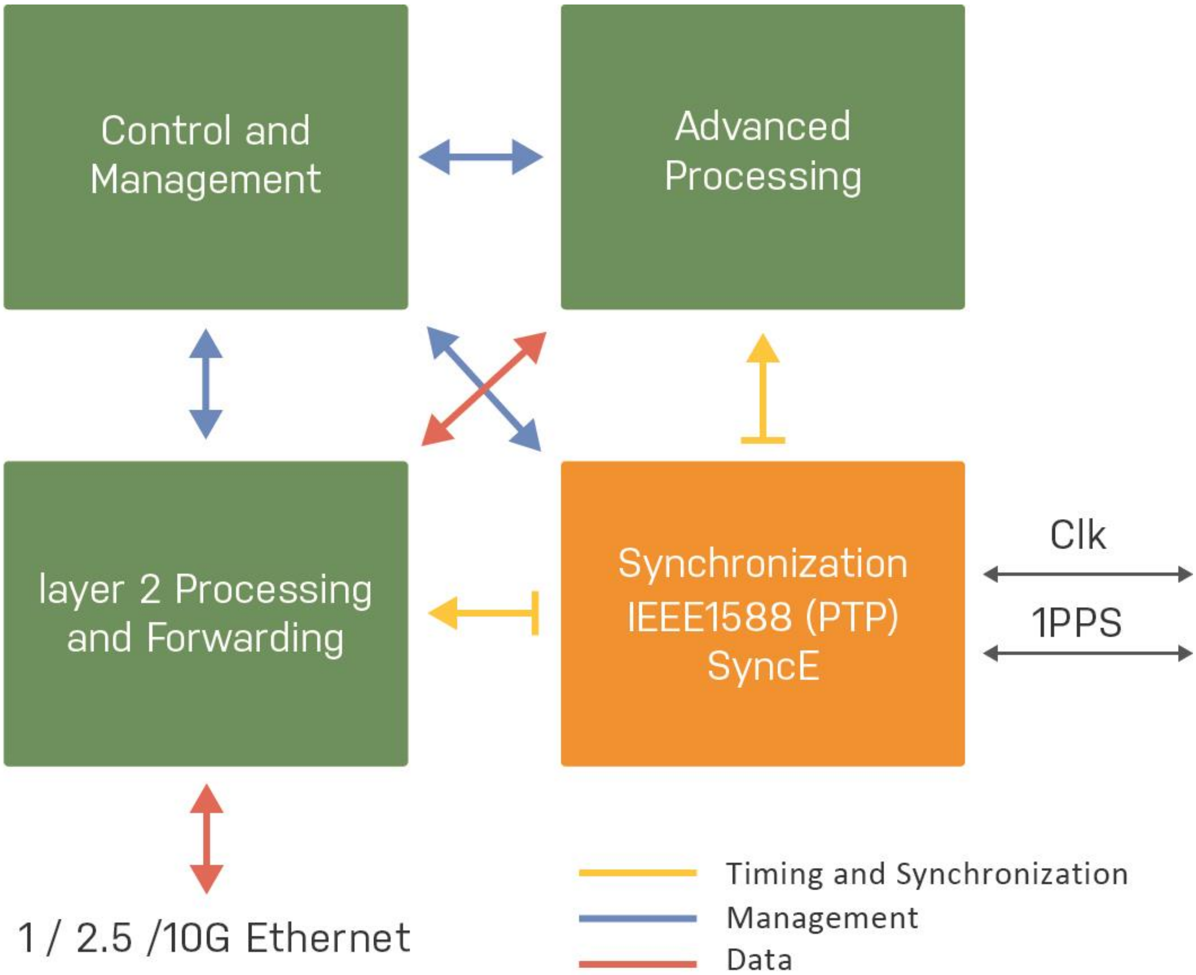


Figure 1-7: M-Class functional block diagram

2.2 M-Class series key features

- 10G service aggregation/demarcation for business Ethernet and mobile backhaul
- Based on 3rd generation Falcon platform with 160Gbps capacity
- Full set of MEF CE2.0 compliant services
- 2.5Gbps support on optical ports
- Extensive Sync and Timing options with GNSS, SyncE, PTP (including GM), BITS, etc
- Advanced QoS and service level traffic management
- Complete OAM toolbox (802.1ag, Y.1731, RFC2544, Y.1564)
- Advanced high speed protection mechanisms for link, path, and ring service resilience
- SW upgradeable to MPLS-TP and L3 routing
- SDN and NFV ready with expansion slot for processing cores (Falcon-MX, µFalcon-MX only)
- Compact design, with low power consumption

2.3 Management

The M-Class series models 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

OAM Management,and NetACE Service Lifecycle Orchestration.

Other Standards: NTPV4, SYSLOG, RADIUS, DHCP, LACP, LLDP.

2.3.2 OAM & Diagnostics:

- IEEE802.3ah link OAM
- IEEE802.1ag CFM
- ITU-T Y.1731 PM (HW based measurements)
- RFC2544 traffic generator & analyzer (up to wire speed)
- L2 & L3 loopback w/ MAC swap
- Throughput metering
- Copper TDR
- SFP diagnostics (SFF-8472)
- Traffic mirroring
- TDM and CES Configuration

2.3.3 NetACE – Key features and benefits:

Fibrolan offers the NetACE platform along with dedicated integrated tools for managing its products (e.g. Falcon) within a complex network The NetACE Orchestrator is a NetOps-driven Service Lifecycle Orchestration, well-known, widely spread platform for managing various networks. The NetACE manages network elements of practically any vendor and therefore enables the operator to manage all devices on the network through a single generic interface, eliminating the need to purchase and maintain different system for each vendor's products

Main platform modules:

NetACE Orchestrator: Lifecycle Service Orchestration, Automation and Assurance

NetACE Analytics: An extension module for SLA Management, Service Analytics and Business Support

NetACE Multi-tenant SLA Portal: An extension module for transparent visualization of Service Performance, SLA Assurance and B2C Communication

2.4 Falcon M-Cass series ports features

The M-Class models 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 M-Class series models ports:

MEF9 EVPL support – S-tag assignment based on C-tag (can be extended to other types of classifications for S-tag assignment). Per port + VLAN (C-tag) double tagging (S-tag assignment) are supported. Such functionality enables full compliance with the MEF9 standard (including EVPL). Refer to Provider Bridges (QinQ)

- Access ports - support service based policing with dual leaky bucket per service
- MEF8: Emulation of PDH Circuits over Metro Ethernet Networks (µFalcon ST & STA only)
- MEF14 EVPL support – C-tag classification enables per service.
- MEF 20: specifies an Implementation Agreement (IA) for MEF User to Network Interface (UNI) Type 2.
- MEF 22.1 :Mobile Backhaul Phase 2
- Service Accounting
- Service accounting is realized using service frame and byte counters
- Per Service Counters: The M-Class series models support frame and byte counters per service basis.
- 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 requires HW based support These functions are:
- Loss measurement
- Delay measurement
- Delay variation measurement
- Synchronous Ethernet and 1588-2008 for LTE mobile backhaul applications.

- Linear (G.8031) and Ring (G.8032v2) Ethernet Protection Switching
- Power Link ports support the implementation of the following:
- RFC2544 traffic generator & analyzer
- Dying-Gasp – Power Link ports can send a Dying-Gasp frame upon power failure. The Dying-Gasp frames are SNMP trap frames
- L2&L3 Loopback (port or VLAN based)
- Automatic Protection Switching

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 M-Class models carry out the following steps:

1. Mount the device at its location (rack or desktop).
2. Install the SFP transceivers if required.
3. Connect the unit to a console and a power source.
4. Verify that the PWR (Power, or PS1,PS2)) LED is green lit.
5. Connect required cables to ports: twisted pair (Ethernet) and fiber (Ethernet SFPs).
6. Verify that the Link and Speed LEDs ports are lit according to connected ports.
7. Configure the selected device via the console if required
8. Access the installed device via one of the management options (RS232, CLI, Telnet or Web management)
9. For a general configuration procedure please refer to the Quick Guide located at Fibrolan Web site (Support > Knowledgebase > Quick Guides)

Remote management requires basic IP configuration.

3.2 Console Connection and Configuration

Applicable to M-Class series devices

Figure 1-8: µFalcon-MX 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

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 M-Class series device to a power source.
   Wait until the device boots up.
3. The system prompts you to log in. Default user name is: **moose**; Default password is: **1234**
4. The above procedure is also applicable in all M-Class series devices

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 Configuration

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 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).

Both setup procedures may be implemented via the following CLI IP configuration commands:

Falcon# config terminal

Falcon(config)# ip ?

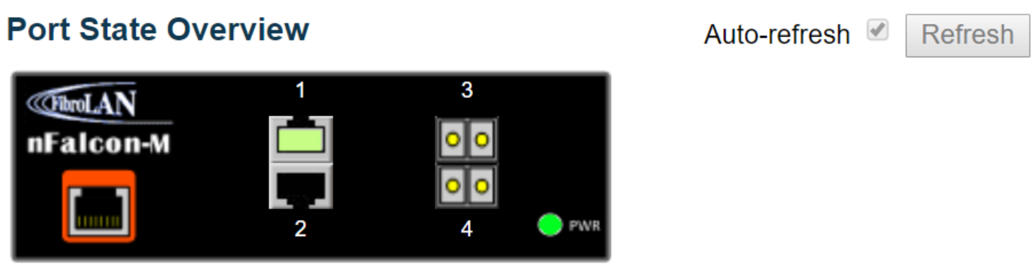
example: Falcon(config)# ip routing

arp	Address Resolution Protocol
dhcp	Dynamic Host Configuration Protocol
dns	Domain Name System
domain	IP DNS Resolver
helper-address	DHCP relay server
http	Hypertext Transfer Protocol
igmp	Internet Group Management Protocol
multicast	IPv4/IPv6 multicast configuration
name-server	Domain Name System
route	Add IP route
routing	Enable routing for IPv4 and IPv6
source	source command
ssh	Secure Shell
verify	verify command

3.2.2 Web management initial display

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.

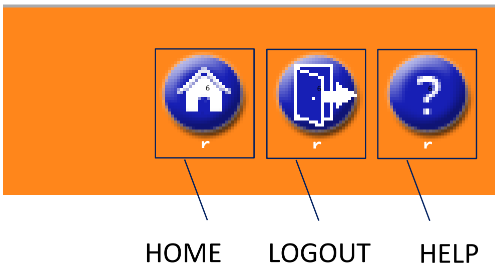


Auto-refresh : Check this box to refresh the page automatically.

Automatic refresh occurs every 3 seconds

Refresh: Click to refresh the page

3.2.3 Web user interface buttons



4 Functional Description

4.1 Overview

This section provides introduction to the **M-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 µM-Class series from the input port toward the output port, as illustrated below.

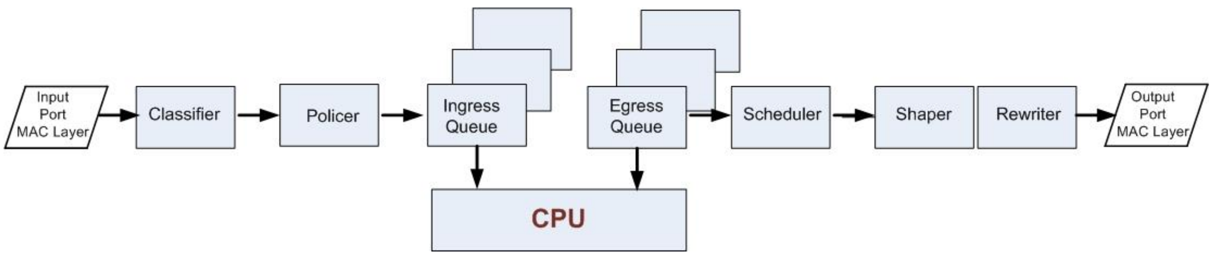


Figure 4-1: Frame Forwarding Diagram

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

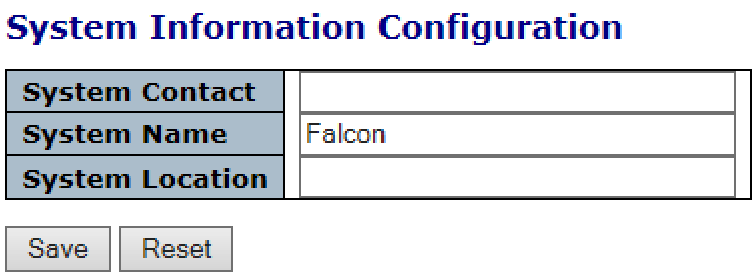


Figure 4-2: System Information Configuration

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.

Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.3.2 IP Configuration

Configure IP basic settings, control IP interfaces and IP routes.
The maximum number of interfaces supported is 8 and the maximum number of routes is 32.

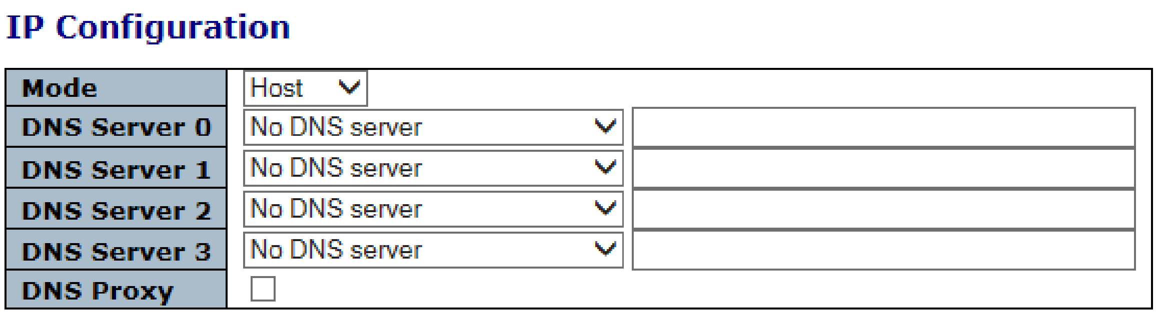


Figure 4-3: IP Configuration

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	This setting 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 linklocal) 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 now supported.

4.3.3 IP Interfaces

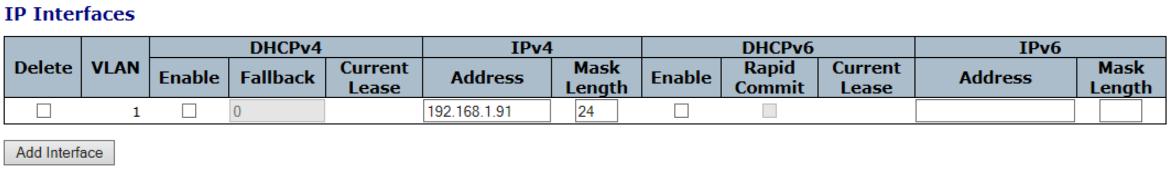


Figure 4-4: IPv6 Configuration

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 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 show 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, **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. 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

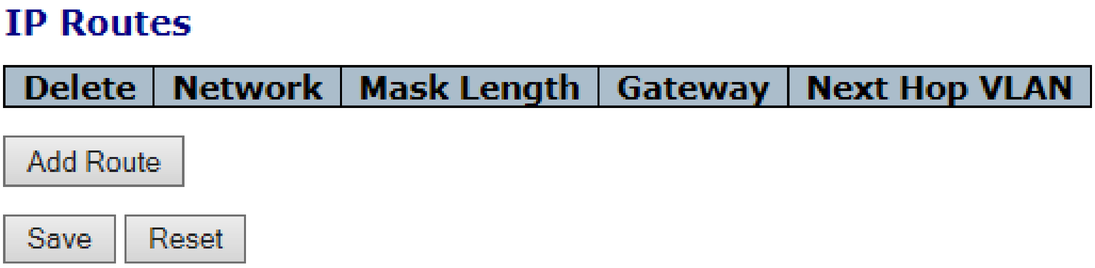


Figure 4-5: IP Routes

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 `0.0.0.0`or 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.
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. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

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

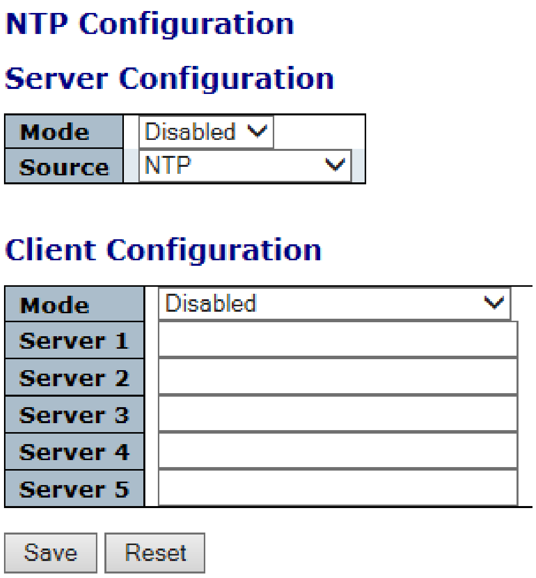


Figure 4-6: NTP Server and Client Configuration

Table 4-5: NTP Configuration Parameters

Sever Configuration	
Mode	Indicates the NTP mode operation. Possible modes are: **Enabled**: Enable NTP mode operation. **Disabled**: Disable NTP mode operation.
Source	The source can be NTP or Sync Center
Client Configuration	
Mode	Enabled or Disabled
Server	Provide the IPv4 or IPv6 address of a NTP server IPv6 address is in 128-bit records represented as eight fields of up to four hexadecimal digits with a colon Enabled n 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'.
Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

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

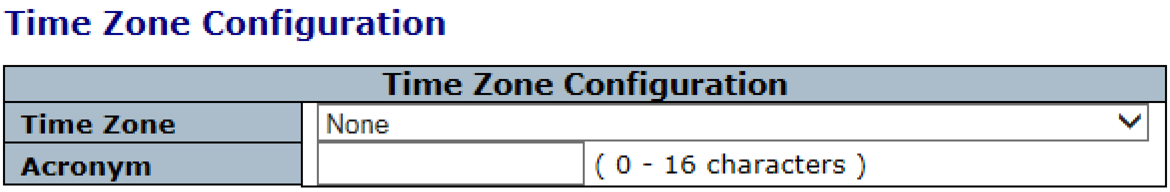


Figure 4-7: Time Zone Configuration

Time Zone Configuration	
Time Zone	Lists various Time Zones worldwide. Select appropriate Time Zone from the drop down and click Save to set.
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
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

Table 4-6: Syslog Configuration Parameters

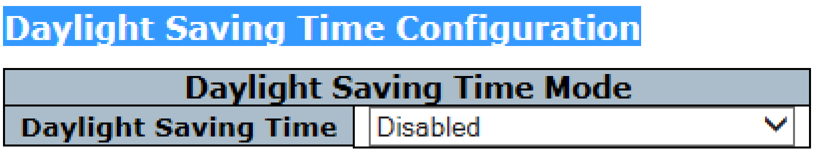


Figure 4-8: Daylight Saving Time Configuration

Table 4-7: 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. 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. (Default : Disabled)
Buttons	**Save:** Click to save changes.

	Reset: Click to undo any changes made locally and revert to previously saved values.

Time Settings

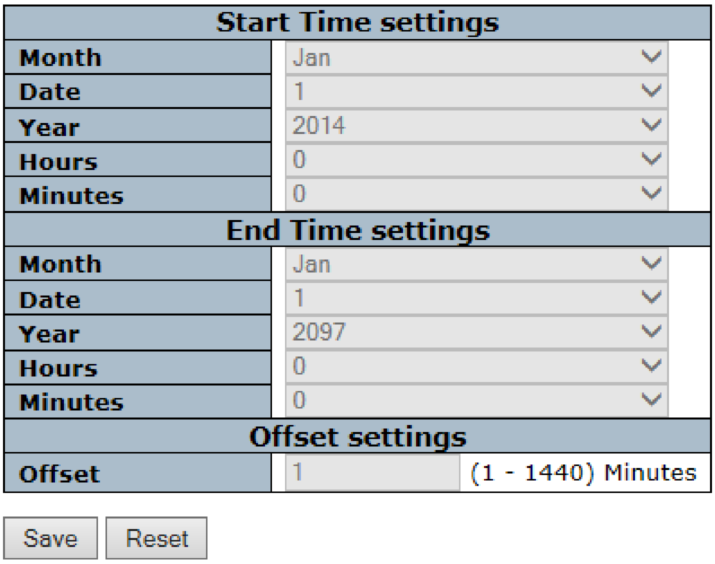


Figure 4-9: Time Settings displays

Table 4-8: 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 1440)
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.3.7 System Log Configuration

Configure System Log on this section

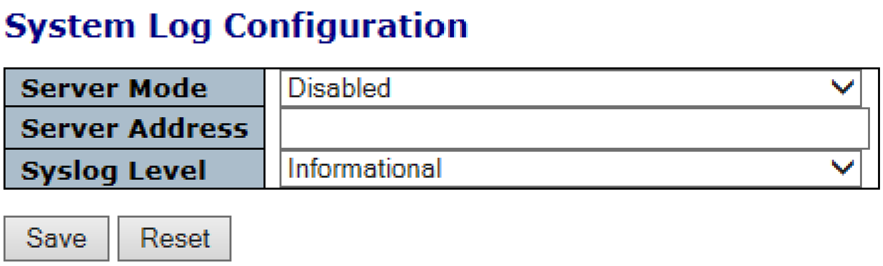


Figure 4-10: System Log Configuration displays

Table 4-9: System Log Configuration Parameters

System Log Configuration	
Server M ode	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 provide 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).
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.3.8 Dying Gasp Configuration

This section configures dying gasp parameters.

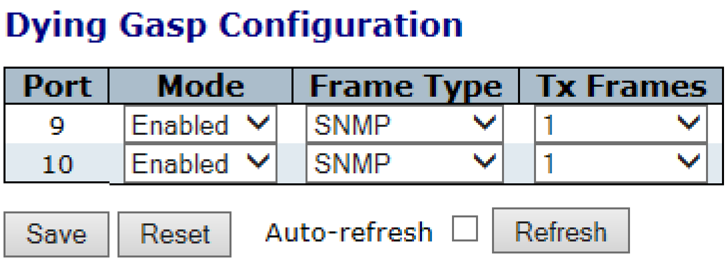


Figure 4-11: Dying Gasp Configuration

Table 4-10: Dying Gasp Configuration Parameters

System Log Configuration	
Port	Select the port to which the Dying Gasp is applied
Mode	Enable or disable dying gasp functionality for a port
Frame Type	Select the sending frame format during dying gasp. SNMP or Link OAM
Tx Frames	Indicates the number of frames to transmit during dying gasp Tx Frames can be set between 1 to 5 frames
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh:** Click to refresh the screen; any changes made locally will be undone **Auto-refresh** **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds

4.3.9 Events

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

Events Configuration

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

Save | Clear All | Reset

Figure 4-12: 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 give interface: SNMP, Syslog, CLI .Flash
Status	Indication whether an event occurred or not .
Clear	Clear event occurred indication
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Clear All:** Click to clear ALL event occurred indications.

4.4 DHCP (Dynamic Host Configuration Protocol

DHCP is an acronym for **D**ynamic **H**ost **C**onfiguration **P**rotocol. 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.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 includes the following sections:

- To refer to "DHCP Server Mode Configuration"
- To refer to "DHCP Server excluded IP Configuration"
- To refer to "DHCP Server Pool Configuration"
- To refer to "DHCP Snooping Configuration"
- To refer to "Dynamic DHCP Snooping Table"
- To refer to "DHCP Relay Configuration"
- To refer to "DHCP Relay Statistics"
- To refer to "DHCP Server Statistics"
- To refer to "DHCP Server Binding IP"
- To refer to "DHCP Server Declined IP"
- To refer to "DHCP Detatiled Statistics Port 1"

4.5 Ports Configuration and Monitoring

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

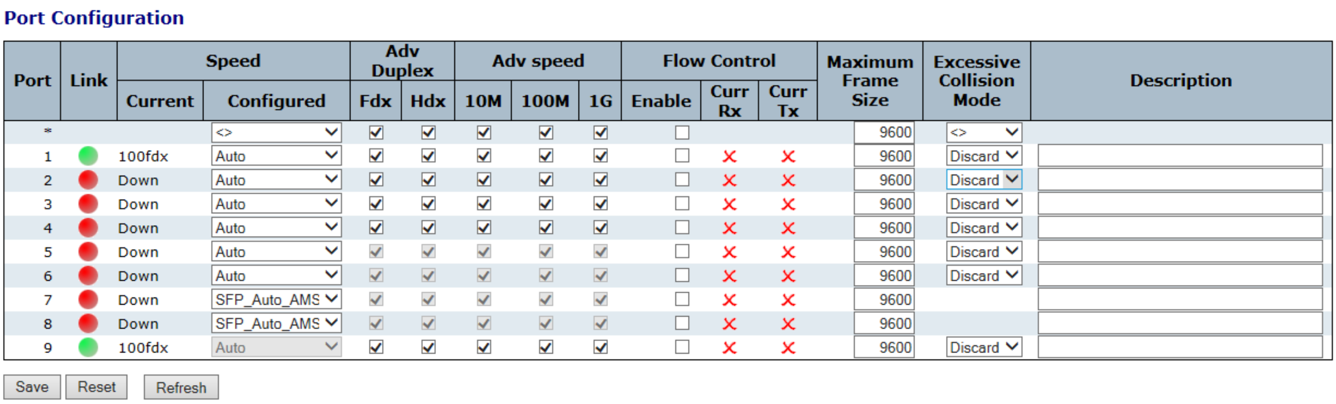


Figure 4-13: Port Configuration

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.
Current Speed	Provides the current link speed of the port

Configured Speed	Selects any 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` - Cu port auto negotiating speed with the link partner and selects the highest speed that is compatible with the link partner. `10Mbps HDX` - Forces the cu port in 10Mbps half duplex mode. `10Mbps FDX` - Forces the cu port in 10Mbps full duplex mode. `100Mbps HDX` - Forces the cu port in 100Mbps half duplex mode. `100Mbps FDX` - Forces the cu port in 100Mbps full duplex mode. `1Gbps FDX` - Forces the cu port in 1Gbps full duplex mode. `SFP_Auto_AMS` - Automatically determines the speed of the SFP. Note: There is no standardized way to do SFP auto detect, so here it is done by reading the SFP rom. Due to the missing standardized way of doing SFP auto detect some SFPs might not be detectable. The port is set in AMS mode with SFP preferred. Cu port is set in **Auto** mode. `100-FX` - SFP port in 100-FX speed. Cu port disabled. `100-FX_AMS` - Port in AMS mode with SFP preferred. SFP port in 100-FX speed. Cu port in **Auto** mode. `1000-X` - SFP port in 1000-X speed. Cu port disabled. `100-X_AMS` - Port in AMS mode with SFP preferred. SFP port in 1000-X speed. Cu port in **Auto** mode. Note: **AMS** is an acronym for **A**uto **M**edia **S**elect. 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 preferred media.
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	WhenSpeed is set as auto i.e auto negotiation, the port will only advertise the specified speeds (**10M** **100M** **1G**) 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 doesn't 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 Flowcontrol 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 can not contain space.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh:** Click to refresh the screen; any changes made locally will be undone.

4.5.1 Port State

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

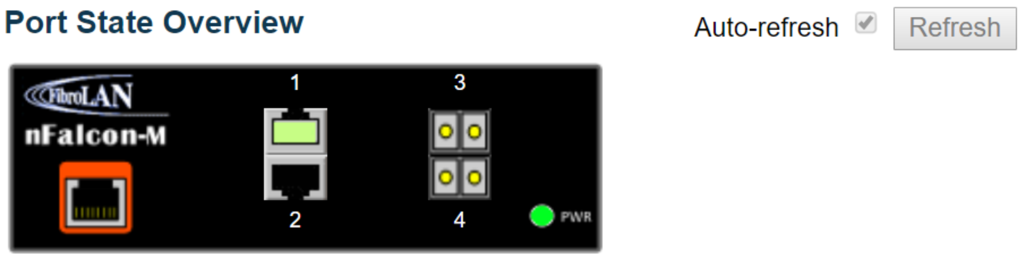
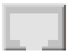
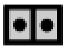
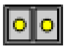
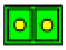


Figure 4-14: Port State

The port states are illustrated as follows:

RJ45 ports			
SFP ports			
State	Disabled	Down	Link

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

4.5.2 SFP Information

This section shows SFP Information

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							

Auto-refresh ☐ Refresh

Figure 4-15: SFP information

Table 4-13: SFP Information Parameters

Vendor #	Indicates vendors name.
Part #	Indicates part number.
Type	Indicates module Type.
Range	Indicates the SFP's nominal optical range.
Wavelength	Indicates the SFP wave length (separately for transmit and receive).
Serial	Indicates the SFP's serial number
Buttons	**Refresh:** Click to refresh the page immediately **Auto-refresh** ☐ : Check this box to enable an automatic refresh of the page at regular intervals

4.5.3 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				

Auto-refresh ☑ Refresh

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

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		

Auto-refresh ☑ Refresh

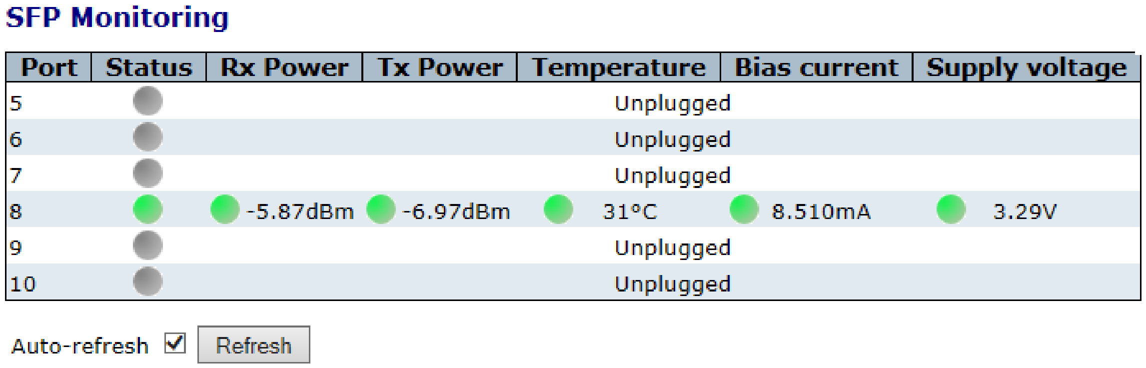
Figure 4-16: Operational Range

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].
Buttons	**Refresh:** Click to refresh the page immediately **Auto-refresh** ☐ : Check this box to enable an automatic refresh of the page at regular intervals

4.5.4 SFP Monitoring

This section shows SFP digital diagnostic information



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				

Auto-refresh Refresh

Figure 4-17: SFP Monitoring

Table 4-15: SFP Monitoring Parameters

RX Power	Module's receive optical power [dBm].
TX Power	Module's transmit optical power [dBm].
Temperature	Module's internal temperature.
Bias Current	Module's transmitter bias current [mA].
Supply voltage	Module's supply voltage [V].
Buttons	**Refresh:** Click to refresh the page immediately **Auto-refresh** : Check this box to enable an automatic refresh of the page at regular intervals

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

4.5.5 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

Auto-refresh ☐ Refresh Clear

Figure 4-18: 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
Buttons	**Refresh:** Click to refresh the page immediately **Clear:** Clears the counters for all ports **Auto-refresh** ☐ : Check this box to enable an automatic refresh of the page at regular intervals

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

4.5.6 QoS Statistics

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

Auto-refresh ☐ Refresh Clear

Figure 4-19: 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
Buttons	**Auto-refresh** ☐ : Check this box to enable an automatic refresh of the screen at regular intervals. **Refresh:** Click to refresh the screen immediately. **Clear:** Clears the counters for all ports.

By clicking selected port 7, you get its detailed port statistics as shown:

Detailed Port Statistics Port 7

Port 7 Auto-refresh ☐ Refresh Clear

Receive Total		Transmit Total	
Rx Packets	3949	**Tx Packets**	6152
Rx Octets	599681	**Tx Octets**	805147
Rx Unicast	390	**Tx Unicast**	593
Rx Multicast	2822	**Tx Multicast**	4601
Rx Broadcast	737	**Tx Broadcast**	958
Rx Pause	0	**Tx Pause**	0
Receive Size Counters		**Transmit Size Counters**	
Rx 64 Bytes	553	**Tx 64 Bytes**	440
Rx 65-127 Bytes	2959	**Tx 65-127 Bytes**	4554
Rx 128-255 Bytes	143	**Tx 128-255 Bytes**	842
Rx 256-511 Bytes	135	**Tx 256-511 Bytes**	148
Rx 512-1023 Bytes	74	**Tx 512-1023 Bytes**	168
Rx 1024-1526 Bytes	85	**Tx 1024-1526 Bytes**	0
Rx 1527- Bytes	0	**Tx 1527- Bytes**	0
Receive Queue Counters		**Transmit Queue Counters**	
Rx Q0	3949	**Tx Q0**	5848
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**	304
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	198		

For details, refer to Detailed Port Statistics

4.5.7 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.

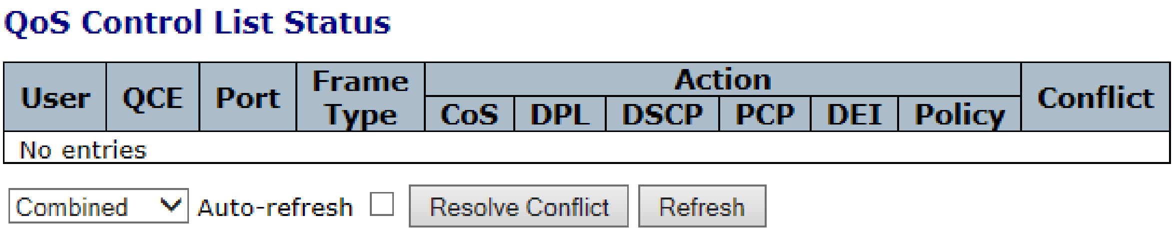


Figure 4-20: QoS Control List Status

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 Ethertype 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.

Conflict	Displays Conflict status of QCL entries. As H/W resources are shared by multiple applications. It may happen that 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 **Auto-refresh** ☐ **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Resolve Conflict:** Click to release the resources required to add QCL entry, in case the conflict status for any QCL entry is 'yes' **Refresh:** Click to refresh the screen; any changes made locally will be undone.

4.5.8 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

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		

Port 1 Auto-refresh Refresh Clear

Figure 4-21: Detailed Port Statistics Display

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.
Buttons	The port select box determines which port is affected by clicking the button. **Auto-refresh** ☐ **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately Click to refresh the screen; any changes made locally will be undone. **Clear**: Clears the counters for the selectedThe number of frames dropped due to output buffer congestion. por

4.5.9 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 overhead 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.

NOTES:

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

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

4.5.10 Thermal Protection

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

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

4.6 Learn MAC 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 M-Class series MAC address space is up to 8K addresses.

4.6.1 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 M-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.

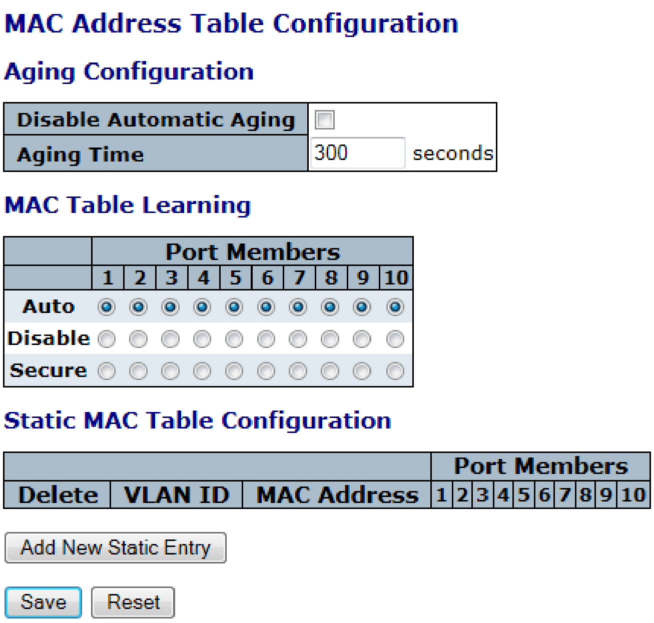


Figure 4-22: MAC Address Table Configuration displays

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.
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".
Buttons	**Save:** Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.6.2 Monitoring the MAC Address Table

Entries in the MAC Table are shown in the below figure. The MAC Table contains up to 8192 entries, and is sorted first by VLAN ID, then by MAC address.

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**
Dynamic	1	00-05-80-00-15-61		✓								
Dynamic	1	00-05-80-00-73-BD		✓								
Static	1	00-05-80-00-83-B2	✓									
Dynamic	1	00-0C-29-D0-1B-36		✓								
Dynamic	1	00-1B-2A-9F-71-1A		✓								
Static	1	33-33-00-00-00-01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Static	1	33-33-00-00-00-02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Static	1	33-33-FF-00-83-B2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dynamic	1	38-60-77-7C-22-EF		✓								
Dynamic	1	40-F4-EC-E0-86-45		✓								
Dynamic	1	D0-67-E5-4A-22-30		✓								
Dynamic	1	D0-67-E5-50-EE-4C		✓								
Static	1	FF-FF-FF-FF-FF-FF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Auto-refresh ☐ [Refresh] [Clear] [|<<] [>>]

Figure 4-23: Monitoring MAC Address Table

4.6.3 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.

Table 4-21: MAC Address Table Configuration Parameters

Start from VLAN	An input field that allows the user to select VLAN starting point in the MAC Table.
MAC address	An input field that allows the user to select the MAC address 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, click on Refresh, 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.

Entries per page	An input field which sets the number of entries per page. The default entry is 20 but can display up 999 entries from the MAC table. The first entry displayed will be the one with the lowest VLAN ID and the lowest MAC address found in the MAC Table.
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.
Buttons	**Auto-refresh** ☐ **:** Automatic refresh occurs every 3 seconds. **Refresh:** Refresh Refreshes the displayed table starting from the "Start from MAC address" and "VLAN" input fields. **Clear:** Clear Flushes all dynamic entries. **<<:** << Updates the table starting from the first entry in the MAC Table, i.e. the entry with the lowest VLAN ID and MAC address. **>>:** >> Updates the table, starting with the entry after the last entry currently displayed.

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).

4.7 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).

4.7.1 VLAN Configuration

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

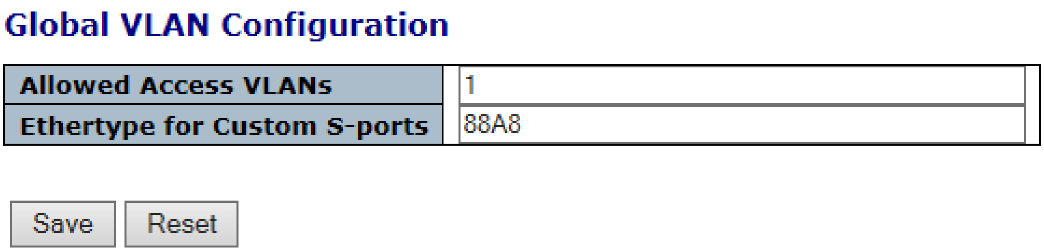


Figure 4-24: Global VLAN Configuration

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.
Buttons	**Save**☹ Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.7.1.1 VLAN Port Configuration

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

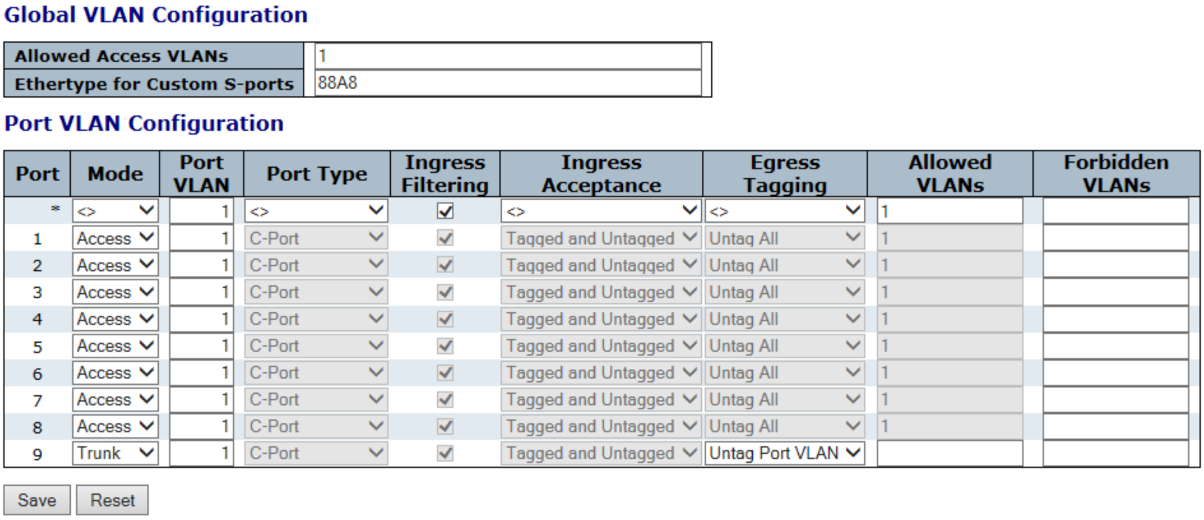


Figure 4-25: VLAN Port Configuration

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 **<u>Trunk:</u>** 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 by the use of 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 **<u>Hybrid:</u>** 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, 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. **<u>Unaware:</u>** 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 **<u>C-Port:</u>** 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.

Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.1.2 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 actually 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.

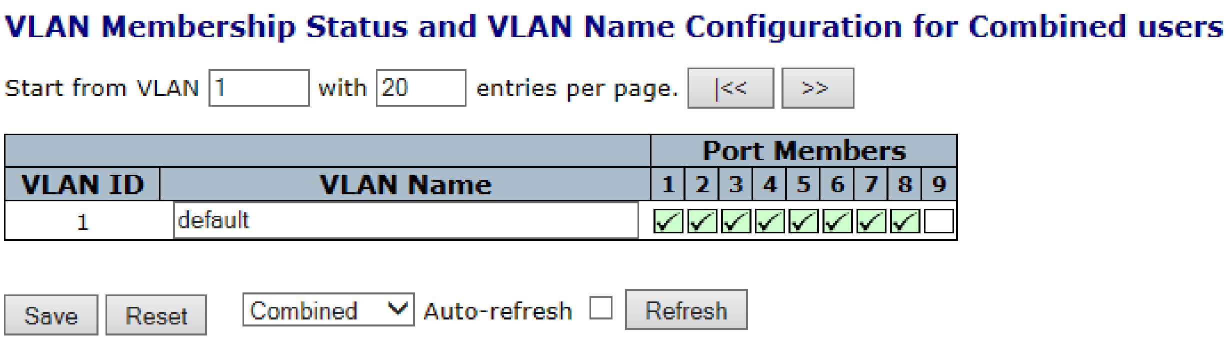


Figure 4-26: VLAN Membership Status and VLAN Name configuration

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	Combined : Select VLAN Users from this drop down list Combined Admin NAS GVRP MVR Voice VLAN MSTP ERPS MEP EVC VCL RMirror **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately

4.7.1.3 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 actually 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.

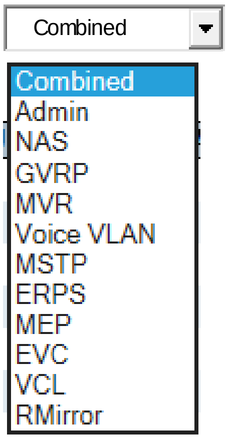
VLAN Port Status for Combined users

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 4-27: 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, Taged, 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 actually configured in hardware.
Buttons	 : Select VLAN Users from this drop down list Auto-refresh : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds Refresh: Click to refresh the page immediately

4.7.2 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 actually 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.

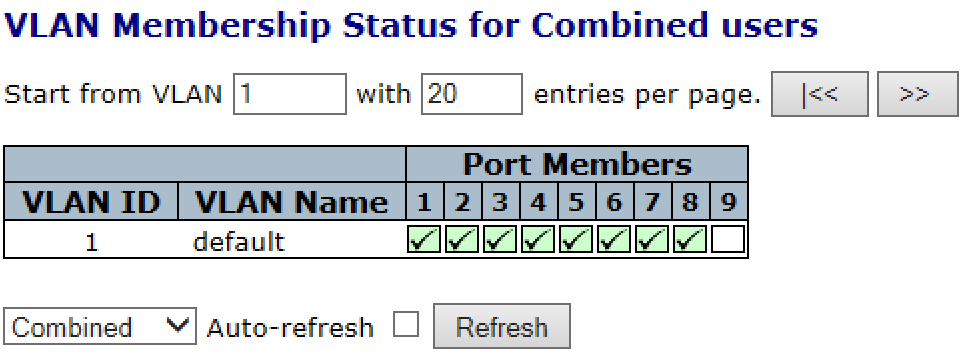
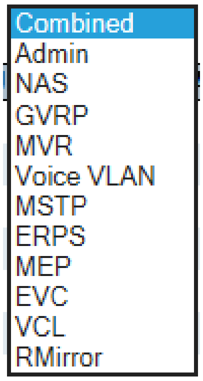


Figure 4-28: VLAN Membership Status for Combined Users

Table 4-26: VLAN Membership Status for Combined usersParameters

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 drop down list  **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately

4.7.3 VLAN Translation

This section allows you to perform:

VLAN Translation Port Configuration
VLAN Translation Mapping Table

4.7.3.1 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.

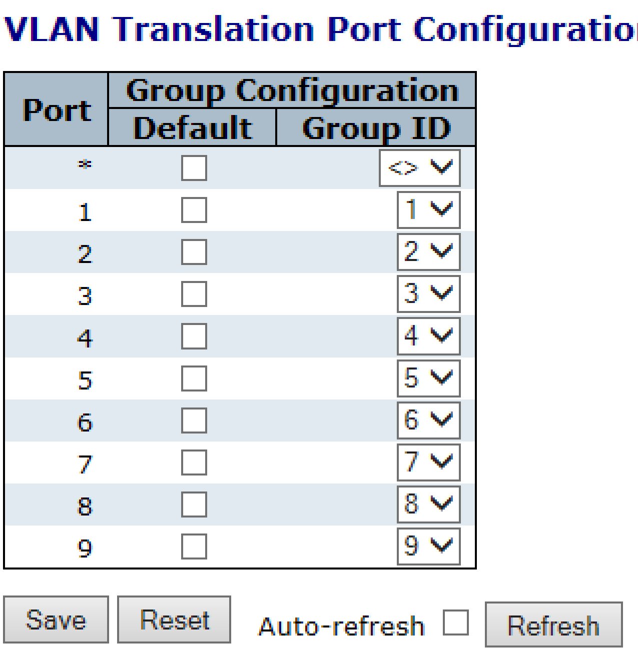


Figure 4-29: VLAN Translation Port Configuration

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 a number of 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. For example, port #1 is by default set to use group with GID = 1.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh:** Click to refresh the page immediately **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.7.3.2 VLAN Translation Mapping Table

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

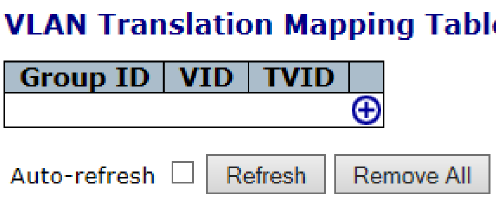


Figure 4-30: VLAN Translation Mapping Table

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 a number of 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.
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. **Refresh:** Refreshes the displayed table starting from the "VLAN ID" input fields. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.
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.

By clicking on ⊕ button, the Mapping Configuration is displayed
The settings can be configured here.

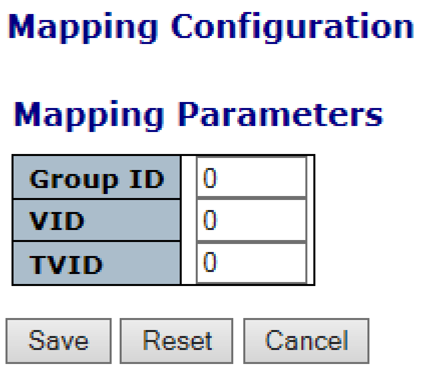


Figure 4-31: Mapping Configuration display

Table 4-29: Mapping Configuration parameters

Group ID	The VLAN Translation mappings are organized into Groups, identified by the Group ID. This way a port is configured to use a number of 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 gIndicates the VLAN of the mapping (i.e. 'source' VLAN). A valid VLAN ID ranges from 1 to 4095. roup with Group ID equal to the port number. For example, port #1 is by default set to use group with GID = 1.
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	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **Cancel:** Return to the previous page; any changes made locally will be undone.

4.7.4 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).

The µFalcon S 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:

1. **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.
2. **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.

4.7.5 Private VLANs (PVLANs)

A traditional VLAN enables communication to/from all its member ports. A private VLAN is a special VLAN which limits the connectivity between its port members. Each private VLAN contains one or more private ports, and a single uplink port.

A typical Private VLAN consists of one “server” port and many “client” ports. A “server” port can talk to all other ports in the VLAN. A “client” port can talk only to the “server” ports and not to other “client” ports. A “client” port in µFalcon is defined as “Isolated” port. A port defined as “Isolated” will behave as such for all private VLANs in which it is a member. A non-isolated port page 4-will serve as “server” port in all private VLANs in which it is a member.

In terms of the switch VLAN table, a Private-VLAN uses a standard VLAN and adds the ‘private’ attribute to it, which instructs the switch to filter the destination ports when forwarding a frame in accordance with the “isolated” ports mask.

4.7.5.1 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.

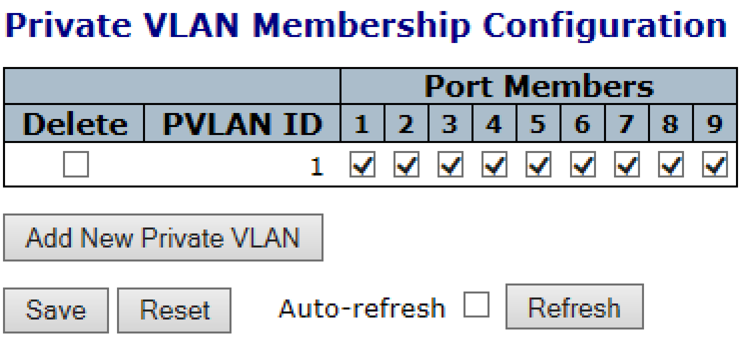


Figure 4-32: Private VLAN Membership Configuration display

Table 4-30: 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 particular 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 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.
Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page immediately **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.5.2 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.

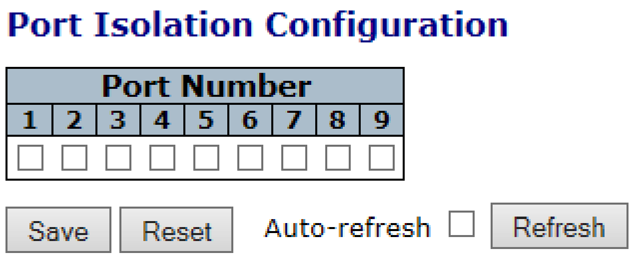


Figure 4-33: Private VLAN Port Isolation Configuration

Table 4-31: 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.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page immediately **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.5.3 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

4.7.5.4 MAC-based VLAN Membership Configuration

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

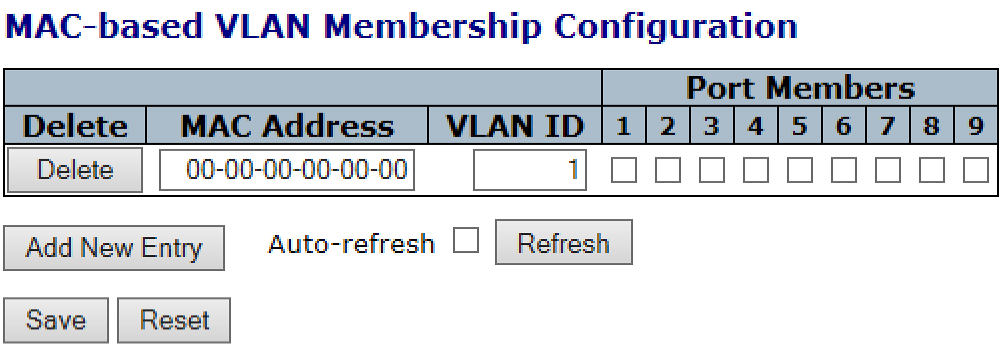


Figure 4-34: MAC based VLAN Membership Configuration display

Table 4-32: 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.
Buttons	**Save:** Click to save changes. **Reset** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately.

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 on "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 are limited to 256.

4.7.5.5 Protocol based VLAN

This section allows you to add new Protocol to 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

Protocol to Group Mapping Table

Group Name to VLAN mapping Table

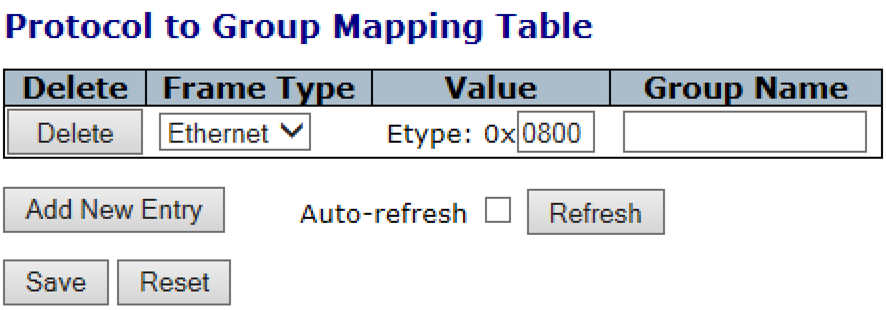


Figure 4-35: Protocol to Group Mapping Table display

Table 4-33: 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. a. **DSAP:** 1-byte long string (0x00-0xff) b. **SSAP:** 1-byte long string (0x00-0xff) **SNAP:** Valid value in this case is also comprised of two different sub-values. a. **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. b. **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). **:** Special characters and underscores (_) are not allowed.
Buttons	**Save:** Click to save changes. **Reset** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately.

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 are limited to 128..

4.7.5.6 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

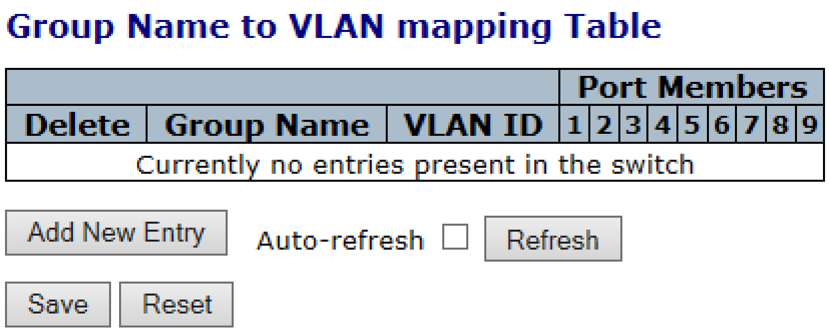


Figure 4-36: Group Name to VLAN Mapping Table display

Table 4-34: 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.
Buttons	**Save:** Click to save changes. **Reset** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately.

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 are limited to 256

4.7.5.7 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.

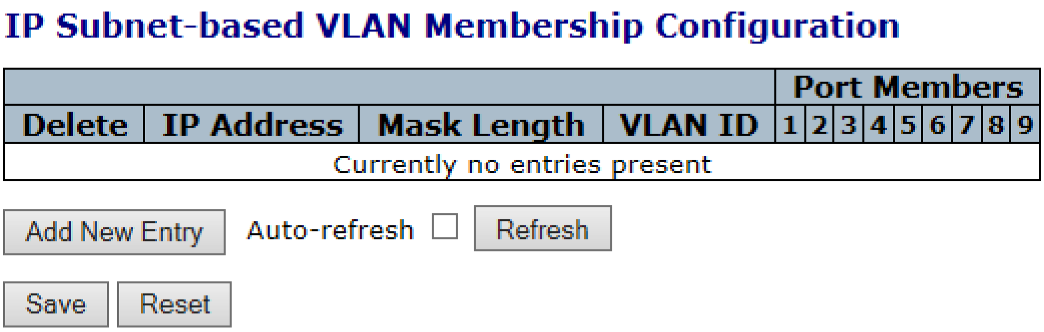


Figure 4-37: IP Subnet based VLAN Membership Configuration display

Table 4-35: 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
Buttons	**Save:** Click to save changes. **Reset** Click to undo any changes made locally and revert to previously saved values. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately.

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

4.7.6 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.

4.7.6.1 Voice VLAN Configuration

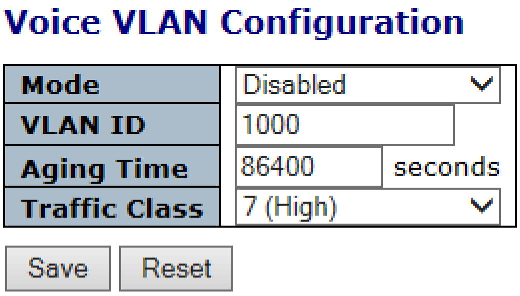


Figure 4-38: Voice VLAN Configuration display

Table 4-36: 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.

Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.6.2 Port Configuration

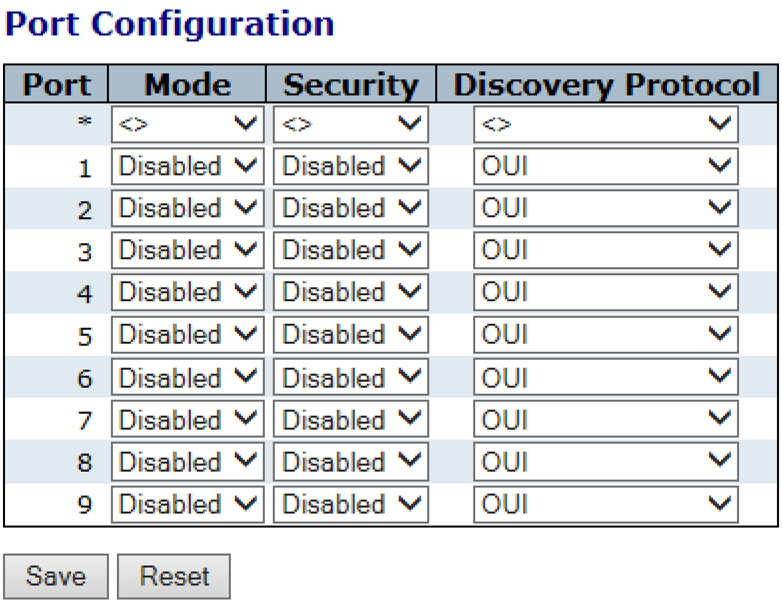


Figure 4-39: Port Configuration display

Table 4-37: 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..
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
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.6.3 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.

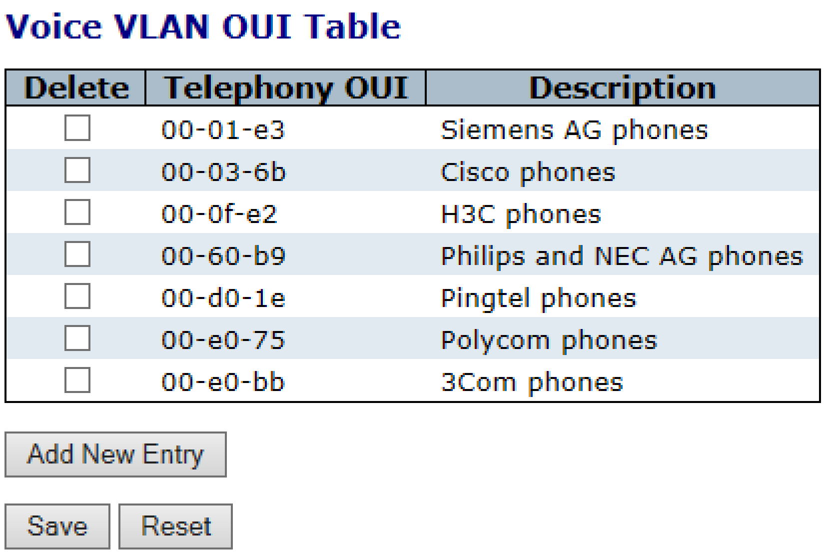


Figure 4-40: Voice VLAN OUI Table display

Table 4-38: 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. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.7 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 MVR includes the following subjects:

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

4.7.7.1 MVR Configurations

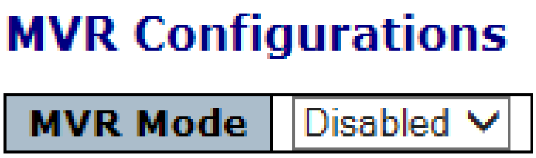


Figure 4-41: MVR Configurations

Table 4-39: 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.

4.7.7.2 VLAN Interface Setting

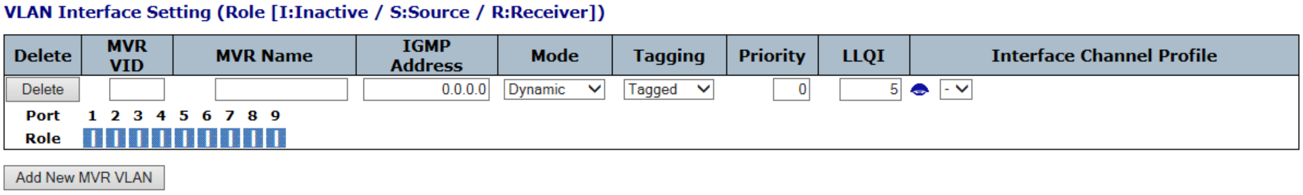


Figure 4-42: VLAN Interface Setting display

Table 4-40: 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 seconds. 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
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 indicates Inactive; S indicates Source; R indicates 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". **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.7.3 Immediate Leave Setting

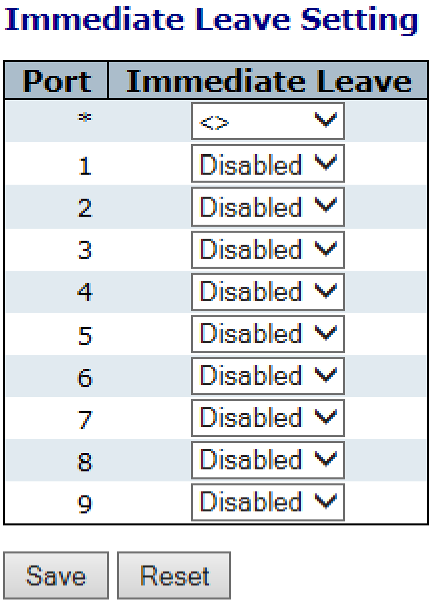


Figure 4-43: Immediate Leave Setting display

Table 4-41: 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.

Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.7.7.4 MVR Statistics

This section provides MVR Statistics information.

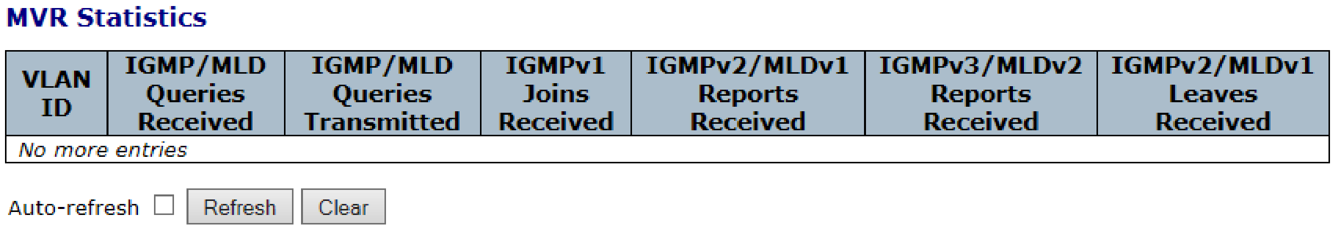


Figure 4-44: MVR Statistics display

Table 4-42: 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 Report's Received	The number of Received IGMPv2 Join's and MLDv1 Report's, respectively.
IGMPv3/MLDv2 Report's Received	The number of Received IGMPv1 Join's and MLDv2 Report's, respectively.
IGMPv2/MLDv1 Leave's Received	The number of Received IGMPv2 Leave's and MLDv1 Done's, respectively.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately **Clear:** Clears all Statistics counters.

4.7.7.5 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.

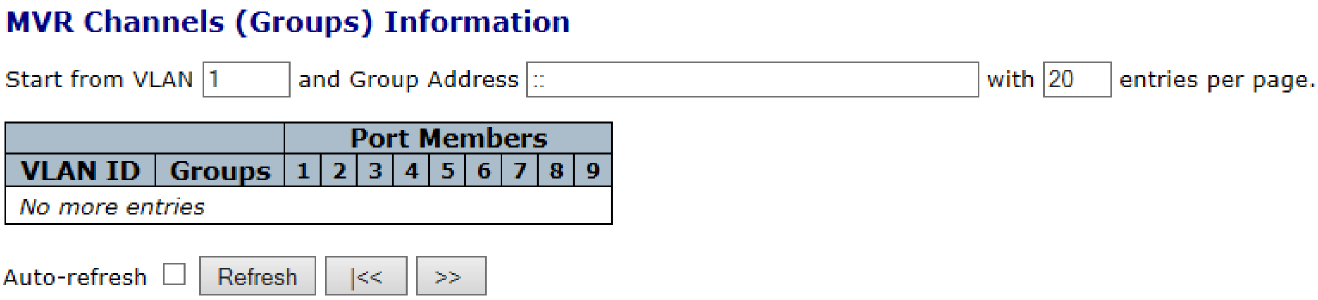


Figure 4-45: MVR Channels (Group) Information display

Table 4-43: 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.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately **Clear:** Clears all Statistics counters. **|<<**: Updates the table starting from the first entry in the MVR Channels (Groups) Information Table. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

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.

4.7.7.6 MVR SFM Information

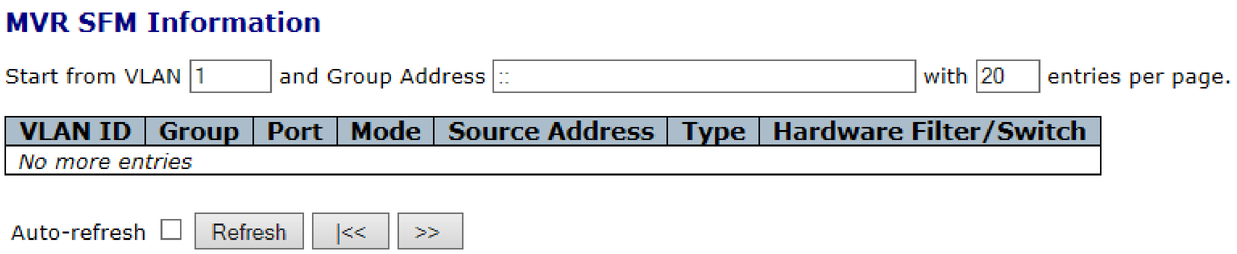


Figure 4-46: MVR SFM Information display

Table 4-44: MVR SFM Information parameters

MVR SFM) Information Table	
ID VLAN	VLAN ID of the group
Groups	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 Adress	IP Address of the source Currently, the maximum number of IP source address 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/IPv6 address could be handled by the chip or not.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Click to refresh the page immediately **Clear:** Clears all Statistics counters. **|<<**: Updates the table starting from the first entry in the MVR Channels (Groups) Information Table. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

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.

4.8 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.

M-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

5. **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.
6. **Classification:** this function is performed in the Classifier block on the ingress side. The Classifier looks into the header of the frames in order to decide to which Class of Service to assign the frame. The class of service is actually 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.
7. **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):

4.8.1 QoS Ingress Port Classification

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

QoS Ingress Port Classification

Port	CoS	DPL	PCP	DEI	Tag Class.	DSCP Based	Address Mode
*	<>	<>	<>	<>		☐	<>
1	0	0	0	0	Disabled	☐	Source
2	0	0	0	0	Disabled	☐	Source
3	0	0	0	0	Disabled	☐	Source
4	0	0	0	0	Disabled	☐	Source
5	0	0	0	0	Disabled	☐	Source
6	0	0	0	0	Disabled	☐	Source
7	0	0	0	0	Disabled	☐	Source
8	0	0	0	0	Disabled	☐	Source
9	0	0	0	0	Disabled	☐	Source

Save Reset

Figure 4-47: QoS Ingress Port Classification display

Table 4-45: 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.
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 in order 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.
Address Mode	The IP/MAC address mode specifying whether the **QCL** classification must be based on source (SMAC/SIP) or destination (DMAC/DIP) addresses on this port The allowed values are: Source: Enable SMAC/SIP matching. Destination**:** Enable DMAC/DIP matching
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values

4.8.2 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 located in front of the ingress queue.

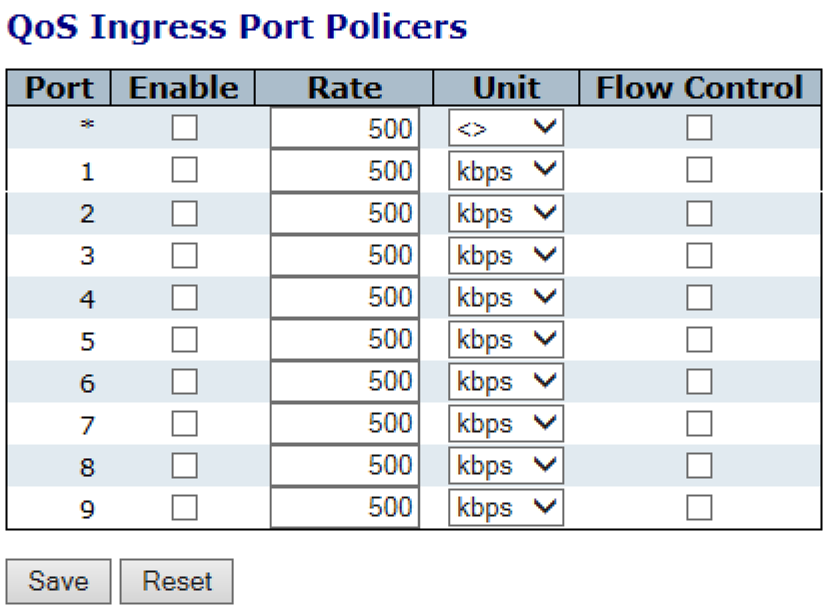


Figure 4-48: QoS Ingress Port Policers

Table 4-46: QoS Ingress Port Policers Parameters

Port	The port number for which the configuration below applies.
Enabled	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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.8.3 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 located in front of the ingress queue.

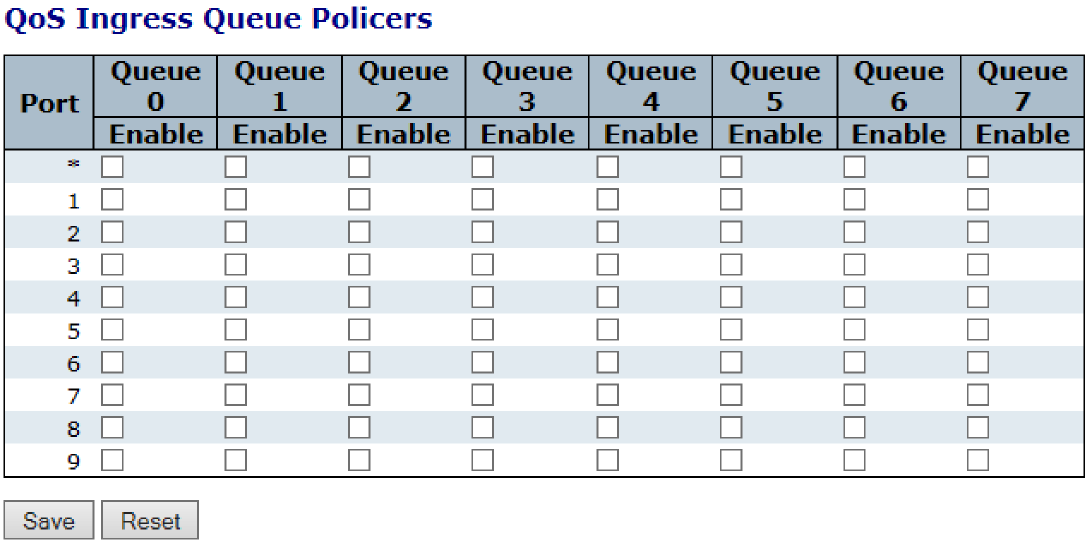


Figure 4-49: QoS Ingress Queue Policers display

Table 4-47: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.8.4 QoS Egress Port Schedulers

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

QoS Egress Port Schedulers

Port	Mode	Weight					
		Q0	Q1	Q2	Q3	Q4	Q5
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	-	-	-	-	-	-

Figure 4-50: QoS Egress Port Schedulers

Table 4-48: QoS Egress Port Schedulers Parameters

Port	The logical port for the settings contained in the same row. Click on the port number in order 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

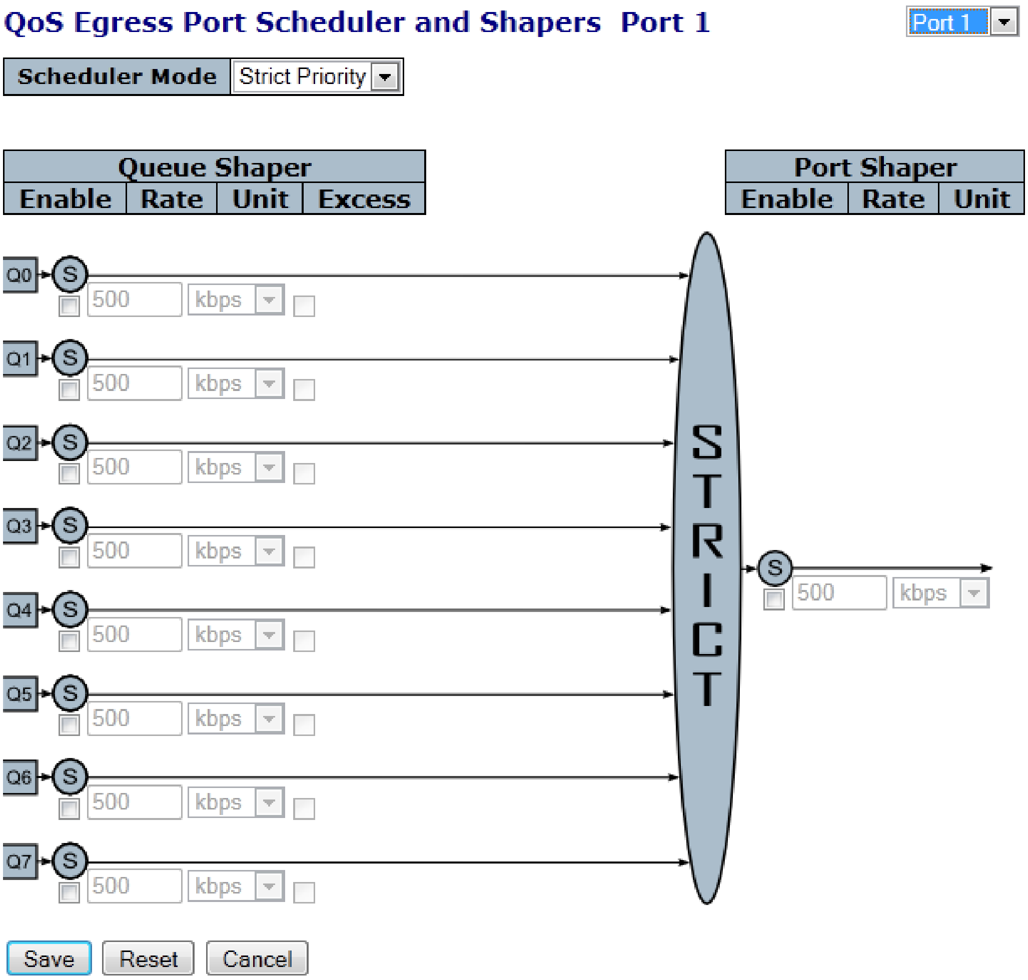


Figure 4-51: QoS Egress Port Schedulers and Shapers

Table 4-49: 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 Excess	Controls whether the queue is allowed to use excess bandwidth.
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".
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Cancel:** Click to undo any changes made locally and return to the previous page.

4.8.5 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.

QoS Egress Port Shapers

Port	Shapers								
	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Port
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-

Figure 4-52: QoS Egress Port Shapers display

Table 4-50: QoS EgressPort 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.

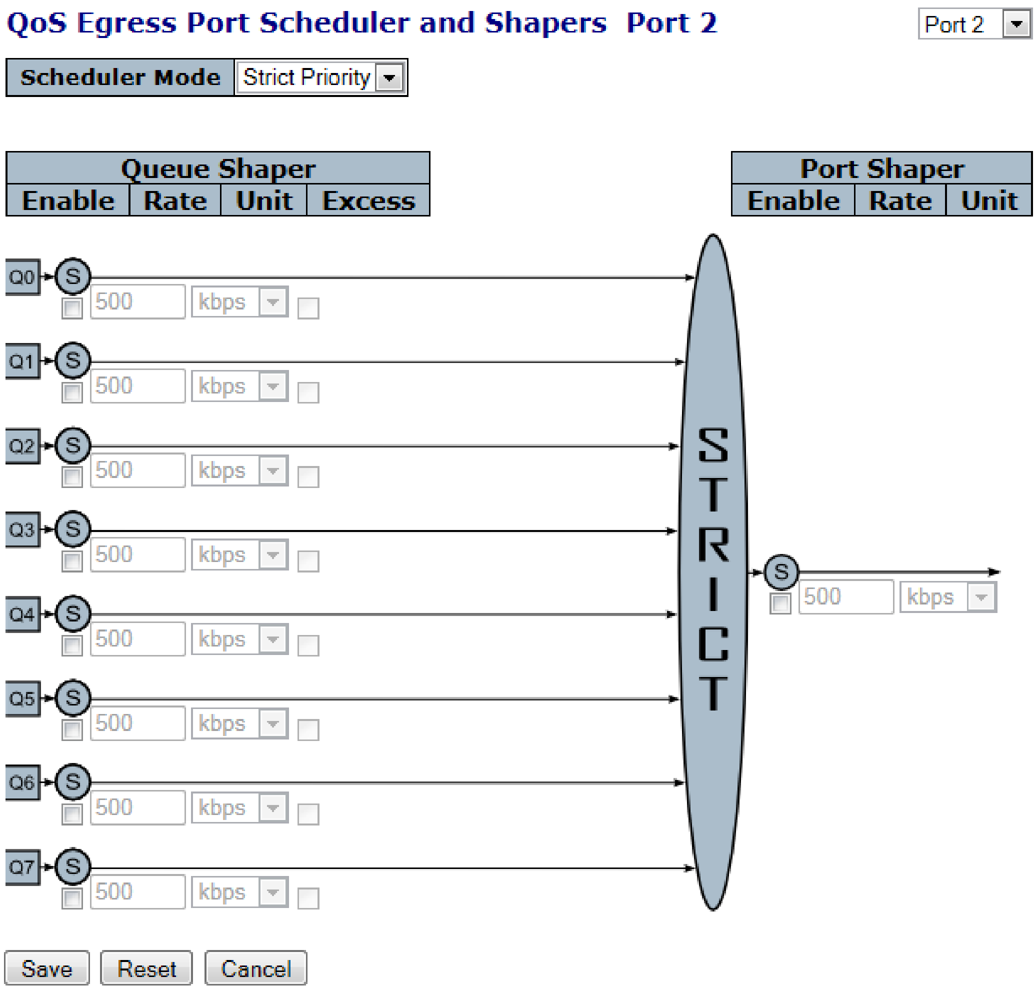


Figure 4-53: QoS Egress Port Scheduler and Shapers Configuration

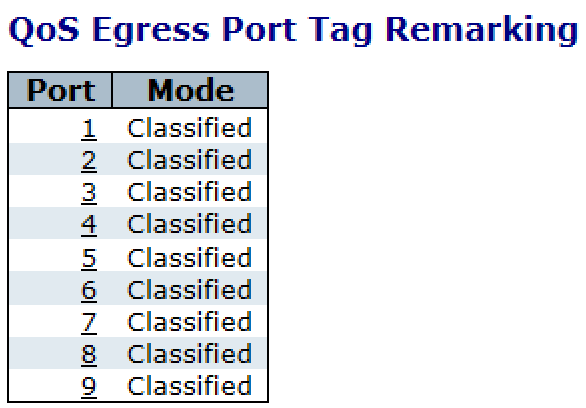
Table 4-51: QoS Egress Port Scheduler & Shapers Parameters

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 Excess	Controls whether the queue is allowed to use excess bandwidth.
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".
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Cancel:** Click to undo any changes made locally and return to the previous page.

4.8.6 QoS Egress Port Tag Remarking

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



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

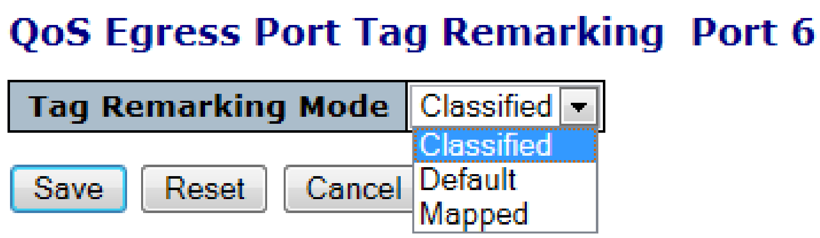


Figure 4-54: QoS Egress Port Tag Remarking

Table 4-52: QoS Egress Port Tag Remarking Parameters

Port	The logical port for the settings contained in the same row. Click on the port number in order 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Cancel:** Click to undo any changes made locally and return to the previous page.

4.8.7 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.

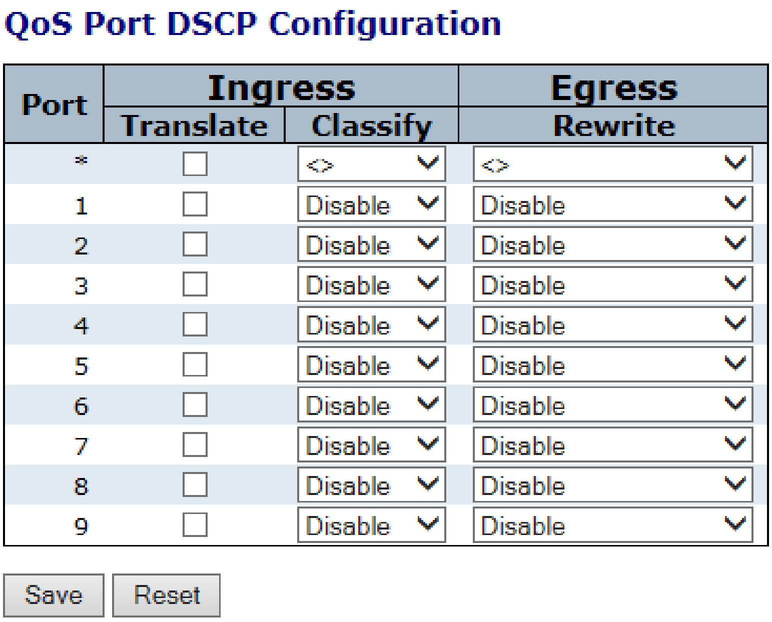


Figure 4-55: QoS Port DSCP Configuration

Table 4-53: 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: **1. Translate** **2. 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 - **Disable:** No Egress rewrite. **Enable:** Rewrite enabled without remapping. **Remap DP Unaware**: DSCP from analyzer is remapped and frame is remarked with remapped DSCP value. The remapped DSCP value is always taken from the 'DSCP Translation->Egress Remap DP0' table. **Remap DP Aware**: DSCP from analyzer is remapped and frame is remarked with remapped DSCP value. Depending on the DP level of the frame, the remapped DSCP value is either taken from the 'DSCP Translation->Egress Remap DP0' table or from the 'DSCP Translation->Egress Remap DP1' table.

Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values

4.8.8 DSCP Based QoS Ingress Classification

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

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

Save Reset

Figure 4-56: DSCP Based QoS Ingress Classification

Table 4-54: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values

4.8.9 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

DSCP Translation

DSCP	Ingress		Egress	
	Translate	Classify	Remap DP0	Remap DP1
*	<>		<>	<>
0 (BE)	0 (BE)		0 (BE)	0 (BE)
1	1		1	1
2	2		2	2
3	3		3	3
4	4		4	4
5	5		5	5
6	6		6	6
7	7		7	7
8 (CS1)	8 (CS1)		8 (CS1)	8 (CS1)
9	9		9	9
10 (AF11)	10 (AF11)		10 (AF11)	10 (AF11)
11	11		11	11
12 (AF12)	12 (AF12)		12 (AF12)	12 (AF12)
13	13		13	13
14 (AF13)	14 (AF13)		14 (AF13)	14 (AF13)
15	15		15	15
16 (CS2)	16 (CS2)		16 (CS2)	16 (CS2)
17	17		17	17
18 (AF21)	18 (AF21)		18 (AF21)	18 (AF21)
19	19		19	19
20 (AF22)	20 (AF22)		20 (AF22)	20 (AF22)
21	21		21	21
22 (AF23)	22 (AF23)		22 (AF23)	22 (AF23)
23	23		23	23
24 (CS3)	24 (CS3)		24 (CS3)	24 (CS3)
25	25		25	25
26 (AF31)	26 (AF31)		26 (AF31)	26 (AF31)
27	27		27	27
28 (AF32)	28 (AF32)		28 (AF32)	28 (AF32)
29	29		29	29
30 (AF33)	30 (AF33)		30 (AF33)	30 (AF33)
31	31		31	31
32 (CS4)	32 (CS4)		32 (CS4)	32 (CS4)
33	33		33	33
34 (AF41)	34 (AF41)		34 (AF41)	34 (AF41)

35	35	☐	35	35
36 (AF42)	36 (AF42)	☐	36 (AF42)	36 (AF42)
37	37	☐	37	37
38 (AF43)	38 (AF43)	☐	38 (AF43)	38 (AF43)
39	39	☐	39	39
40 (CS5)	40 (CS5)	☐	40 (CS5)	40 (CS5)
41	41	☐	41	41
42	42	☐	42	42
43	43	☐	43	43
44	44	☐	44	44
45	45	☐	45	45
46 (EF)	46 (EF)	☐	46 (EF)	46 (EF)
47	47	☐	47	47
48 (CS6)	48 (CS6)	☐	48 (CS6)	48 (CS6)
49	49	☐	49	49
50	50	☐	50	50
51	51	☐	51	51
52	52	☐	52	52
53	53	☐	53	53
54	54	☐	54	54
55	55	☐	55	55
56 (CS7)	56 (CS7)	☐	56 (CS7)	56 (CS7)
57	57	☐	57	57
58	58	☐	58	58
59	59	☐	59	59
60	60	☐	60	60
61	61	☐	61	61
62	62	☐	62	62
63	63	☐	63	63

Save Reset

Figure 4-57: DSCP Translation

Table 4-55: 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 – **1. Remap DP0** Controls the remapping for frames with DP level 0. **2. Remap DP1** Controls the remapping for frames with DP level 1.QoS class value can be any of (0-7)
1. Remap DP0	Select the DSCP value from select menu to which you want to remap. DSCP value ranges form 0 to 63.
2. Remap DP1	Select the DSCP value from select menu to which you want to remap. DSCP value ranges form 0 to 63.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values

4.8.10 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.

QoS Control List Configuration

QCE	Port	DMAC	SMAC	Tag Type	VID	PCP	DEI	Frame Type	Action					
									CoS	DPL	DSCP	PCP	DEI	Policy

Figure 4-58: Quality of Service Control List Configuration

Table 4-56: 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 anyl frame type. **Ethernet:** Match Ethernet type frames **LLC**: Only (LLC) frames are allowed **LLC:** Match (LLC) frames.. **SNAP:** Match(SNAP) 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.

4.8.11 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.

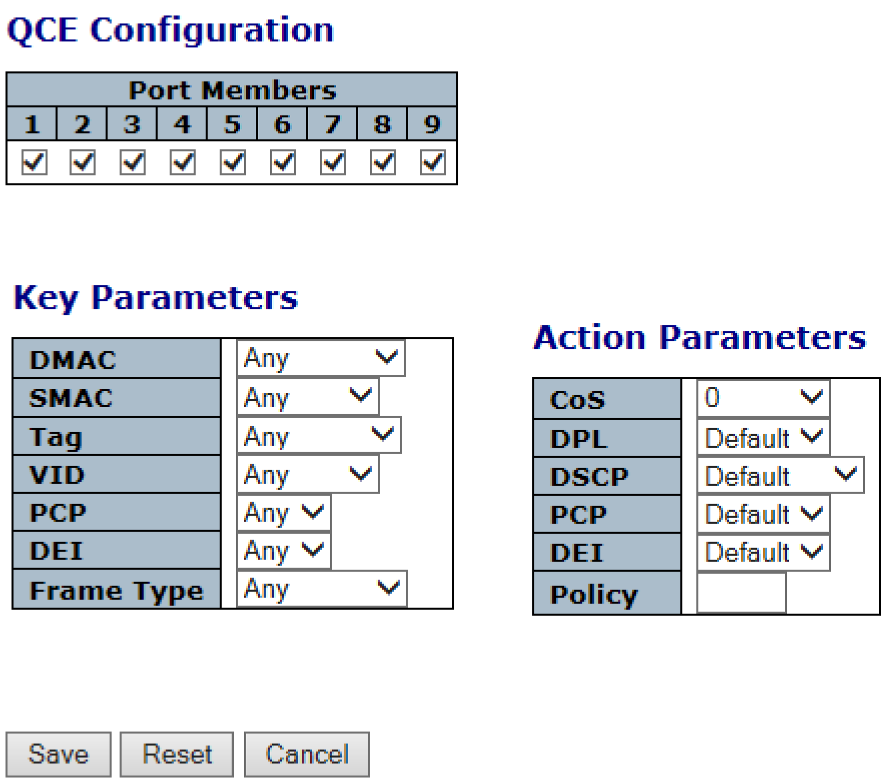


Figure 4-59: QCE Parameters displays

Table 4-57: 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-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'. **Frame Type** Frame Type can have any of the following values: 1.Any 2.Etherr TYype 3.LLC 4.SNAP 5.IPv4 6 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.ype) 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. **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. **IP Fragment** IPv4 frame fragmented option: yes|no|any. **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.(0-1or '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).
Buttons	**Save:** Click to save the configuration and move to main QCL page. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Cancel:** to the previous page without saving the configuration change

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

4.8.12 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 in order 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 in order 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.

4.8.12.1 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.

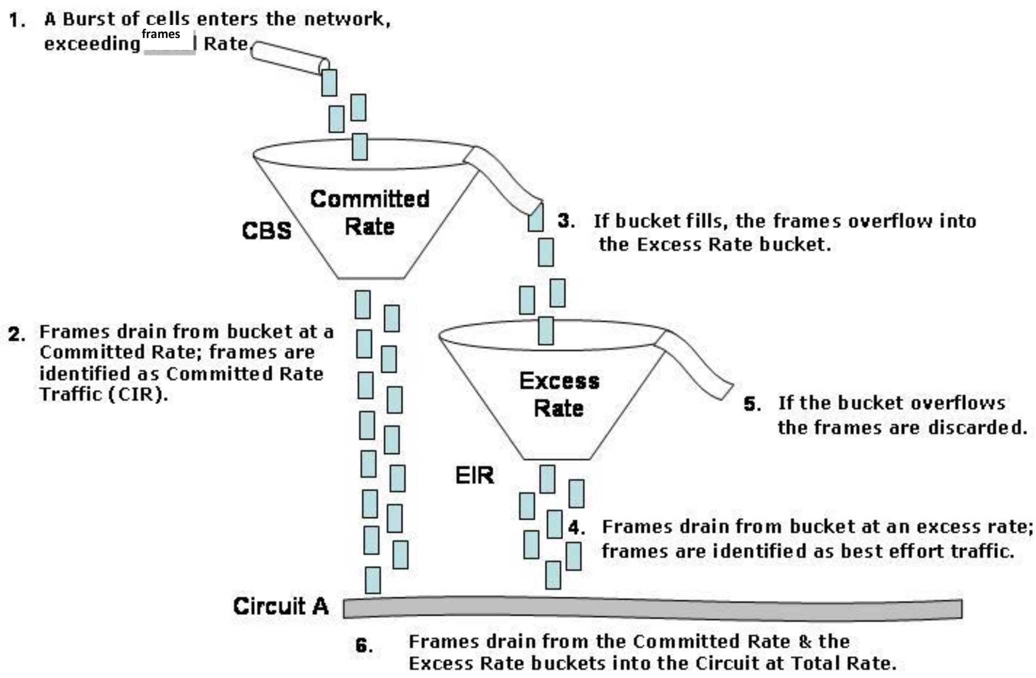


Figure 4-60: Dual Leaky Bucket

4.8.13 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.

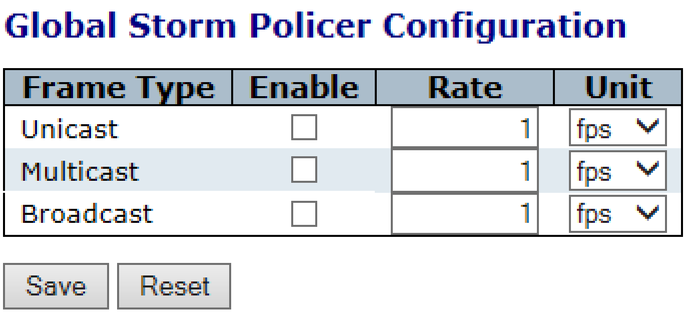


Figure 4-61: Global Storm Policer Configuration

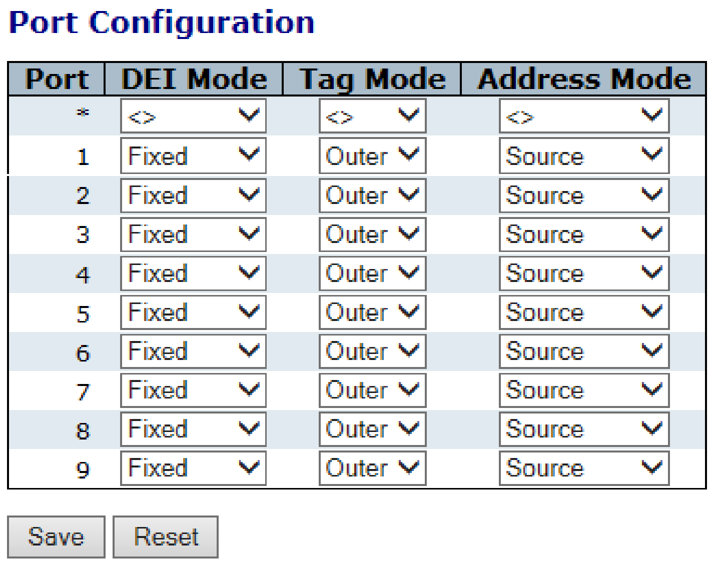
Table 4-58: Global Storm Policer Configuration Parameters

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 1-1024000 when "Unit" is fps, and 1-1024 when "Unit" is kfps The rate is internally rounded up to the nearest value supported by the global storm policer.
Unit	Controls the unit of measure for the global storm policer rate as fps or kfps.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.9 Ethernet Services

The Ethernet Services are delivered from UNI to UNI.
An Ethernet Service is defined by an abstract construct called the Ethernet Virtual Connection (EVC).This page displays the current EVC port configurations The settings can also be implemented and configured here

4.9.1 EVC Port Configuration


Port Configuration

Port	DEI Mode	Tag Mode	Address Mode
*	<>	<>	<>
1	Fixed	Outer	Source
2	Fixed	Outer	Source
3	Fixed	Outer	Source
4	Fixed	Outer	Source
5	Fixed	Outer	Source
6	Fixed	Outer	Source
7	Fixed	Outer	Source
8	Fixed	Outer	Source
9	Fixed	Outer	Source

Save Reset

Figure 4-62: EVC Port Configuration

Table 4-59: EVC Port Configuration parameters

Port	The logical port for the settings contained in the same row.
DEI Mode	**DEI** is an acronym for **Drop Eligible Indicator**. It is a 1-bit field in the VLAN tag The DEI mode for an NNI port determines whether frames transmitted on the port will have the DEI field in the outer tag marked based on the colour of the frame. The allowed values are: **Coloured**: The DEI is 1 for yellow frames and 0 for green frames. **Fixed**: The DEI value is determined by ECE rules.
Tag Mode	The tag mode specifying whether the EVC classification must be based on the outer or inner tag. This can be used on NNI ports connected to another service provider, where an outer "tunnel" tag is added together with the inner tag identifying the EVC. The allowed values are: **Inner**: Enable inner tag in EVC classification. **Outer**: Enable outer tag in EVC classification.
Address Mode	The IP/MAC address mode specifying whether the EVC classification must be based on source (SMAC/SIP) or destination (DMAC/DIP) addresses. The allowed values are: `Source`: Enable SMAC/SIP matching. `Destination`: Enable DMAC/DIP matching.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.9.2 L2CP Port Configuration

This section displays current EVC L2CP configurations. The settings can also be configured here MEF standards describe services provided to customers at User Network Interfaces (UNIs). Inside provider networks, nodes are connected using Internal Network-to-Network Interfaces (I-NNIs). Connections between service providers are done using External Network-to-Network Interfaces (E-NNIs). An Ethernet Virtual Connection is an association of two or more UNIs. LC2P Port

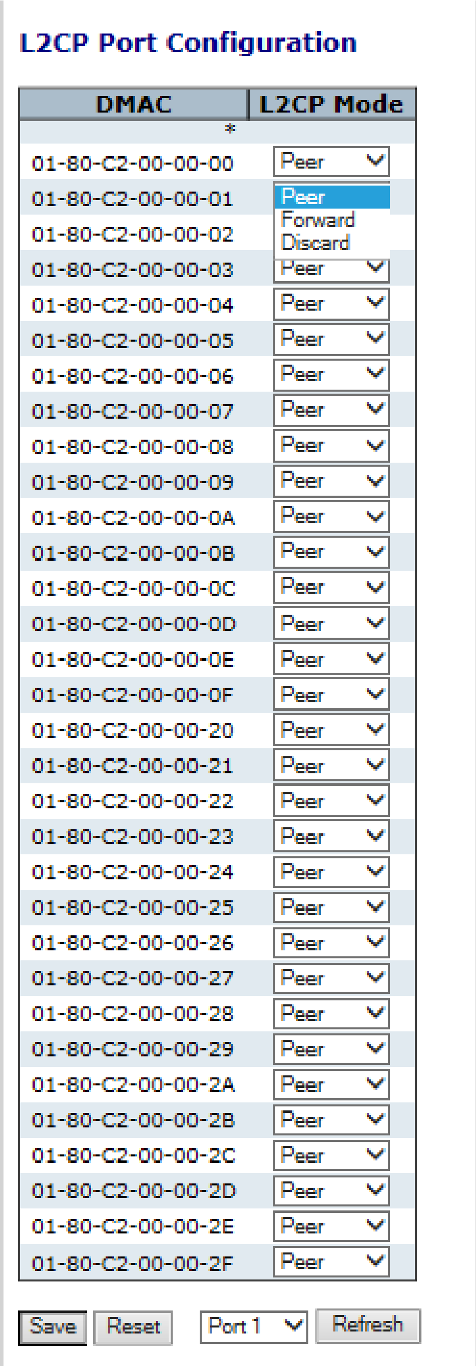


Figure 4-63: LC2P Port Configuration display

Table 4-60: LCP2 Port Configuration parameters

LCP2 Port Configuration	
DMAC	The destination BPDU MAC addresses (01-80-C2-00-00-0X) and GARP (01-80-C2-00-00-2X) MAC addresses for the settings contained in the same row.
LCP2 Mode	The L2CP mode for the specific port. The possible values are: **Peer**: Redirect to CPU to allow 18 peering/tunneling/discard depending on ECE and protocol configuration. **Forward**: Allow to 20 peer/forward/tunnel/discard depending on ECE and protocol configuration. **Discard**: Drop frame.
Buttons	**Refresh :** Click to refresh the page. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.9.3 Bandwidth Profiles Configuration

This section displays current EVC ingress bandwidth profile configurations. These policers may be used to limit the traffic received on UNI ports. A policer can limit the bandwidth of received frames. It is located in front of the ingress queue. The settings can also be configured here

Bandwidth Profiles Configuration

Start from Policer ID 1 with 20 entries per page.

Policer ID	State	Type	Policer Mode	Rate Type	CIR (kbps)	CBS (bytes)	EIR (kbps)	EBS (bytes)
*	<>	<>	<>	<>	0	0	0	0
1	Disabled	MEF	Aware	Data	0	0	0	0
2	Disabled	MEF	Aware	Data	0	0	0	0
3	Disabled	MEF	Aware	Data	0	0	0	0
4	Disabled	MEF	Aware	Data	0	0	0	0
5	Disabled	MEF	Aware	Data	0	0	0	0
6	Disabled	MEF	Aware	Data	0	0	0	0
7	Disabled	MEF	Aware	Data	0	0	0	0
8	Disabled	MEF	Aware	Data	0	0	0	0
9	Disabled	MEF	Aware	Data	0	0	0	0
10	Disabled	MEF	Aware	Data	0	0	0	0
11	Disabled	MEF	Aware	Data	0	0	0	0
12	Disabled	MEF	Aware	Data	0	0	0	0
13	Disabled	MEF	Aware	Data	0	0	0	0
14	Disabled	MEF	Aware	Data	0	0	0	0
15	Disabled	MEF	Aware	Data	0	0	0	0
16	Disabled	MEF	Aware	Data	0	0	0	0
17	Disabled	MEF	Aware	Data	0	0	0	0
18	Disabled	MEF	Aware	Data	0	0	0	0
19	Disabled	MEF	Aware	Data	0	0	0	0
20	Disabled	MEF	Aware	Data	0	0	0	0

Save Reset Refresh |<< << >> >>|

Figure 4-64: Bandwidth Profiles Configuration display

Table 4-61: Bandwidth Profiles Configuration parameters

Start Policer ID	The start Policer ID displays the table entries. The allowed range is from **1** through **256**.
Number of Entries	The number of entries per page. The allowed range is from **2** through **256**
Policer ID	The Policer ID is used to identify one of the 256 policers.
State	The administrative state of the bandwidth profile. The allowed values are: **Enabled**: The bandwidth profile enabled. **Disabled**: The bandwidth profile is disabled.
Type	The policer type of the bandwidth profile. The allowed values are: **MEF**: MEF ingress bandwidth profile. **Single**: Single bucket policer.
Policer Mode	The colour mode of the bandwidth profile. The allowed values are: **Coupled**: Colour-aware mode with coupling enabled. **Aware**: Colour-aware mode with coupling disabled.
Rate Type	The rate type of the bandwidth profile. The allowed values are: **Data**: Specify that this bandwidth profile operates on data rate. **Line**: Specify that this bandwidth profile operates on line rate
CIR	The Committed Information Rate of the bandwidth profile. The allowed range is from **0** through **10000000** kilobit per second.
CBS	The Committed Burst Size of the bandwidth profile. The allowed range is from **0** through **100000** bytes
EIR	The Excess Information Rate for MEF type the bandwidth profile. The allowed range is from **0** through **10000000** kilobit per second.
EBS	The Excess Burst Size for MEF TYPE the bandwidth profile. The allowed range is from **0** through **100000** bytes.
Buttons	**Refresh:** Refresh Click to refresh the displayed table starting from VLAN" input fields. **|<<:** |<< Updates the table starting from the first entry in the Table, **<<:** The Excess Information Rate for MEF type bandwidth profile. Updates the table, ending at the entry before the first entry currently displ ayed. **>>:** >> Updates the table, starting with the entry after the last entry currently displayed. **>|:** Updates the table, ending at the last entry in the table **Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.9.4 EVC Control List Configuration

This section displays current EVC configurations. On this system, only Provider Bridge based EVCs are supported.

An **Ethernet virtual connection** (EVC) is a logical relationship between Ethernet user-to-network interfaces (UNI) in a provider Ethernet service.

When such service provider offers a Metro Ethernet service that is compliant with the Metro Ethernet Forum (MEF) specifications, the service has two basic elements: the **UNI** by which the service is provided to the customer, and an **EVC** that establishes a communication relationship between one or more UNIs.

In Metro Ethernet services, there are three types of EVC:

Point-to-point: an EVC that supports communication between two (and only two) UNIs. This type of EVC operates similarly to a virtual circuit. It is service type known as **Eline**

(Ethernet Line Service)

Multipoint-to-multipoint: an EVC that supports any-to-any communication between two or more UNIs. This EVC creates a service that behaves like a switched Ethernet. It is a service type known as **E-LAN.(Ethernet Line Service)**

Point-to-multipoint: an EVC that supports communication between two or more UNIs, but does not support any-to-any communication. Specifically, UNIs are designated as root or leaf. Transmissions from the root are delivered to the leaves, and transmission from the leaves is delivered to the root(s). No communication can occur between the leaves or between the roots

It is a service type known as **E-Tree**

Note: The MEF technical specifications can be found at the MEF website at the following URL: http://www.metroethernetforum.org/.

EVC Control List Configuration

				Inner Tag						Outer Tag		
EVC ID	**VID**	**IVID**	**Learning**	**Type**	**VID Mode**	**VID**	**PCP/DEI Preservation**	**PCP**	**DEI**	**VID**	**NNI Ports**	

Auto-refresh ☐ Refresh Remove All

Figure 4-65: EVC Control List Configuration

Table 4-62: EVC Control List Configuration Parameters

EVC ID	The EVC ID identifies the EVC. The range is from **1** through **128**.
VID	The VLAN ID in the PB network. It may be inserted in a C-tag, S-tag or S-custom tag depending on the NNI port VLAN configuration. The range is from 1 through 4095.
IVID	The Internal/classified VLAN ID in the PB network. The range is from **1** through **4095**.
Learning	The learning mode for the EVC controls whether source MAC addresses are learned for frames matching the EVC. Learning may be disabled if the EVC only includes two UNI/NNI ports. The possible values are: **Enabled**: Learning is enabled (MAC addresses are learned). **Disabled**: Learning is disabled (MAC addresses are not learned).
Inner Tag Type	The inner tag type is used to determine whether an inner tag is inserted in frames forwarded to NNI ports. The possible values are: **None**: An inner tag is not inserted. **C-tag**: An inner C-tag is inserted. **S-tag**: An inner S-tag is inserted. **S-custom-tag**: An inner tag is inserted and the tag type is determined by the VLAN port configuration of the NNI
Inner VID Mode	The inner VID Mode affects the VID in the inner and outer tag. The possible values are: **Normal**: The VID of the two outer tags aren't swapped. **Tunnel**: The VID of the two outer tags are swapped, so that the VID of the outer tag is taken from the Inner Tag configuration and the VID of the inner tag is the EVC VID. In this mode, the NNI ports are normally configured to do EVC classification based on the inner tag.
Inner Tag VID	The Inner tag VLAN ID. The allowed range is from **0** through **4095**.
Inner Tag PCP/DEI Preservation	The inner tag PCP and DEI preservation. The possible values are: **Preserved**: The inner tag PCP and DEI is preserved. **Fixed**: The inner tag PCP and DEI is fixed.
Inner Tag PCP	The inner tag PCP value. The allowed range is from **0** through **7**.
Inner Tag DEI	The inner tag DEI value. The allowed value is **0** or 1
Outer Tag VID	The EVC outer tag VID for UNI ports. The allowed range is from **0** through **4095**
NNI Ports	The list of Network to Network Interfaces for the EVC.
Modification Button	You can modify each EVC in the table using the following button ⊕: Adds new EVC.
Buttons	**Refresh:** Refresh Click to refresh the displayed table starting from the "Start from the MAC address" and "VLAN" input fields. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Remove All**: Click to remove all ECEs.

By clicking on the right lowest plus sign on the previous display EVC Control List Configuration, you get the EVC Configuration displays. Refer to the next section

4.9.5 EVC Configuration

This section displays current EVC configurations. The settings can also be configured here

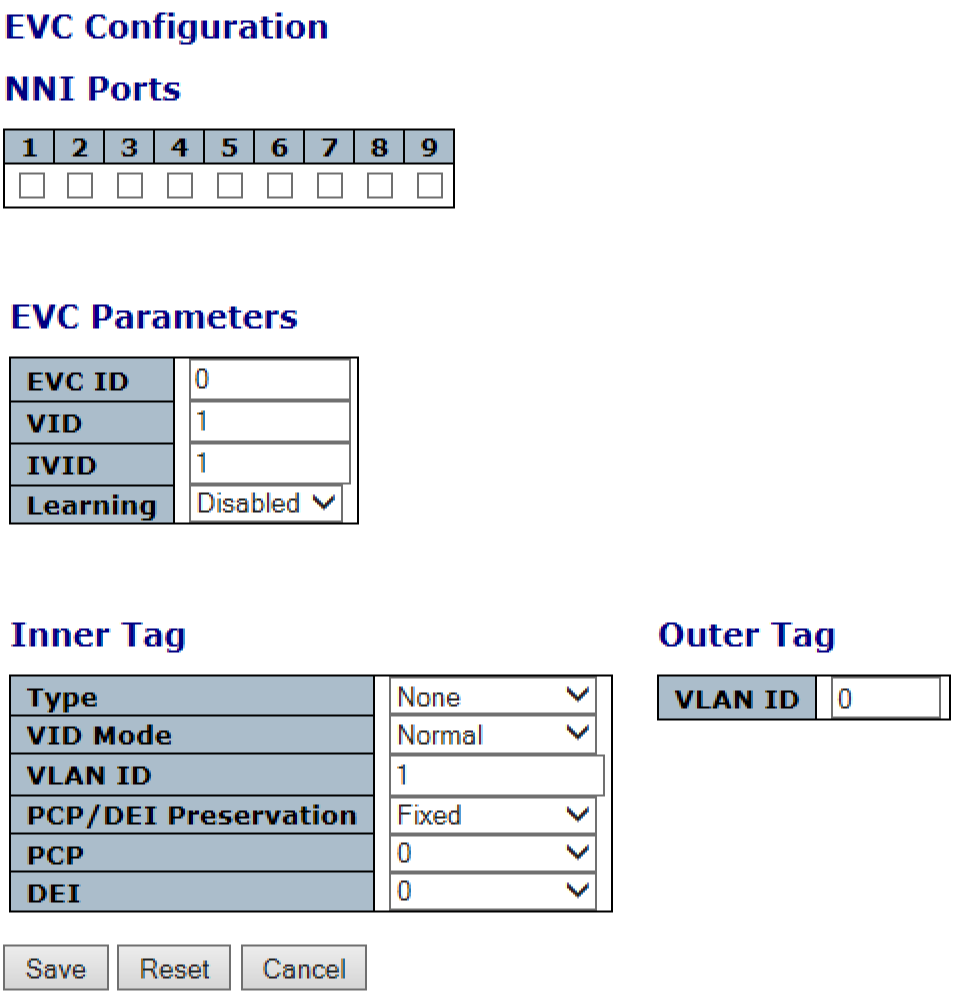


Figure 4-66: EVC Configuration displays

Table 4-63: EVC Parameters

EVC Configuration	
NNI Ports	The list of Network to Network Interfaces for the EVC
EVC Parameters	
EVC ID	The EVC ID identifies the EVC. The range is from **1** through **128**.
VID	The VLAN ID in the PB network. It may be inserted in a C-tag, S-tag or S-custom tag depending on the NNI port VLAN configuration. The range is from `1` through `4095`.
IVID	The Internal/classified VLAN ID in the PB network. The range is from **1** through **4095**.

Learning	The learning mode for the EVC controls whether source MAC addresses are learned for frames matching the EVC. Learning may be disabled if the EVC only includes two UNI/NNI ports. The possible values are: **Enabled**: Learning is enabled (MAC addresses are learned). **Disabled**: Learning is disabled (MAC addresses are not learned).
Inner Tag	
Inner Tag Type	The inner tag type is used to determine whether an inner tag is inserted in frames forwarded to NNI ports. The possible values are: **None**: An inner tag is not inserted. **C-tag**: An inner C-tag is inserted. **S-tag**: An inner S-tag is inserted. **S-custom-tag**: An inner tag is inserted and the tag type is determined by the VLAN port configuration of the NNI
Inner VID Mode	The inner VID Mode affects the VID in the inner and outer tag. The possible values are: **Normal**: The VID of the two outer tags aren't swapped. **Tunnel**: The VID of the two outer tags are swapped, so that the VID of the outer tag is taken from the Inner Tag configuration and the VID of the inner tag is the EVC VID. In this mode, the NNI ports are normally configured to do EVC classification based on the inner tag.
Inner Tag VID	The Inner tag VLAN ID. The allowed range is from **0** through **4095**.
Inner Tag PCP/DEI Preservation	The inner tag PCP and DEI preservation. The possible values are: **Preserved**: The inner tag PCP and DEI is preserved. **Fixed**: The inner tag PCP and DEI is fixed.
Inner Tag PCP	The inner tag PCP value. The allowed range is from **0** through **7**.
Inner Tag DEI	The inner tag DEI value. The allowed value is **0** or 1
Outer Tag	
Outer Tag VLAN ID	The EVC outer tag VID for UNI ports. The allowed range is from **0** through **4095**
Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **Cancel**: Return to the previous page; any changes made locally will be undone

4.9.6 ECE Control List Configuration

This section displays the current EVC Control Entries (ECEs). The settings can also be configured here.

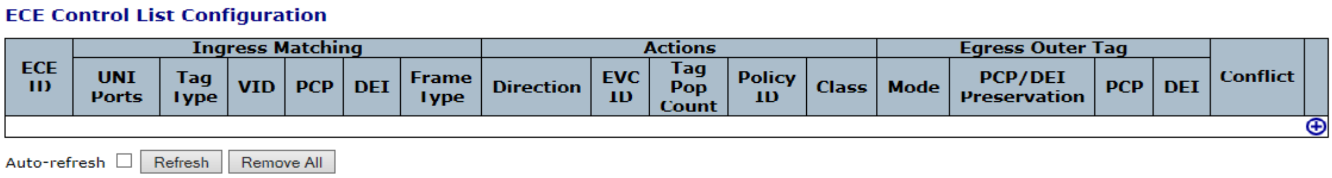


Figure 4-67: ECE Control List Configuration

Table 4-64: ECE Control List Parameters

ECE ID	The ECE ID identifies the ECE (EVC Control Entry). Unique ECE IDs are automatically assigned to ECEs added. The possible range is from **1** through **256**.
Ingress Matching	
UNI Ports	The list of User Network Interfaces for the ECE.
Tag Type	The tag type for the ECE. The possible values are: **Any**: The ECE will match both tagged and untagged frames. **Untagged**: The ECE will match untagged frames only. **C-Tagged**: The ECE will match custom tagged frames only. **S-Tagged**: The ECE will match service tagged frames only **Tagged**: The ECE will match tagged frames only.
VID	The VLAN ID for the ECE. It only significant if tag type 'Tagged' is selected. The possible values are: **`Specific`**: The range is from `1` through `4095`. `Any`: The ECE will match any VLAN ID.
PCP	PCP is an acronym for **P**riority **C**ode **P**oint. It is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as User Priority. The PCP value for the ECE. It only significant if tag type 'Tagged' is selected. The possible values are: **Specific**: The ECE will match a specific PCP in the range **0** through **7** . **Range**: The ECE will match PCP values in the selected range **0-1**, **2-3**, **4-5**, **6-7**, **0-3** or **4-7**. **Any**: The ECE will match any PCP value.
DEI	The DEI value for the ECE. It only significant if tag type 'Tagged' is selected. The possible values is: **0**, **1** or **Any**.
Frame Type	The frame type for the ECE. The possible values are: **Any**: The ECE will match any frame type. **IPv4**: The ECE will match IPv4 frames only. **IPv6**: The ECE will match IPv6 frames only.

Actions	
Direction	The EVCs and ECEs are used to setup flows in one or both directions as determined by the ECE Direction parameter. If the ECE is bidirectional, the ingress rules of the NNI ports will be setup to match the traffic being forwarded to NNI ports. Possible values are: **Both**: Bidirectional. **UNI-to-NNI**: Unidirectional from UNI to NNI. **NNI-to-UNI**: Unidirectional from NNI to UNI.
EVC ID	The EVC ID for the ECE. The ECE is only active when mapping to an existing EVC. Possible values are: **Specific**: The range is from **1** through **128**. **None**: The ECE does not map to an EVC.
Tag Pop Count	The ingress tag pop count for the ECE. The possible range is from **0** through **2**.
Policy ID	The ACL Policy ID for the ECE. The range is from 0 through 255. ACL is an acronym for **Access** Control List. 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.
Class	The traffic class for the ECE. The range is from **0** through 7
Egress Outer Tag	
Outer Tag Mode	The outer tag for nni-to-uni direction for the ECE. The possible values are: **Enable**: Enable outer tag for nni-to-uni direction for the ECE. **Disable**: Disable outer tag for nni-to-uni direction for the ECE.
Outer Tag PCP/DEI Preservation	The outer tag PCP and DEI preservation for the ECE. The possible values are: **Preserved**: The outer tag PCP and DEI are preserved. **Disable**: The outer tag PCP and DEI are fixed.
Outer Tag PCP	The outer tag PCP value for the ECE. The possible range is from **0** through **7**.
Outer Tag DEI	The outer tag DEI value for the ECE. The possible value is **0** or **1**.
Conflict	Indicates the hardware status of the specific ECE. The specific ECE is not applied to the hardware due to hardware limitations.
Modification Button	You can modify each ECE (EVC Control Entry) in the table using the following buttons: ⊕: Inserts a new ECE before the current row.
Buttons	**Refresh:** Refresh Click to refresh the displayed table starting from the "Start from the MAC address" and "VLAN" input fields. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Remove All**: Click to remove all ECEs.

Note: by clicking on the right lowest + sign, in the above ECE Control List Configuration display you get the following ECE Configuration display.

See next section

4.9.7 ECE Configuration

This section displays current ECE configurations. The settings can also be configured here.

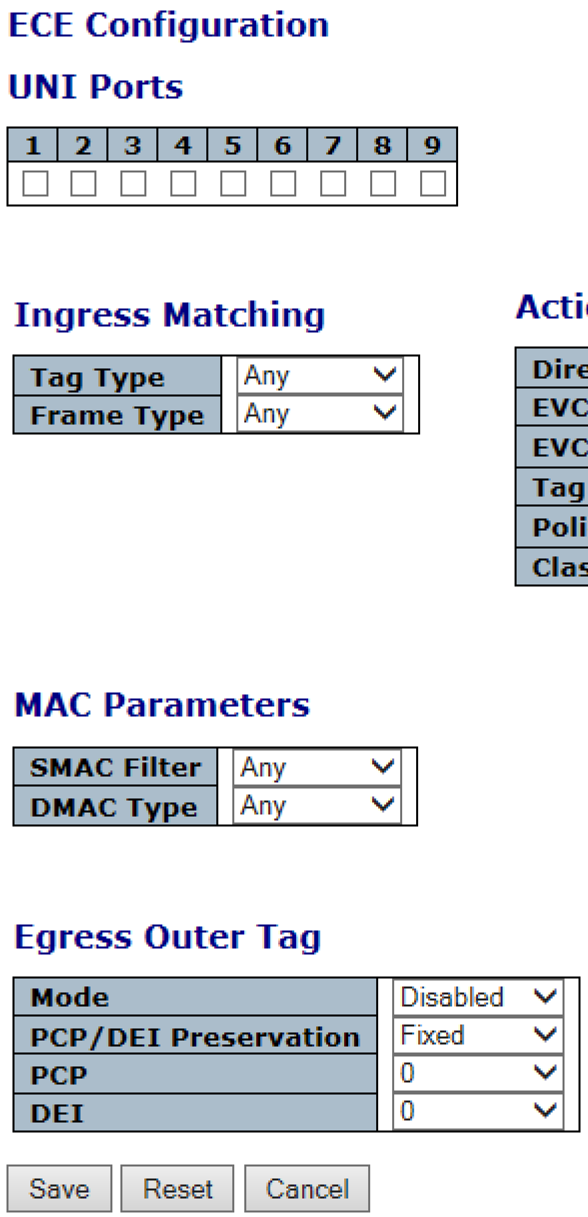


Figure 4-68: ECE Configuration

Table 4-65: ECE Configuration Parameters

UNI Ports	The list of User Network Interfaces for the ECE
Ingress Matching	
Tag Type	The tag type for the ECE. The possible values are: **Any**: The ECE will match both tagged and untagged frames . **Untagged**: The ECE will match untagged frames only . **C-Tagged**: The ECE will match custom tagged frames only. **S-Tagged**: The ECE will match service tagged frames only . **Tagged**: The ECE will match tagged frames only.
Frame type	The frame type for the ECE. The possible values are: **Any**: The ECE will match any frame type. **IPv4**: The ECE will match IPv4 frames on ly. **IPv6**: The ECE will match IPv6 frames only.
Actions	
Direction	The EVCs and ECEs are used to setup flows in one or both directions as determined by the ECE Direction parameter. If the ECE is bidirectional, the ingress rules of the NNI ports will be setup to match the traffic being forwarded to NNI ports. The possible values are: **Both**: Bidirectional. **UNI-to-NNI**: Unidirectional from UNI to NNI . **NNI-to- UNI** Unidirectional from NNI to UNI
EVC ID Filter	The EVC ID for the ECE. The ECE is only active when mapping to an existing EVC. The possible values are: **Any**: No EVC ID filter is specified. (EVC ID filter status is "don't-care".)
EVC ID Value	When "Specific" is selected for the VLAN ID filter, you can enter a specific value. The allowed value is from 1 through 256
Tag Pop Count	The ingress tag pop count for the ECE The allowed range is from **0** through **2**..
Policy ID	The ACL Policy ID for the ECE for matching ACL rules 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.
Class	The traffic class for the ECE. The allowed range is from **0** through **7** or **disabled**.
MAC Parameters	
SMAC Filter	The source MAC address for matching the ECE. The possible values are: **Any**: No SMAC filter is specified. (SMAC filter status is "don't-care".) **Specific**: If you want to filter a specific SMAC value with this ECE, choose this value. A field for entering a specific value appears.

DMAC Type	The destination MAC address type for matching the ECE. The possible values are: **Any**: No DMAC tyoe is specified. (DMAC filter status is "don't-care".) **Unicast**: Frame must be unicast. **Multicast**: Frame must be multicast. **Broadcast**: Frame must be broadcast.
Egress Outer Tag	
Mode	The outer tag for nni-to-uni direction for the ECE. The possible values are: **Enable:** Enable outer tag for nni-to-uni direction for the ECE. **Disable:** Disable outer tag for nni-to-uni direction for the ECE.
PCP/DEI Preservation	The outer tag PCP and DEI preservation for the ECE. The possible values are: **Preserved**: The outer tag PCP and DEI are preserved. **Disable**: The outer tag PCP and DEI are fixed.
PCP	The outer tag PCP value for the ECE. The possible range is from **0** through **7**.
DEI	The outer tag DEI value for the ECE. The possible value is **0** or **1**.
Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **Cancel**: Return to the previous page; any changes made locally will be undone

4.9.8 EVC Statistics

This section provides NNI port traffic statistics for the selected EVC. It also shows counters for UNI ports of ECEs mapping to the EVC.

And the MPLS Pseudo-Wires counters are included when the PW ID is attached to the selected EVC.

EVC Statistics

Class	Green Frames		Yellow Frames		Red Frames	Discarded Frames	
	Rx	Tx	Rx	Tx	Rx	Green	Yellow
0	125562020	136644420	74908513	0	526791832	7580236	4518688
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0

Port 1 Auto-refresh Refresh Clear

Figure 4-69: EVC Statistics display

Table 4-66: EVC Statistics Parameters

Class	The traffic class for the EVC.
Rx Green	The number of green received.
Tx Green	The number of green transmitted.
Rx Yellow	The number of yellow received.
Tx Yellow	The number of yellow transmitted.
Rx Red	The number of red received.
Green Discarded	The number of discarded in the green color.
Yellow Discarded	The number of discarded in the yellow color.
Buttons	The port select box determines which port is affected by clicking the buttons. **Auto-refresh** ☐ **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Refresh Click to refresh the displayed table starting from the "Start from the MAC address" and "VLAN" input fields. **Clear:** Clears the counters for selected ports

4.10 Security Features

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

4.10.1 Switch

The Switch section contains the following sub-sections:

1. User Configuration
2. Privilege Level Configuration
3. Authentication Method Configuration
4. SSH Configuration
5. HTTPS Configurations
6. Access Management Configuration
7. Access Management Statistics

4.10.1.1 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.

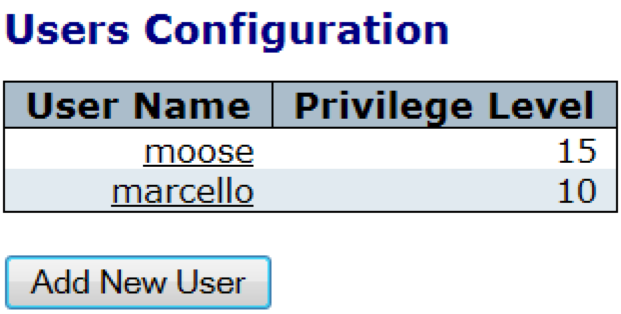


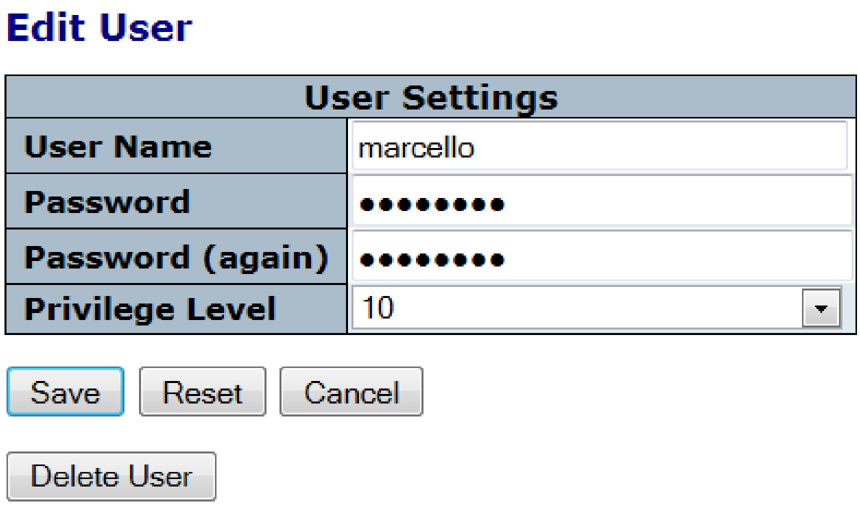
Figure 4-70: User Configuration

Table 4-67: User Configuration Parameters

User Name	The name identifying the user.
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 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 and 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

	Marcello is a new added User with privilege level 10

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



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

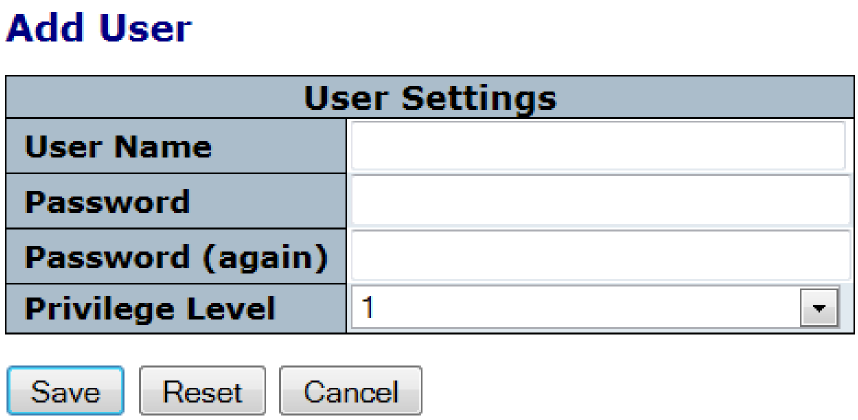


Figure 4-71: Add/Edit User Configurations

Table 4-68: Add/Edit User Configuration Parameters

User Name	A string identifying the user name that this entry should belong to. The allowed string length is **1** to **31**. The valid user name 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 **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 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 and 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 Marcello is a new added User with privilege level 10

4.10.1.2 Privilege Level Configuration

This subsection provides an overview of the privilege levels.

Privilege Level Configuration

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
Debug	15	15	15	15
DHCP	5	10	5	10
DHCPv6_Client	5	10	5	10
Diagnostics	5	10	5	10
EEE	5	10	5	10
EPS	5	10	5	10
ERPS	5	10	5	10
ETH_LINK_OAM	5	10	5	10
EVC	5	10	5	10
FL_GPS	5	10	5	10
Green_Ethernet	5	10	5	10
IP	5	10	5	10
IPMC_Snooping	5	10	5	10
JSON_RPC	5	10	5	10
JSON_RPC_Notification	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
Maintenance	15	15	15	15
MEP	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
QoS	5	10	5	10
RMirror	5	10	5	10
Security	5	10	5	10
sFlow	5	10	5	10
Spanning_Tree	5	10	5	10
System	5	10	1	10
UDLD	5	10	5	10
UPnP	5	10	5	10
VCL	5	10	5	10
VLAN_Translation	5	10	5	10
VLANs	5	10	5	10
Voice_VLAN	5	10	5	10
XXRP	5	10	5	10

Save Reset

Figure 4-72: Privilege Level Configuration

Table 4-69: 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 details: **System**: Contact, Name, Location, Timezone, 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	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. Note that some web pages(for example, MPLS-TP and MEP BFD pages) are based on JSON to transmit dynamic data between the web server and application. These pages require the configuration Read/Write privilege of JSON_RPC group before any operations. This This requirement must be met first, then it will evaluate the current privilege level against the required privilege level for the given method. For example, assumes the MPLS-TP page only allows Read-Only attribute under privilege level 5, the privilege configuration should be set as JSON_RPC:[5,5,5,5] and MPLS_TP:[5,10,5,10].
Buttons	**Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values

4.10.1.3 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 a number of columns.

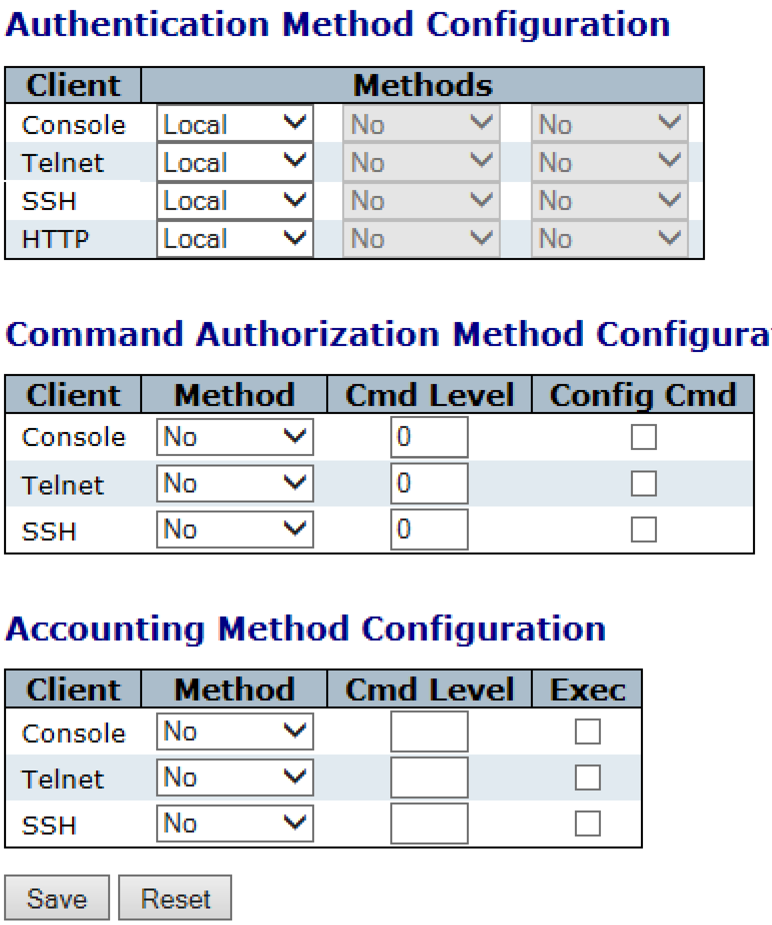


Figure 4-73: Authentication Method Configurations displays

Table 4-70: Authentication Method Configurations Parameters

Authentication Method Configuration	
Client	The management client for which the configuration below applies.
Authentication Method	Authentication Method can be set to one of the following values: none: 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.	
Buttons	**Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values
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 Lvi	Authorize all commands with a privilege level higher than or equal to this level. Valid values are in the range 0 to 15.
Cfg Cmd	Also authorize configuration commands.
Buttons	**Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values
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:** Accountinkg is disabled. **tacacs:** Use remote TACACS+ server(s) accounting.

Cmd Lvi	Enable accountimg of all 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.
Buttons	**Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values

4.10.1.4 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

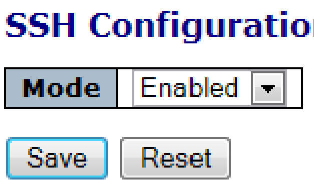


Figure 4-74: SSH Configuration

Table 4-71: Authentication Method Configuration Parameters

Mode	Indicates the SSH mode operation. Possible modes are: **Enabled**: Enable SSH mode operation. **Disabled**: Disable SSH mode operation.
Buttons	**Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values

4.10.1.5 HTTPS Configuration

HTTP 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 actually 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.

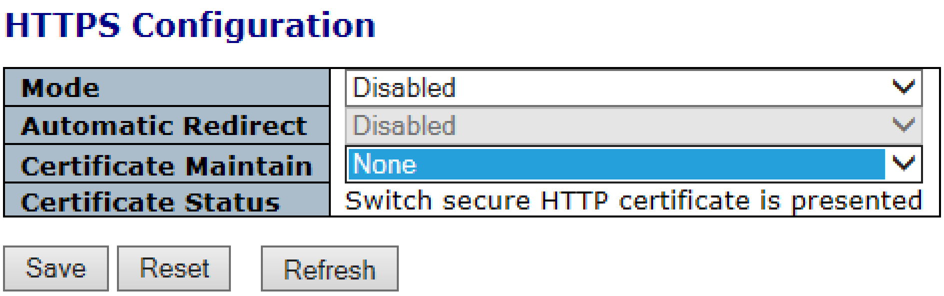
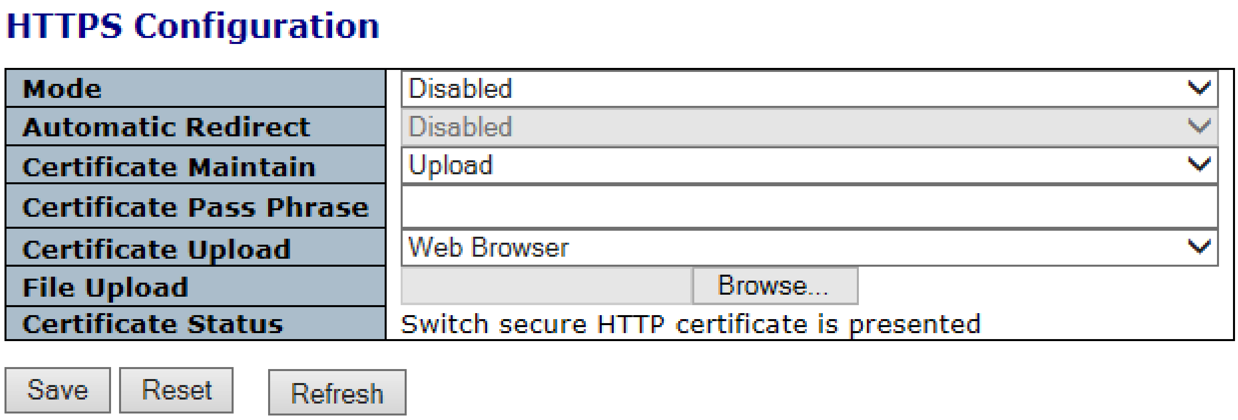


Figure 4-75: HTTPS Configuration

Table 4-72: 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. **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.

<table>
<tr><td></td><td>Upload: Upload a certificate PEM file. Possible methods are: Web Browser or URL.
Generate: Generate a new self-signed RSA certificate</td></tr>
<tr><td>Certificate Pass Phrase</td><td>Enter the pass phrase in this field if your uploading certificate is protected by a specific passphrase.</td></tr>
<tr><td colspan="2">By choosing the Upload option in the Certificate Maintain, the following display is shown, the parameters of which are explained below

</td></tr>
<tr><td>Certificate Upload</td><td>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:
<code>Web Browser</code>: Upload a certificate via Web browser.
<code>URL</code>: 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 (-), under score(_). The maximum length is 63 and hyphen must not be first character. The file name content that only contains '.' is not allowed.</td></tr>
<tr><td>Certificate Status</td><td>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 .....</td></tr>
<tr><td>Buttons</td><td>Save: Click to save changes.
Reset: Click to undo any changes made locally and revert to previously saved values .
Refresh: Click to refresh the page. Any changes made locally will be undone.</td></tr>
</table>

4.10.1.6 Access Management Configuration

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

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

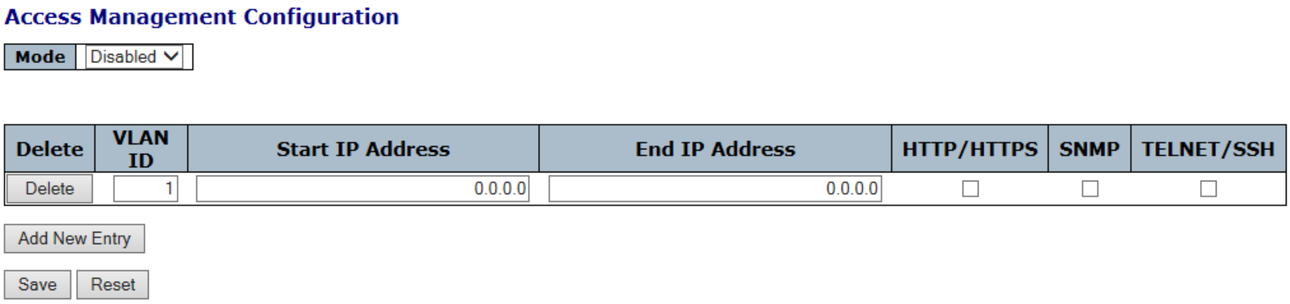


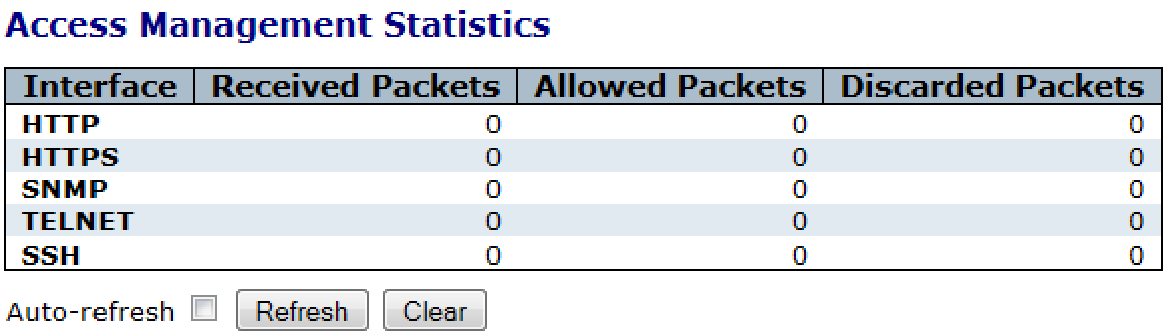
Figure 4-76: Access Management Configuration display

Table 4-73: 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. **Save** : Click to save change **Reset :** Click to undo any changes made locally and revert to previously saved values

4.10.1.7 Access Management Statistics

This sub-section provides statistics for selected access management



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 4-77: Access Management Statistics display

Table 4-74: 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.
Buttons	**Auto-refresh** **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Refresh Click to refresh the displayed table starting from the "Start from the MAC address" and "VLAN" input fields. **Clear:** Clears the counters for selected ports

4.10.2 Network Security

The 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

4.10.2.1 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

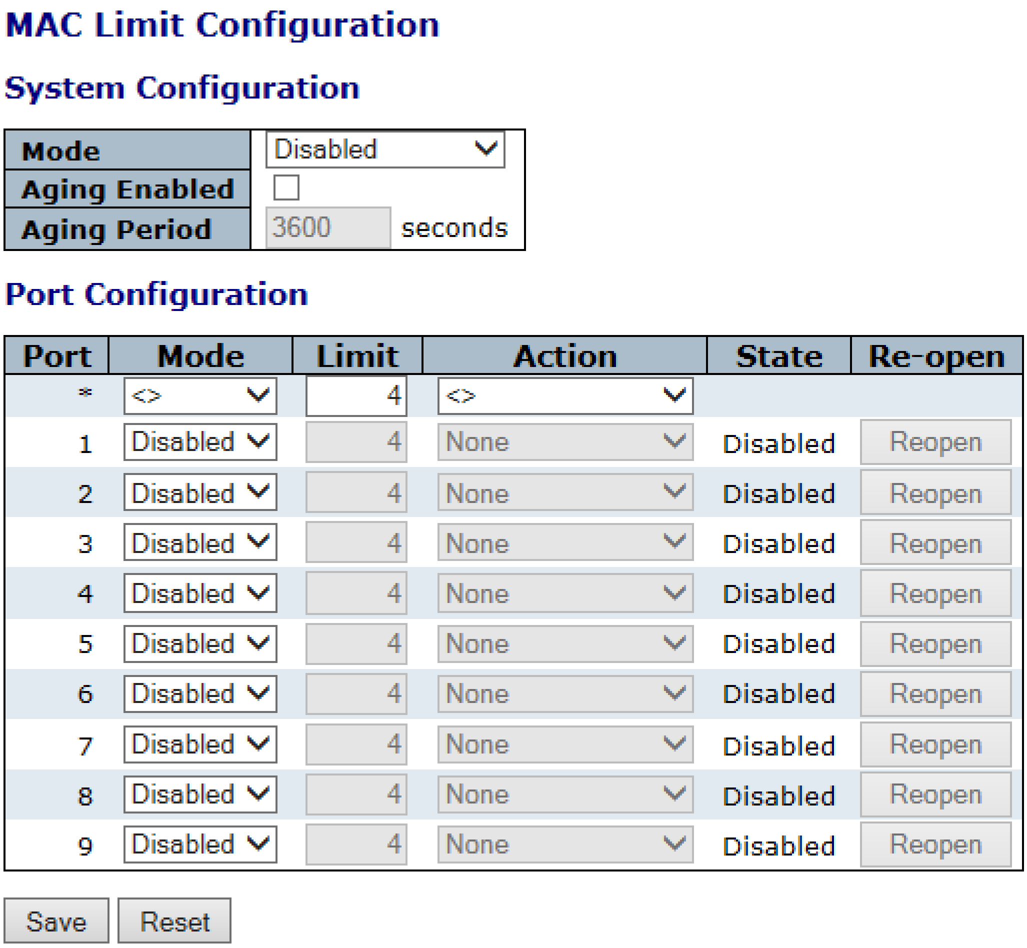


Figure 4-78: MAC Limit Control Configuration

Table 4-75: System and Port Configuration Parameters

1. System 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**
Age 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 wasn't 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.
The table has one row for each port on the selected switch and a number of columns.	
2. 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 1024. If the limit is exceeded, the corresponding action is taken (refer to next page). 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.

Action	If Limit is reached, the switch can take one of the following actions: None: Do not allow more than Limit MAC addresses on the port, but take no further action. Trap: If Limit + 1 MAC addresses is seen on the port send an SNMP trap. If Aging is disabled, only one SNMP trap will be sent, but with Aging enabled, new SNMP traps will be sent every time the limit gets exceeded. Shutdown: If Limit + 1 MAC addresses is seen on the port, shut down the port. This implies that all secured MAC addresses will be removed from the port, and no new address will be learned. Even if the link is physically disconnected and reconnected on the port (by disconnecting the cable), the port will remain shut down. There are three ways to re-open the port: 1) Boot the switch, 2) Disable and re-enable Limit Control on the port or the switch, 3) Click the Reopen button. Trap & Shutdown: If Limit + 1 MAC addresses is seen on the port, both the "Trap" and the "Shutdown" actions described above will be taken.
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 Shutdown or Trap & Shutdown
Re-open Button	If a port is shutdown 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 Shutdown in the Action section. Note that clicking the reopen button causes the page to be refreshed, so non-committed changes will be lost.
Buttons	**Refresh:** Click to refresh the screen. **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saves values.

4.10.2.2 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.

Port Security Switch Status

User Module Legend

User Module Name	Abbr
Limit Control	L
802.1X	8
Voice VLAN	V

Port Status

Port	Users	State	MAC Count	
			Current	Limit
1	---	Disabled	-	-
2	---	Disabled	-	-
3	---	Disabled	-	-
4	---	Disabled	-	-
5	---	Disabled	-	-
6	---	Disabled	-	-
7	---	Disabled	-	-
8	---	Disabled	-	-
9	---	Disabled	-	-

Auto-refresh ☐ Refresh

Figure 4-79: Port Security Switch Status

Table 4-76: System and Port Configuration Parameters

1. 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)
2. Port Status	
The table has one row for each port on the selected switch and a number of columns.	
Port	The port number to which the configuration below applies. **Click the port number to see the status for this particular 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.
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 frames from unknown MAC addresses to arrive. **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 Web-page.
Mac Count (Current,Limit)	The two columns indicate the number of currently learned MAC addresses (forwarding as well as blocked) 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 the Limit Control user module is not enabled on the port, the Limit column will show a dash (-).
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Refresh Click to refresh the screen.

4.10.2.3 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.

Figure 4-80: Port Security Port Status

Table 4-77: Port Security Port Status Parameters

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.
State	Indicates whether the corresponding MAC address is blocked or forwarding. In the blocked state, it will not be allowed to transmit or receive traffic.
State	Indicates whether the corresponding MAC address is blocked or forwarding. In the blocked state, it will not be allowed to transmit or receive traffic.
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.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Refresh : Click to refresh the screen

4.10.2.4 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 doesn't 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.

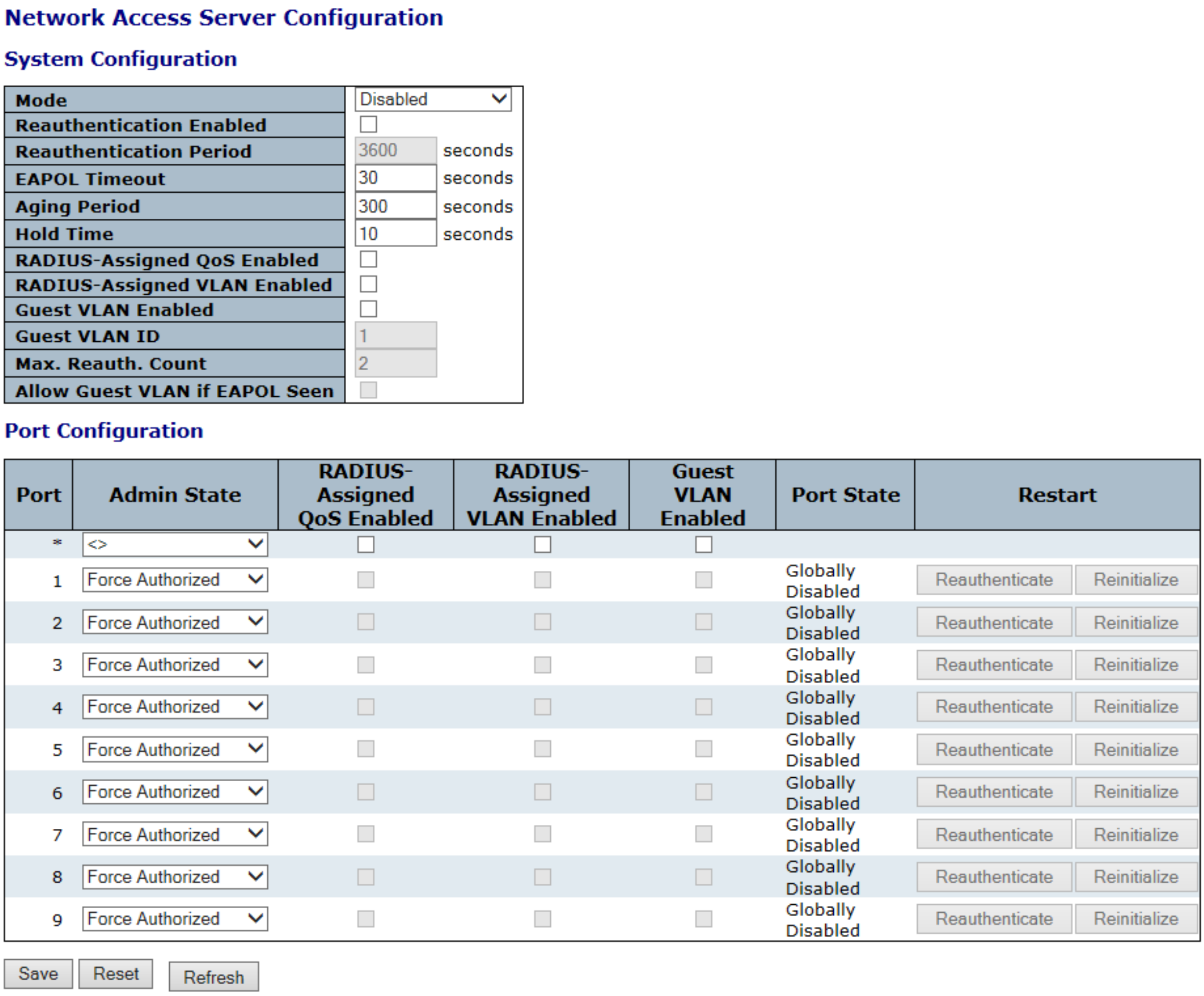


Figure 4-81: Network Access Server Configuration

Table 4-78: 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 of time. 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 doesn't 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 life-time 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 life-time 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 life-time of the port. The value can only be changed if the Guest VLAN option is globally enabled.
Port Configuration	
The table below has one row for each port on the switch a number of 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:	
1.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
2 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.

3.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) doesn't 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 up 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 hasn't yet failed (because the X seconds haven't 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.
4.**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 aren't authenticated. To overcome this security breach, use the Single 802.1X variant. Single 802.1X is really 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 doesn't 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

5.**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.
6.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 802.1X-based authentication is that the clients don't 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 trouble-shooting 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-IDdoes 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 trouble-shooting 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.
Buttons	**Refresh:** Click to refresh the page. Click to refresh the screen immediately **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values

4.10.2.5 Network Access Server Switch Status

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

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			-	

Auto-refresh ☐ Refresh

Figure 4-82: Network Access Server Switch Status

Table 4-79: 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 user name (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).
Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh**: Click to refresh the page; any changes made locally will be undone

4.10.2.6 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.

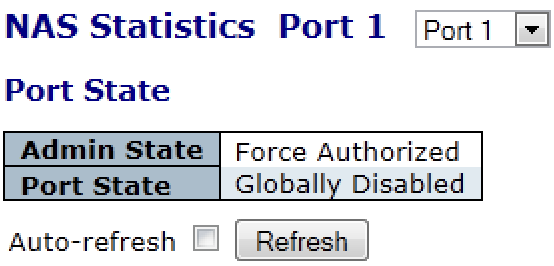


Figure 4-83: NAS Port Statistics

Table 4-80: 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
These 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 user name (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. As long as the backend server hasn't 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. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page immediately. **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

4.10.2.7 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 an detailed explanation of ACL and ACE terms, refer to the Glossary of Terms at the end of this manual

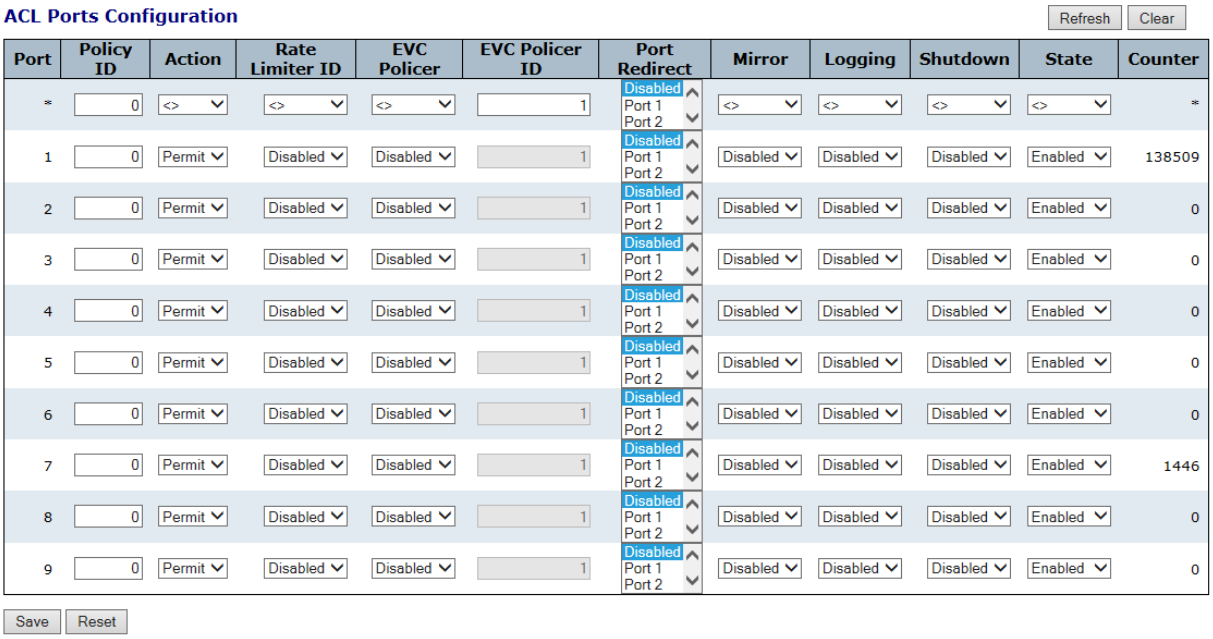


Figure 4-84: ACL Port Configuration

Table 4-81: 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".
EVC Policer	Select whether EVC policer is enabled or disabled. The default value is "Disabled".
EVC Policer ID	Select which EVC policer ID to apply on this port. The allowed values are **Disabled** or the values **1** through **256**
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.
Buttons	**Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values **Refresh:** Click to refresh the page; any changes made locally will be undone. **Clear**: Click to clear the counters.

4.10.2.8 Configuration

Configure the rate limiter for the ACL of the switch.

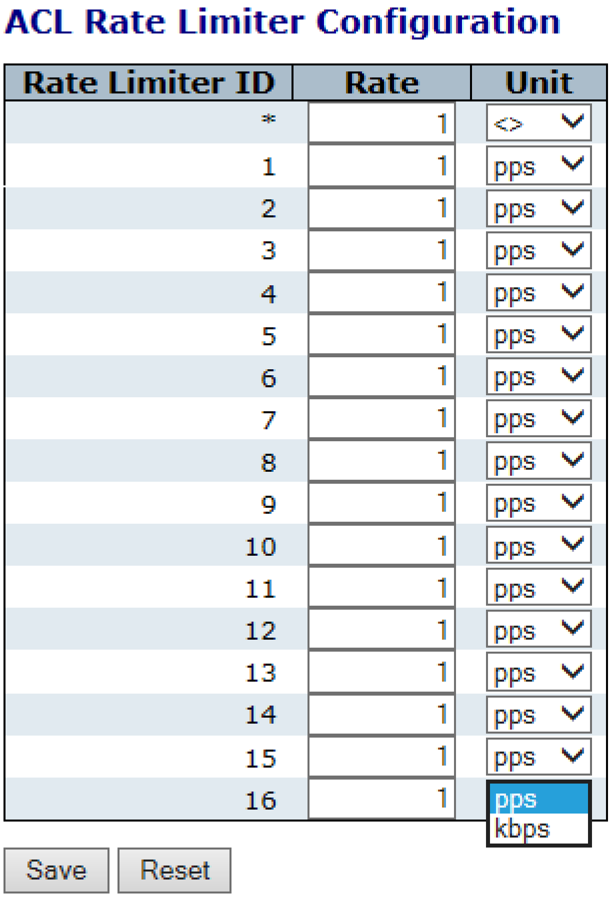


Figure 4-85: ACL Rate Limiter Configuration

Table 4-82: 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. **kbps**: Kbits per second.
Buttons	**Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values

4.10.2.9 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.

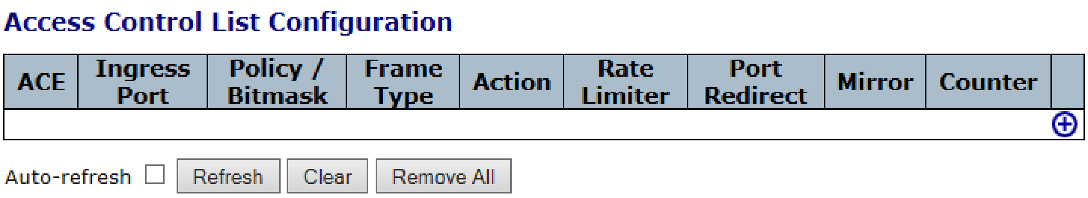


Figure 4-86: Access Control List Configuration

Table 4-83: 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)
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh**: Click to refresh the page; any changes made locally will be undone **Clear:** Click to clear the counters **Remove ALL**: Click to remove all ACEs.

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

4.10.2.10 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.

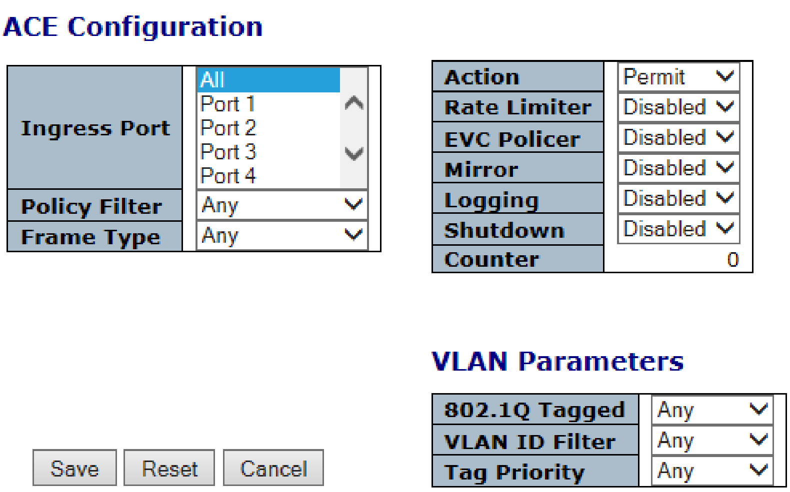


Figure 4-87: ACE Configuration displays

Table 4-84: ACL Configuration Parameters

ACE Configuration	
Ingress Port	Select the ingress port for which this ACE applies. **All**: The ACE applies to all port. **Port *n***: 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 an policy value and bitmask appears
Frame Type	Select the frame type for this ACE. These frames are mutually exlusive: **Any**: Any frame can match this ACE.v **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 won't match the ACE with ethernet type. **IPv4:** Only IPv4 frames can match this ACE. Notice the IPv4 frames won't match the ACE with ethernet type. **IPv6:** Only IPv6 frames can match this ACE. Notice the IPv6 frames won't 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 whetherther 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 can not 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 doesn't 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".)
Buttons	**Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values. **Cancel**: Return to the previous page.

4.10.2.11 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.

ACL Status

combined Auto-refresh Refresh

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 4-88: ACL Status

Table 4-85: 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 **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh**: Click to refresh the page; any changes made locally will be undone **Combined** combined static ipManagement ipSourceGuard ipmc evc mep arpInspection upnp ptp dhcp loopProtect ttLoop y1564 linkOam ztp conflict

4.10.2.12 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

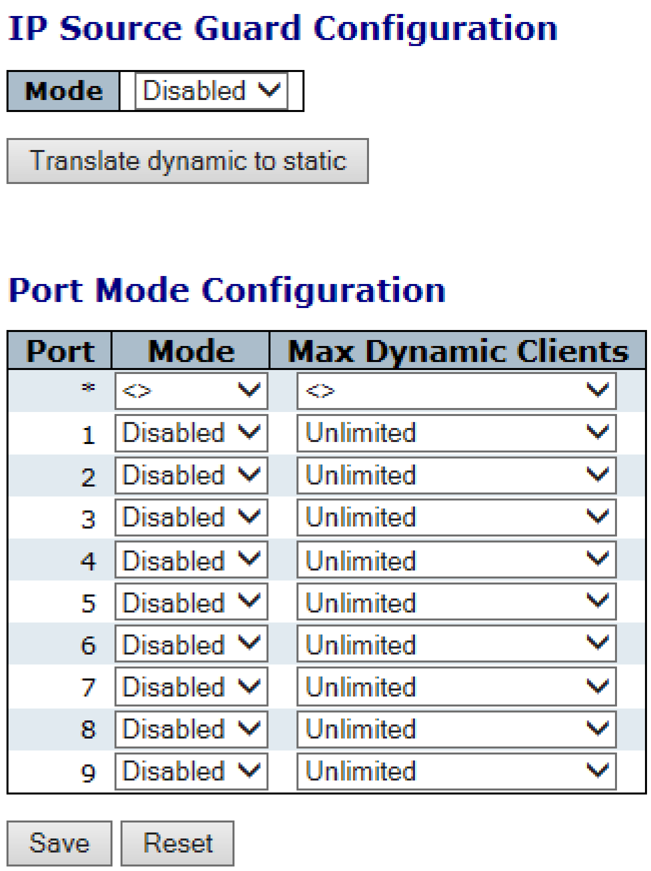


Figure 4-89: IP Source Guard Configuration

Table 4-86: 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	**Save:** Click to save change **Reset**: Click to undo any changes made locally and revert to previously saved values **Translate dynamic to static**: Click to translate all dynamic entries to static entries.

4.10.2.13 Static IP Source Guard Table

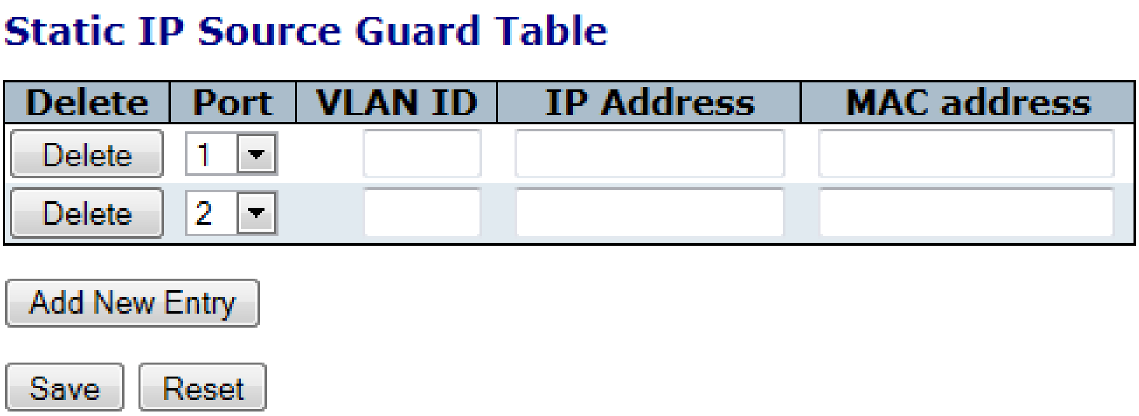


Figure 4-90: Static IP Source Guard Table

Table 4-87: 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 **Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values

4.10.2.14 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.

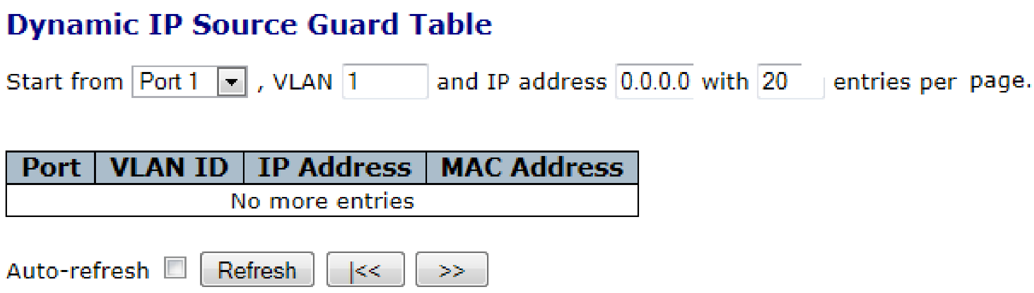


Figure 4-91: Dynamic IP Source Guard Table

Table 4-88: 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	**Auto-refresh** ☑ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh**: Refreshes the displayed table starting from the input fields. **Clear:** Flushes all dynamic entries **<<:** 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

4.10.3 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

4.10.3.1 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.

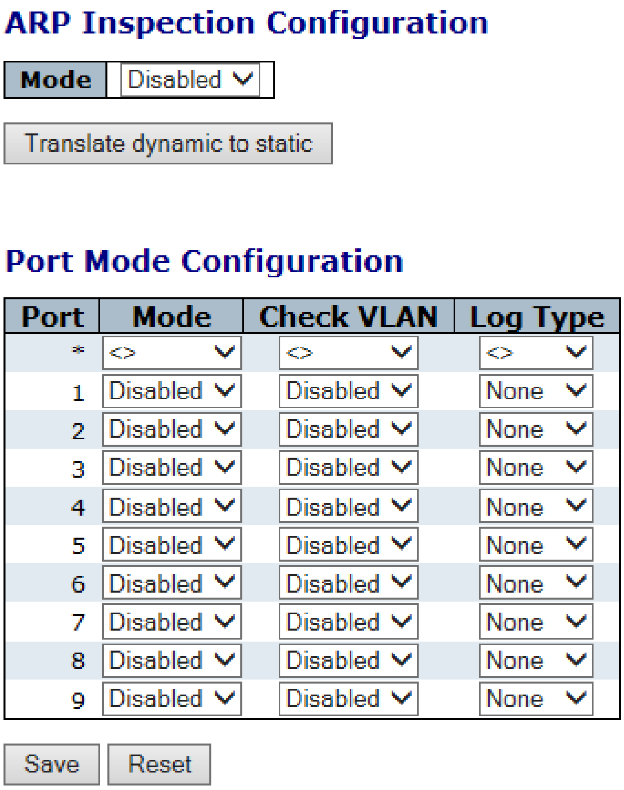


Figure 4-92 : ARP Configurations displays

Table 4-89::ARP Configuration displays Parameters

ARP Inspection Configuration	
Mode of ARP Inspection Configuration	Enable the Global ARP iInspection 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 have to 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	**Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values **Translate dynamic to static**: Click to translate all dynamic entries to static entries.

4.10.3.2 VLAN Mode Configuration

This section provides ARP enabled on which VLAN.

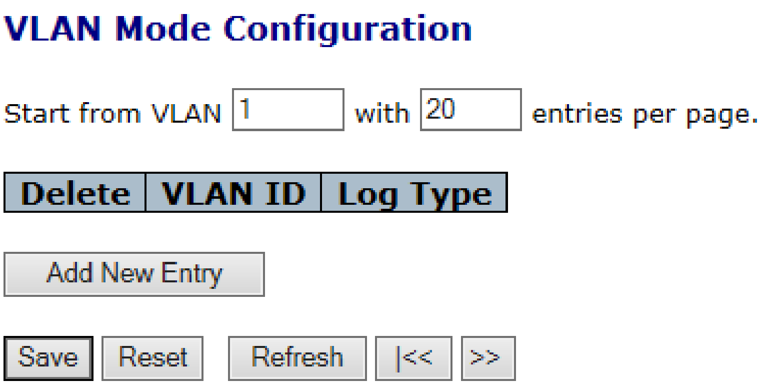


Figure 4-93: VLAN Mode Configurations display

Table 4-90: VLAN Mode Configuration Parameters

VLAN Mode Configuration	
Specify ARP Inspection is enabled on which VLANs. First, you have to 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. **Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.
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	

\

4.10.3.3 Static ARP Inspection Table

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

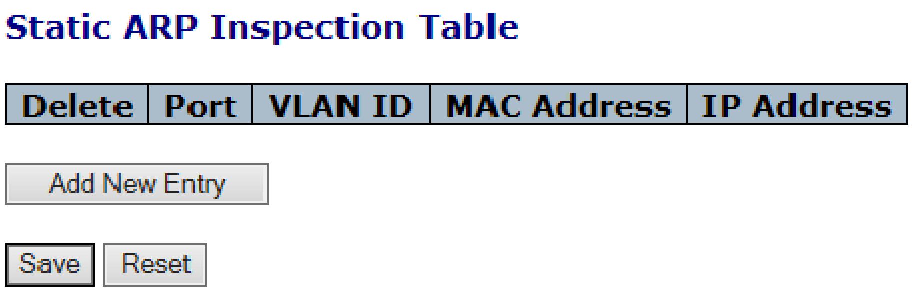


Figure 4-94: Static ARP Inspection Table display

Table 4-91: 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. **Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.10.3.4 Dynamic ARP Inspection Table

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.

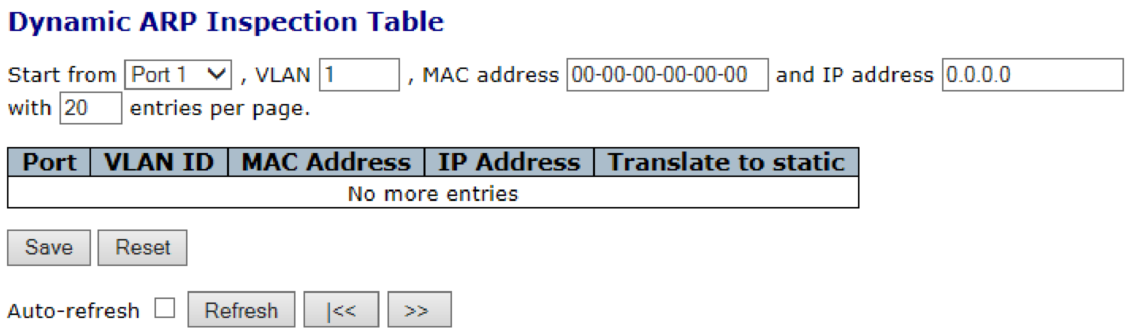


Figure 4-95: Dynamic ARP Inspection Table display

Table 4-92: 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.
Buttons	**Refresh:** Refreshes the displayed table starting from the input fields. **Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **>>** Updates the table, starting with the entry after the last entry currently displayed. **<<** Updates the table starting from the first entry in the Dynamic ARP Inspection Table.
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	

4.10.4 Authentication Server Configuration (AAA)

This section allows to configure the various Authentication Servers

4.10.4.1 Radius Server Configuration

This section allows you to configure the RADIUS servers

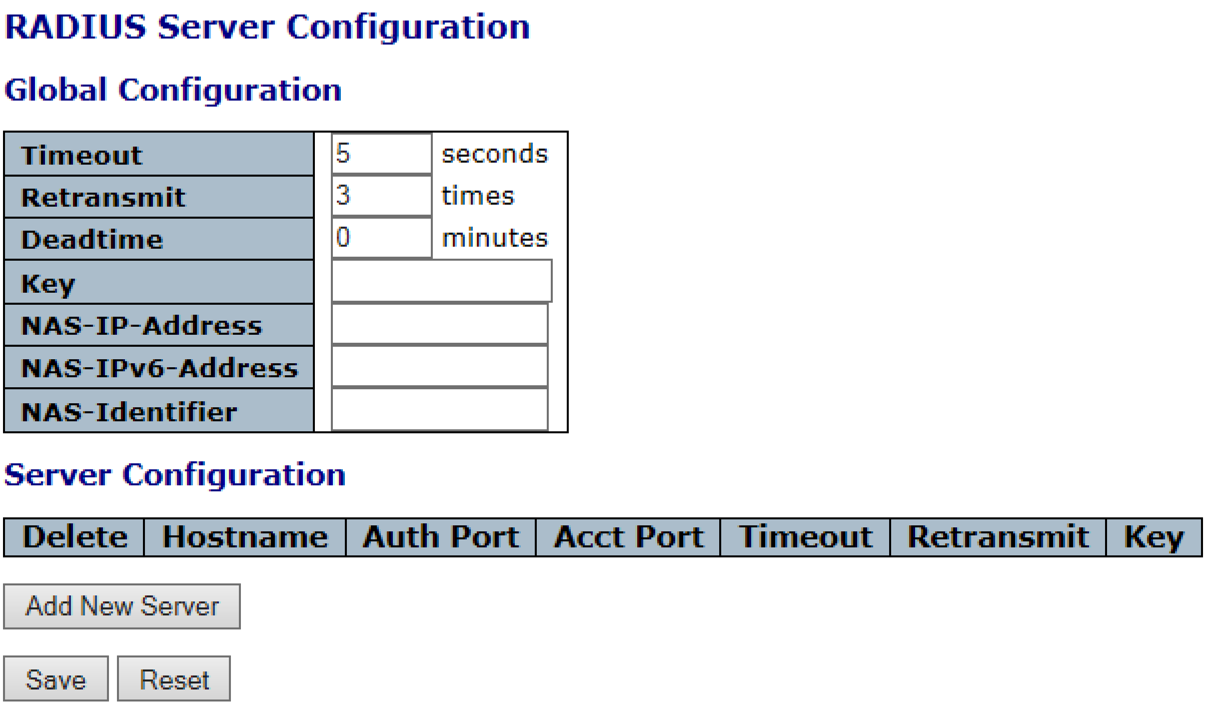


Figure 4-96: Radius: Server Configuration

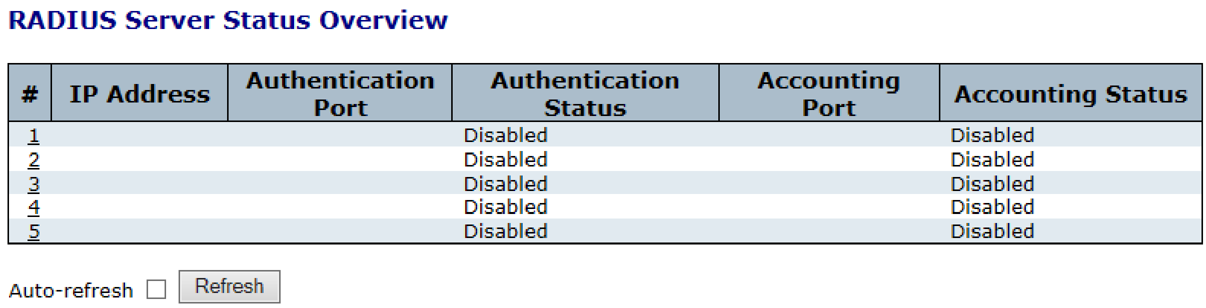
Table 4-93: Radius: Server Configuration Parameters

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 considered to be dead.
Dead Time	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
Key	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 a number of 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
Key	This optional 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	
Buttons	**Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values

4.10.4.2 Radius Server Status Overview

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



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 4-97: RADIUS: Server Status Overview

Table 4-94: 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 servesr 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 Port	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.
Buttons	**Auto-refresh** **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately

4.10.4.3 TACACS+ Sever Configuration

This page allows you to configure the TACACS+ servers.

TACACS+ is an acronym for Terminal Acess 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.

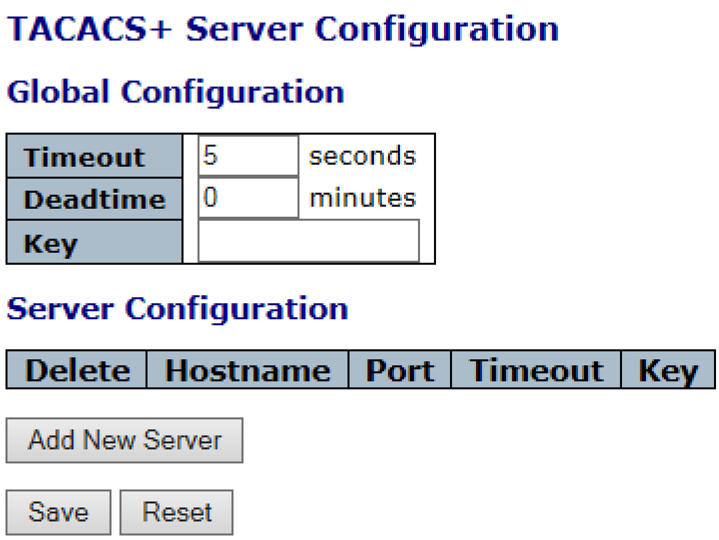


Figure 4-98: TACACS+ Server Configuration

Table 4-95: 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 considered to be dead.
Dead Time	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
Key	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 a number of 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.
Key	This optional 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	
Buttons	**Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values

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.

RADIUS Authentication Statistics for Server #1

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			0.0.0.0:1812
State			Disabled
Round-Trip Time			0 ms

RADIUS Accounting Statistics for Server #1

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			0.0.0.0:1813
State			Disabled
Round-Trip Time			0 ms

Server #1 Auto-refresh Refresh Clear

Figure 4-99: RADIUS Statistics for Server

Table 4-96: 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 hasn't 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 hasn't been round-trip communication with the server yet.
Buttons	The server select box determines which server is affected by clicking the buttons. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh**: Refreshes the displayed table starting from the input fields. **Clear:** Flushes all dynamic entries	

4.11 SyncCenter Configuration

This section displays 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, GPS, TDM and External .The SyncCenter will output the required sync clock according to reference quality and priority

---

Note:Refer to n "<u>Fibrolan Falcon Products Matrix"2016</u>" to find out which Fibrolan units support the SyncCenter

---

Block Diagram

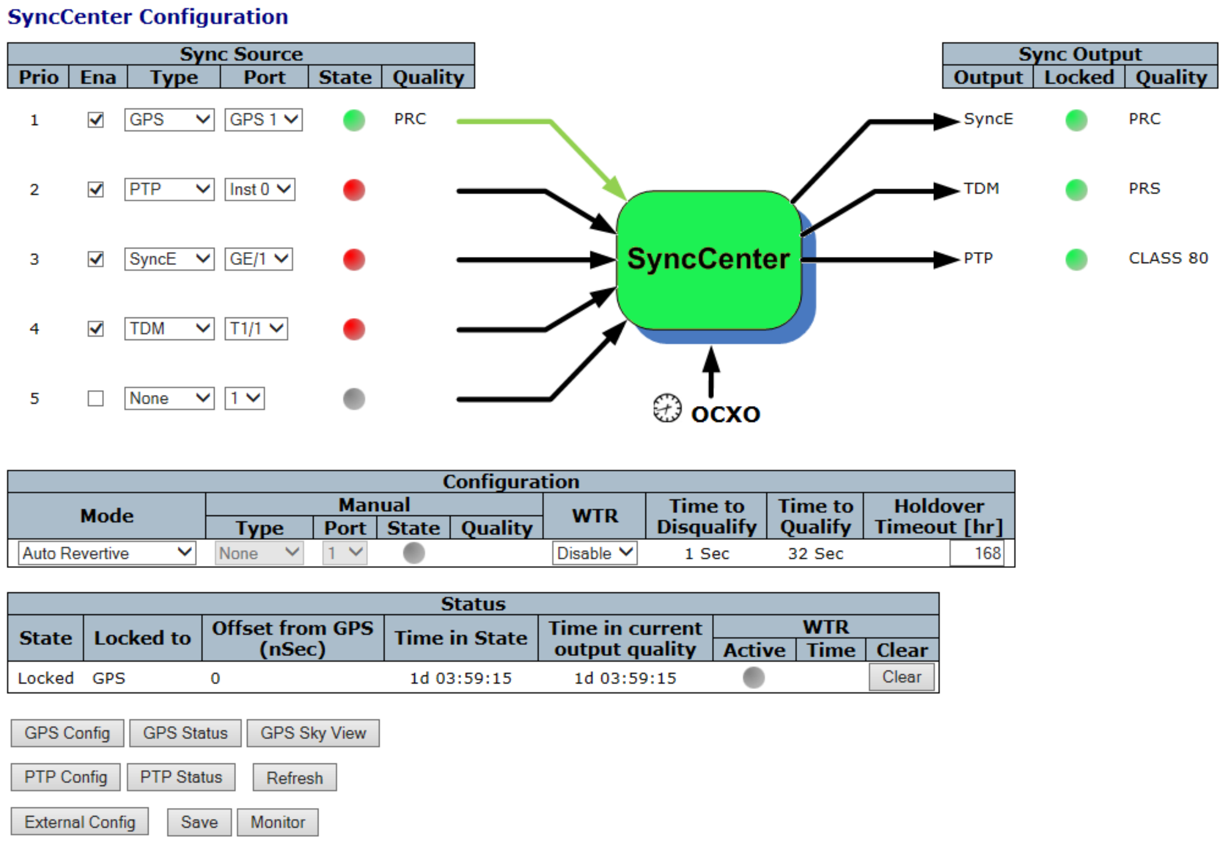


Figure 4-100: Sync Center displays

The following displays will allow the implementation of the SyncCenter functionality

4.11.1 SyncCenter

Table 4-97: Sync Center parameters

SyncCenter	
Input arrows	Visualization of sources feeding the system. A **green** arrow indicates the source is currently selected. The OCXO is the main clock for the Sync Center It will be synchronized to any input clock
SyncCenter	Provides a visual indication of the current system clock status: **Green** indicates system is locked to a sync source, **Blue** indicates the system is in Holdover state and **Yellow** indicates Free-running (internal clock) state.
Output arrows	Visualization of outputs (distributed from the system clock).
Buttons	**Save:** Click to save changes **Refresh** Click to refresh the page immediately. **Monitor:** Direct link to the SyncCenter monitoring page.

4.11.2 Sync Source

Sync Source					
Prio	Ena	Type	Port	State	Quality

Figure 4-101: Sync Source display

Table 4-98: Sync Source parameters

Sync Source	
Prio	Indicates the sync source priority (1 is highest).
Ena	Enable or disable the sync source.
Type	Select the type of sync source. Available options depend on model and may include: SyncE, PTP, GPS, 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 ID, etc.
State	The current status of the sync source. When the source provides a valid reference clock, this indicator will be **Green**. When source is disabled or not applicable, indicator will be **Grey**.
Quality	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.

Buttons	**Save:** Click to save changes **Refresh:** Click to refresh the page immediately. **Monitor**: Direct link to the SyncCenter monitoring page.

4.11.3 Sync Center Configuration

This section allows the implementation of different settings

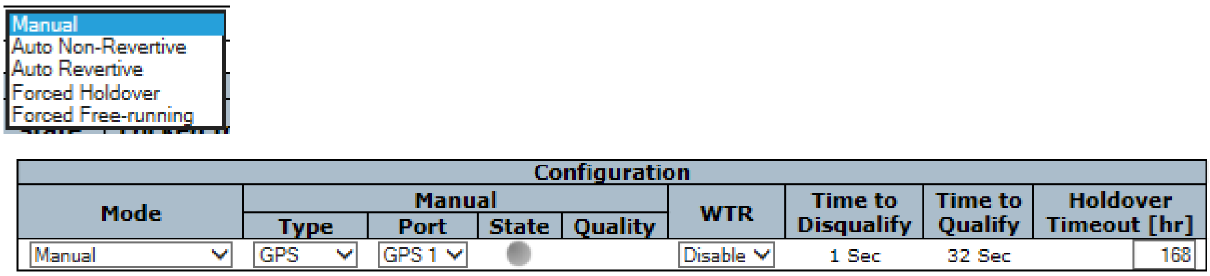


Figure 4-102: SyncCenter Configuration

Table 4-99: SyncCenter Configuration parameters

SyncCenter 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:** clock source is automatically selected based on priority and state. When higher priority source that previously failed, is valid again, switchover will take place **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.
Manual Type	When system sync mode is set to manual the source type is configured here (None, SyncE, PTP, TDM, External)
Manual Port	When system sync mode is set to manual, the source port or instance is configured here.

Manual State	The status of the sync source. When the source provides a valid reference clock, this indicator will be Green. When source is disabled or not applicable, indicator will be Grey.
Manual Quality	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
WTR	Configure the Wait To Restore (WTR) timer or disable its operation (applicable when in Auto-Revertive mode).
Time to Disqualify	Indicates the time the system waits between failures of a sync source (quality degraded) and until it is declared as disqualified (invalid).
Time to Quality	Indicates the time the system waits between detection of a valid sync source (adequate quality) and until it is declared as qualified (valid).
Holdover Timeout(hr)	Configure the time duration for holdover that after that time period, it will move from holdover to free running state.
Buttons	**Save:** Click to save changes **Refresh:** Click to refresh the page immediately . **Monitor**: Direct link to the SyncCenter monitoring page.

4.11.4

4.11.5 Sync Output

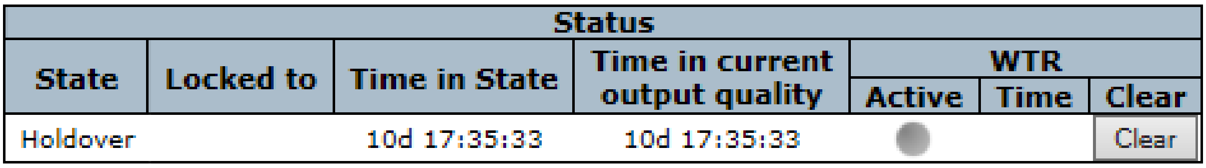
Sync Output		
Output	Locked	Quality

Figure 4-103: Sync Output

Table 4-100: Sync Output parameters

Sync Output	
Output	Indicates the type of output (e.g. SyncE).
Locked	Indicates the clock output used to synchronize the functional block in 'Output'.
Quality	Indicates the clock quality distributed on this type of output
Buttons	**Save:** Click to save changes **Refresh** Click to refresh the page immediately . **Monitor:** Direct link to the SyncCenter monitoring page.

4.11.6 SyncCenter Status



Status						
State	Locked to	Time in State	Time in current output quality	WTR		
				Active	Time	Clear
Holdover		10d 17:35:33	10d 17:35:33			Clear

Figure 4-104: Sync Center Status

Table 4-101: Sync Center Status parameters

Sync Output	
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. **Green** indicates system is locked to a sync source, **Blue** indicates the system is in Holdover state and **Yellow** indicates Free-running (internal clock) state.
Locked to	Indicates the sync source (type and port/instance) the system is currently locked to (e.g. SyncE 2).
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	**Save:** Click to save changes **Refresh:** Click to refresh the page immediately. **Monitor** Direct link to the Sync Center monitoring page **Other Buttons**: Direct link to relevant pages.

4.12 SyncCenter Monitoring

This session allows us to monitor and view the status of the SyncCenter

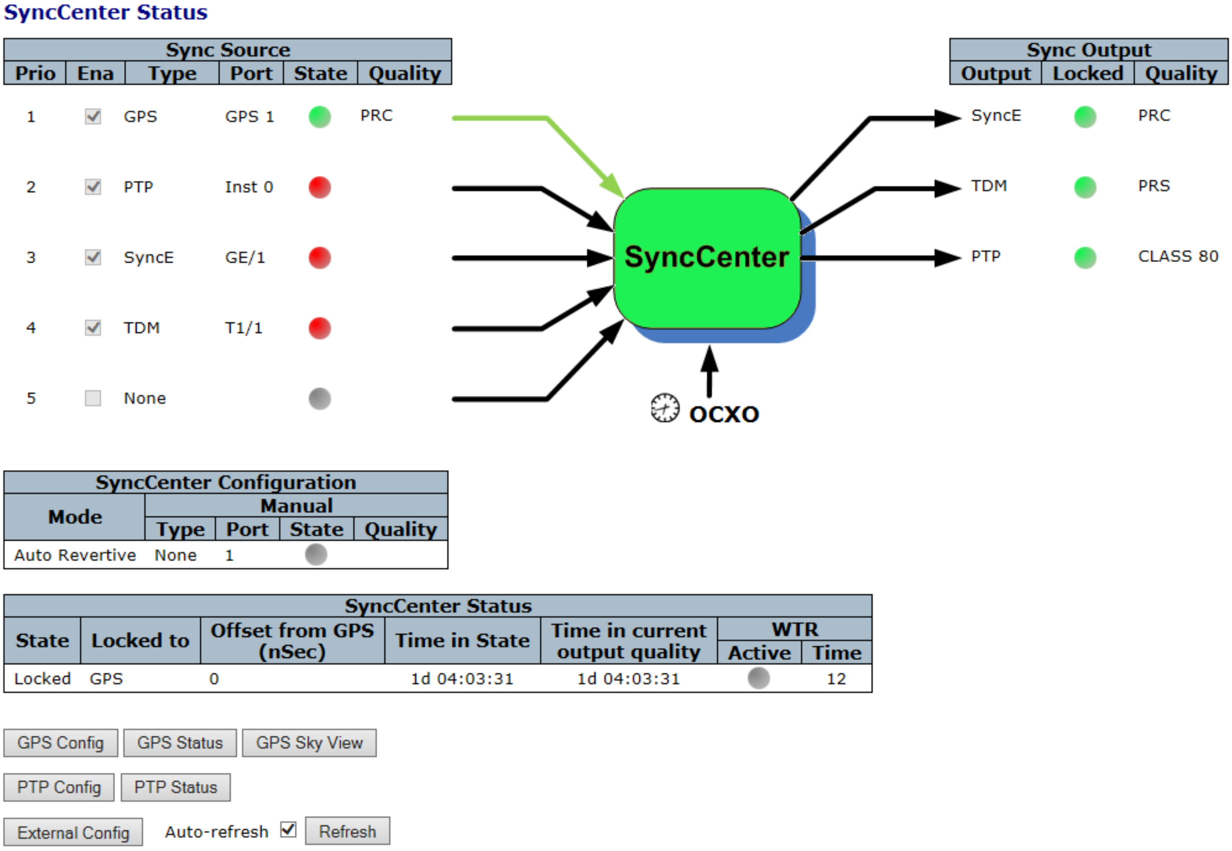


Figure 4-105: Monitoring Sync Center Status displays

The following displays allow us to monitor the Sync Center status and activity

4.12.1 SyncCenter

Table 4-102: SyncCenter parameters

SyncCenter	
Input arrows	Visualization of sources feeding the system. A green arrow indicates the source is currently selected. OCXO is the clock fed to the SyncCenter.It will be synchronized by any input clock
SyncCenter	Provides a visual indication of the current system clock status: **Green** indicates system is locked to a sync source, **Blue** indicates the system is in Holdover state and **Yellow** indicates Free-running (internal clock) state.
Output arrows	Visualization of outputs (distributed from the system clock).
Buttons	Configuration: Direct link to the SyncCenter configuration page Refresh: Click to refresh the page immediately. Auto-refresh :Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.12.2 Sync Source Status

Sync Source					
Prio	Ena	Type	Port	State	Quality

Auto-refresh ☑ Refresh Configuration

Figure 4-106: Sync Source Status

Table 4-103: Sync Source status parameters

Sync Source	
Prio	Indicates the sync source priority (1 is highest).
Ena	Shows which sync source is enabled or disabled.
Type	Show the type of sync source. Available options depend on model and may include: SyncE, PTP, GPS, TDM and External.
Port	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 ID, etc.
State	The status of the sync source. When the source provides a valid reference clock, this indicator will be **Green.** When source is disabled or not applicable, indicator will be **Grey**.
Quality	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.
Buttons	**Configuration:** Direct link to the SyncCenter configuration page **Refresh:** Click to refresh the page immediately. **Auto-refresh** ☐ Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.12.3 SyncCenter Configuration

SyncCenter Configuration				
Mode	Manual			
	Type	Port	State	Quality
Auto Revertive	None	1	●	

Auto-refresh ☑ Refresh Configuration

Figure 4-107: SyncCenter Configuration

Table 4-104: SyncCenter parameters

SyncCenter Configuration	
Mode	Shows the current system's overall synchronization mode: **Auto Non-Revertive:** source is automatically selected based on priority and state. When higher priority source that previously failed, is valid again, no switchover will take place. **Auto Revertive:** source is automatically selected based on priority and state. When higher priority source that previously failed, is valid again, switchover will take place. **Manual:** source will the one configured in the manual source configuration fields, regardless of its state. **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.
Manual Type	When system sync mode is set to manual the source type is shown here (None,SyncE, PTP, TDM, External)
Manual Port	When system sync mode is set to manual the source port or instance is shown here.
Manual State	The status of the sync source When the source provides a valid reference clock, this indicator will be **Green.** When source is disabled or not applicable, indicator will be Grey.
Manual Quality	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.
Buttons	**Configuration** :Direct link to the SyncCenter configuration page **Refresh:** Click to refresh the page immediately. **Auto-refresh** ☐ Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.12.4 SyncCenter Status

SyncCenter Status					
State	Locked to	Time in State	Time in current output quality	WTR	
				Active	Time
Locked	SyncE 3735928559	0d 18:30:03	0d 18:30:03		12

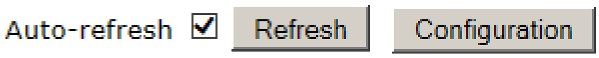


Figure 4-108: SyncCenter Status

Table 4-105: SyncCenter Status parameters

SyncCenter Status	
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
Locked to	Indicates the sync source (type and port/instance) the system is currently locked to (e.g. SyncE 2).
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).
Buttons	**Configuration**: Direct link to the SyncCenter configuration page **Refresh:** Click to refresh the page immediately. **Auto-refresh** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.12.5 Sync Output

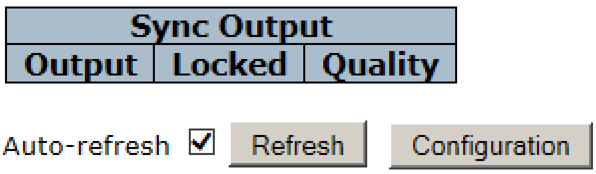


Figure 4-109: Sync Output Status

Table 4-106: Sync Output parameters

Sync Output	
Output	Indicates the type of output (e.g. SyncE, PTP or TDM).
Locked	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 **Refresh:** Click to refresh the page immediately. **Auto-refresh** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds..
Special Buttons	**GPS Config: click on it,you will go to GPS Configuration** Other Buttons: Direct link to relevant pages. **GPS Status** **GPS Sky View** **PTP Config** **PTP Status** **External Config**

4.13 External Configuration

Note: Refer to section "[Fibrolan Falcon Products Matrix"2016]" to find out which Fibrolan units support this subject

---

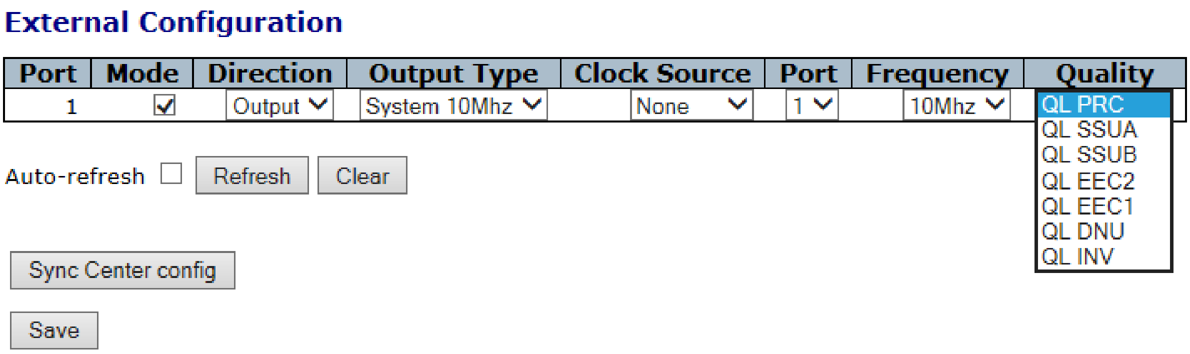


Figure 4-110: External Clock Configuration

Table 4-107: 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 source and frequency. Applicable when the port is set to **Output**
Cloock Source	Can be set to :None,SyncE,PTP,TDM,GPS, and External
Port	Port T/1 thru T1/8 selection
Frequency	Set the port's input/output frequency. Available options are 10MHz and 1PPS

Quality	Set the clock quality (QL) when used as an input. This quality will be used (i.e. distributed) when the system is synchronized to this sync port. Quality Clock Level options: **QL-PRC** (For Primary Reference Clock accuracy) **QL-SSU-A** (For Synchronization Supply Unit-A accuracy) **QL-SSU-B** (For Synchronization Supply Unit-B accuracy) **QL-EEC1** (For Ethernet Equipment Clock 1 accuracy) **QL-EEC2** For Ethernet Equipment Clock 1 accuracy) **QL-DNU** (For Do Not Use). **QL- INV** (Invalid followed by a number+`e.g INV1)
Buttons	**Refresh:** Click to refresh the page immediately. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values **Sync Center config:** click to go to SyncCenter Configuration

4.14 GPS Receiver

This section shows the various GPS displays and their functionality.receiver
GPS Configuration

This section displays the configuration and status info of the GPS receiver.

Note:Refer to "[Fibrolan Falcon Products Matrix"2016"]document to find out which Fibrolan units support this subject

---

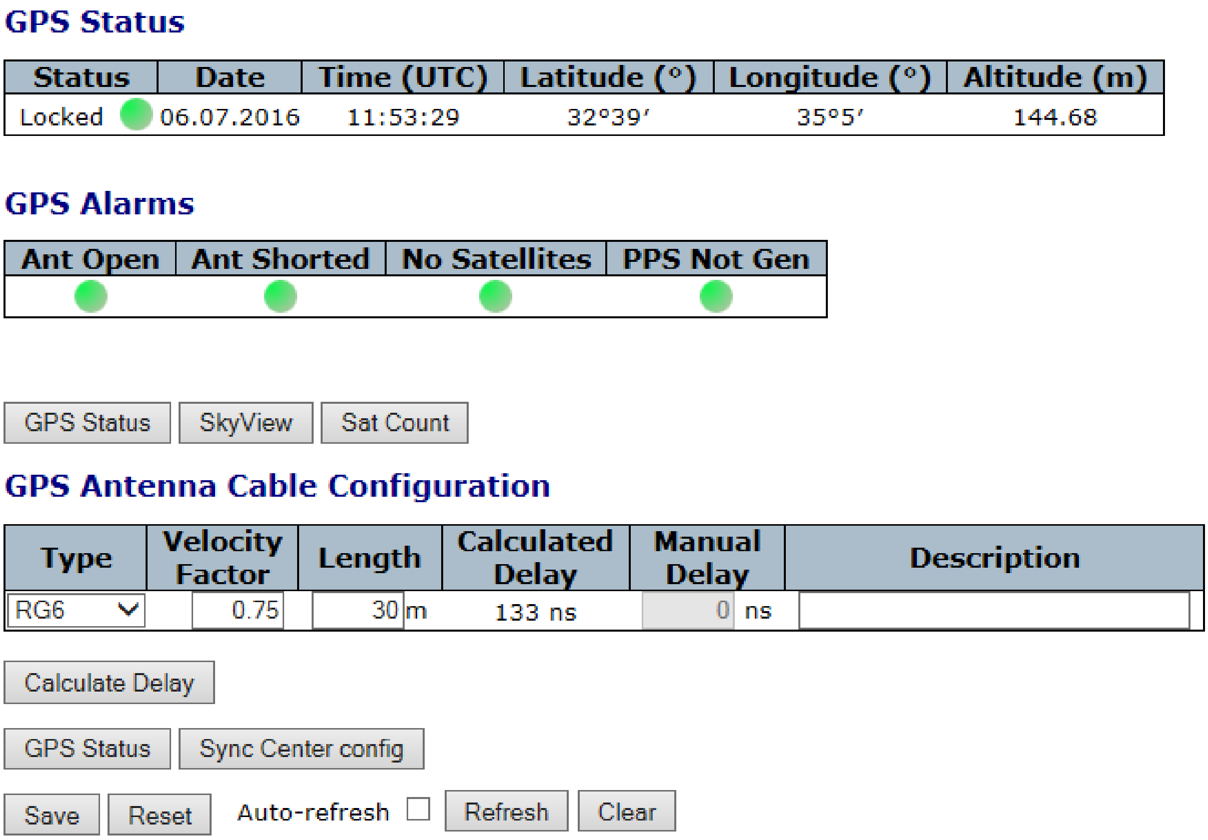


Figure 4-111: GPS Displays

4.14.1 GPS Antenna Cable Configuration

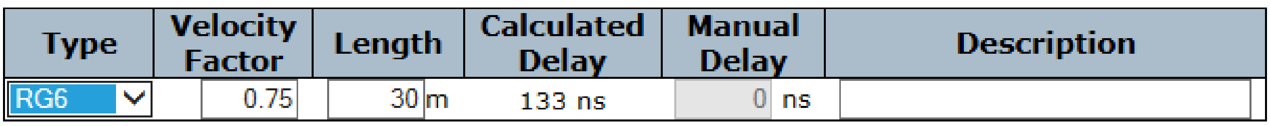
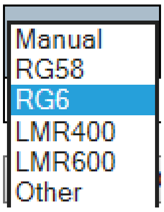


Figure 4-112: GPS Antenna Cable Configuration



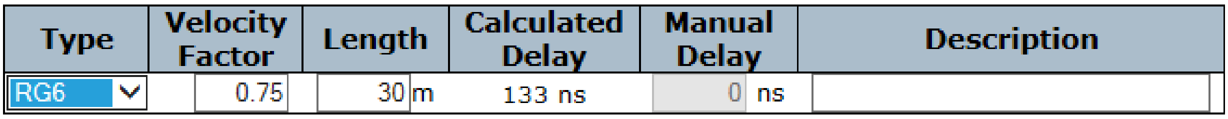


Table 4-108: GPS Antenna Cable Configuration parameters

Type	Set the type of cable being used for the GPS antenna. When Maual is selected , it is possible to directly configure the cable delay Cable type:RG58, RG6,LMR400, LMR600 OR OTHER
Velocity Factor	Set the Velocity Factor (VF) of the antenna cable.
Length	Set the length of the antenna cable in meters.
Calculate 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	**Refresh:** Click to refresh the page immediately. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Clear :** Click to clear current status. **Calculate Delay:** Click to calculate the cable delay based on current parameters. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values **Sync Center config**,: click to go to SyncCenter Configuration **GPS Status**:: click on it to go "GPS Status display **SkyView:** click on it to go GPSs SkyView **Sat Count:** click on it to go Satellite count display

4.14.2 GPS Status

GPS Status

Status	Date	Time (UTC)	Latitude (°)	Longitude (°)	Altitude (m)
Locked	06.07.2016	11:53:29	32°39′	35°5′	144.68

Figure 4-113: GPS Status

Table 4-109: GPS Status parameters

GPS Status	
Status	Indicates the overall status of the GPS receiver (e.g. Doing Fixes).
Date	Indicates the current date as received by the GPS.
Time	Indicates the current time of day as received by the GPS.
Latitude	Indicates the current latitude as received by the GPS in degrees.
Longitude	Indicates the current longtitude as received by the GPS in degrees.
Altitude	Indicates the current altitude as received by the GPS in meters.
Buttons	**Refresh:** Click to refresh the page immediately. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Clear :** Click to clear current status.

4.14.3 GPS Alarms

GPS Alarms

Ant Open	Ant Shorted	No Satellites	PPS Not Gen

Figure 4-114: GPS Alarm

Table 4-110: GPS Alarm parameters

GPS Alarms	
Ant Open	When it lights **red** there is no antenna or the cable is not connected
Ant Shorted	When it lights red there is a short on the antenna cable or in the antenna itself. When it lights red the GPS can see no satellites.
No Satellites	When it lights red the GPS can see no satellites.

PPS Not Gen	When it lights red the GPS cannot generate 1PPS signal.
Buttons	**Refresh:** Click to refresh the page immediately. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Clear :** Click to clear current status.

4.14.4 Monitoring GPS Status

This section displays the status of the GPS receiver

GPS Status

Status		Time		Coordinates			Offsets	
State	Time In State	Date	Time	Latitude	Longitude	Altitude	1PPS	Clock
Locked	0d 00:49:37	06.07.2016	12:17:13	32°39'25"	35°05'46"	144.68m	-9.44nsec	0.16ppb

Figure 4-115: Monitoring GPS Status

Table 4-111: GPS Status parameters

GPS Status	
Status	Indicates the overall status of the GPS receiver (e.g. Doing Fixes).
Date	Indicates the current date as received by the GPS.
Time	Indicates the current time of day as received by the GPS.
Latitude	Indicates the current latitude as received by the GPS in degrees.
Longitude	Indicates the current longitude as received by the GPS in degrees.
Altitude	Indicates the current altitude as received by the GPS in meters.
Offsets-1PPS	Indicates the current estimated 1PPS time error the GPS is generating, in nsec.
Offsets-Clock	Indicates the current estimated frequency error the GPS is generating, in ppb.

4.14.5 GPS Alarms

GPS Alarms

Ant Open	Ant Shorted	No Satellites	PPS Not Gen

Figure 4-116: Monitoring GPS Alarms

Table 4-112: GPS Alarms parameters

GPS Alarms	
Ant Open	When it lights **red** there is no antenna or the cable is not connected
Ant Shorted	When it lights **red** there is a short on the antenna cable or in the antenna itself.
No Satellites	When it lights r**ed** the GPS can see no satellites.
PPS Not Gen	When it lights **red** the GPS cannot generate 1PPS signal.

4.14.6 Satellite Status

Satellite Status

Satellite PRN	Signal Level [dB-Hz]
25	47
29	47
12	49
2	37
18	43
21	46
20	49
5	47
31	30
85	37
84	37
73	45
83	45
80	42
69	40
68	45
67	35
74	41
82	18

Total visible	19
Total good	11

GPS Config | SkyView | Sat Count

Figure 4-117: Satellite Status

Table 4-113: Satellite Staus parameters

Satellite Status	
Satellite PNR	The PRN (satellite number) of the tracked satellites.
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**).
Smmary table	When it lights red the GPS can see no satellites.

4.14.7 GPS Antenna Cable Status

GPS Antenna Cable Status

Type	Length	Delay	Description
RG 6	30	133	

Figure 4-118: GPS Antenna Cable Status

Table 4-114: GPS Antenna Cable parameters

GPS Antenna Cable Status	
Type	The type of cable being used for the GPS 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	**Auto-refresh** : Check this box to enable an automatic refresh of the page at regular intervals. **Refresh:** Click to refresh the page immediately. **Clear:** Click to clear current status **Other Buttons: GPS Config. Sky View. Sat Coun** are direct links to the respective pages

4.14.8 Sky View

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

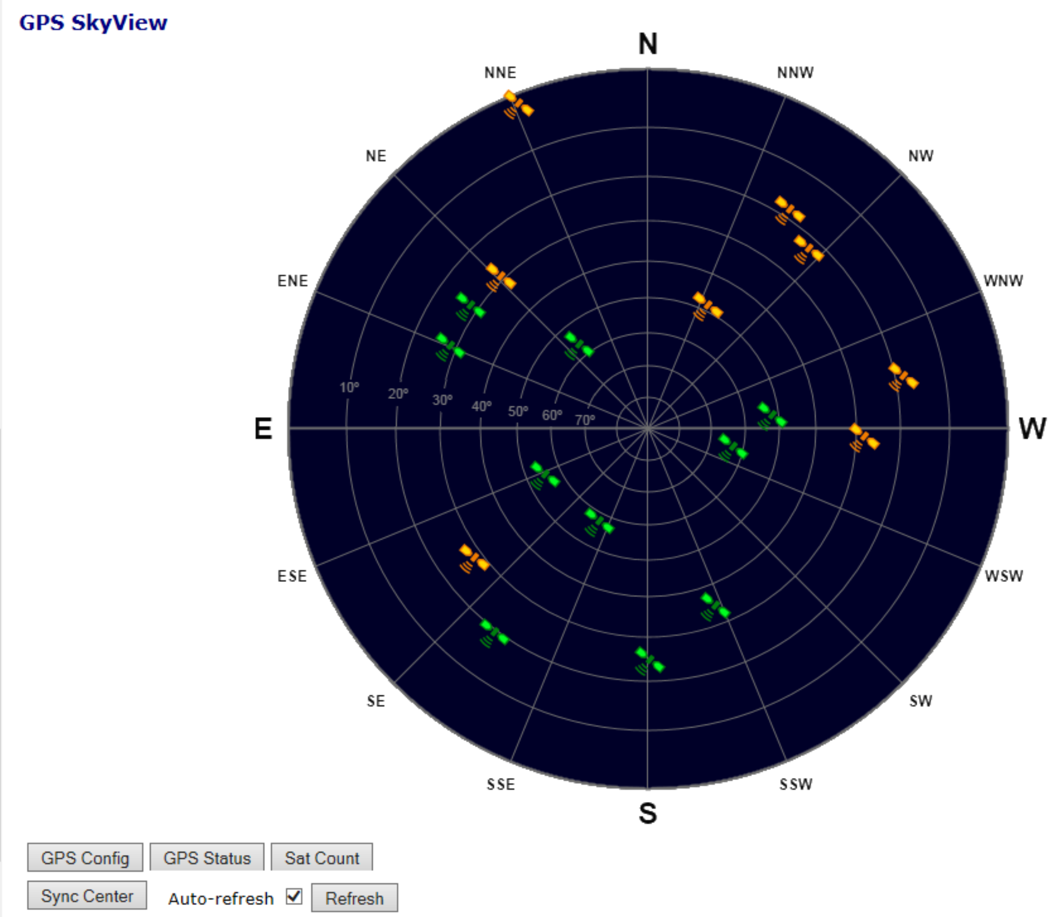


Figure 4-119: Sky view display

Table 4-115: Sky View parameters

GPS Sky View	
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 current status and displayed in green (strong receive signal) or orange (fair signal). When pointing on a satellite a text box balloon will automatically open, showing satellite info highlights.	
Buttons	**Auto-refresh** ☐ : Check this box to enable an automatic refresh of the page at regular intervals. **Refresh** **GPS Status , GHPS Config, Sat Count, Sync Cent:direct links**

4.14.9 Satellite Count

This section displays a graph of the tracked satellites count.

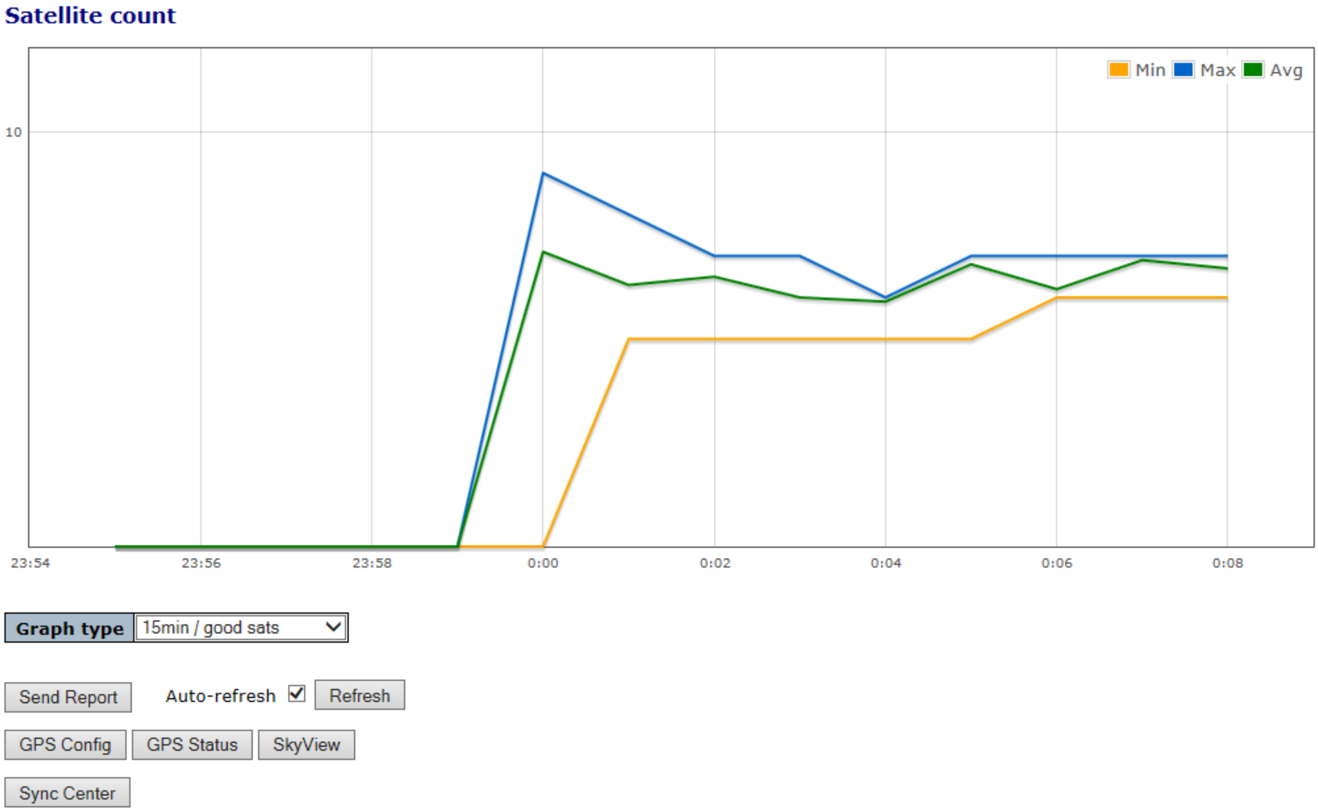


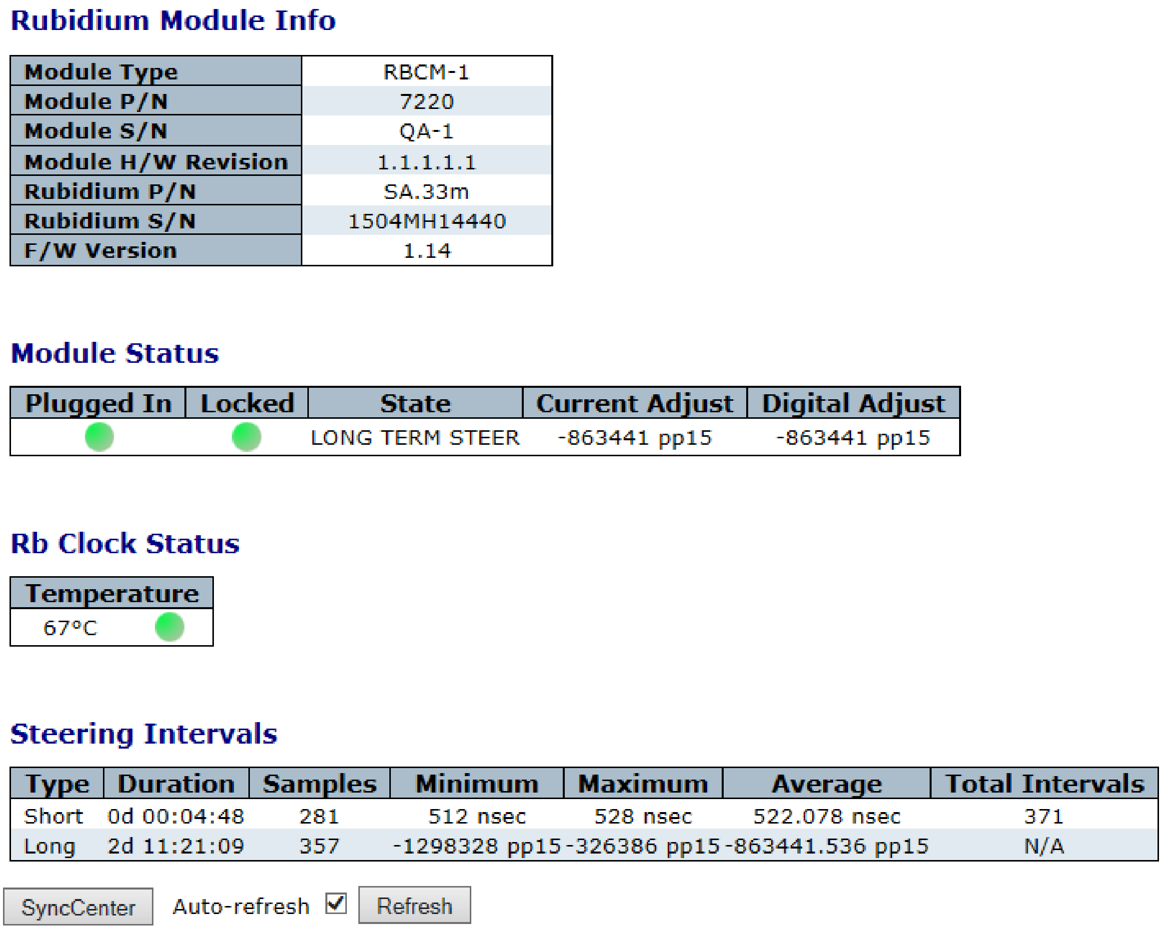
Figure 4-120: Satellite Count display

Table 4-116 Satellite Count parameters

GPS Satellite Count	
Satellite Count	The type of cable being used for the GPS 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	**Auto-refresh** : Check this box to enable an automatic refresh of the page at regular intervals. **Refresh: click to refresh the page** **Send Report:**send report yo your computer if you have set the required parameter in the [Falcon report Configuration] **Other Buttons: GPS Config. Sky View. Sat Coun** are direct links to the respective pages

4.14.10 Rubidium module

Note:Refer to "<u>Fibrolan Falcon Products Matrix"2016</u>"document to find out which Fibrolan unit' supports the Rubidium module



Rubidium Module Info

Module Type	RBCM-1
Module P/N	7220
Module S/N	QA-1
Module H/W Revision	1.1.1.1.1
Rubidium P/N	SA.33m
Rubidium S/N	1504MH14440
F/W Version	1.14

Module Status

Plugged In	Locked	State	Current Adjust	Digital Adjust
		LONG TERM STEER	-863441 pp15	-863441 pp15

Rb Clock Status

Temperature
67°C

Steering Intervals

Type	Duration	Samples	Minimum	Maximum	Average	Total Intervals
Short	0d 00:04:48	281	512 nsec	528 nsec	522.078 nsec	371
Long	2d 11:21:09	357	-1298328 pp15	-326386 pp15	-863441.536 pp15	N/A

SyncCenter Auto-refresh Refresh

Figure 4-121: Rubidium module displays

Table 4-117 Rubidium module displays parameters

Rubidium Module Info	
Module Type	Indicates the type of the module.
Module P/N	Indicates the Fibrolan Part Number of the module
Module S/N	Indicates the Fibrolan Serial Number of the module
Module H/W Revision	Indicates the Hardware revision of the module.
Rubidium P/N	Indicates the Part Number of the Rb clock installed on the module.
Rubidium S/N	Indicates the Serial Number of the Rb clock installed on the module.
F/W Version	Indicates the Firmware version of the Rb clock installed on the module.

Module Status	
Plugged In	Indicates whether the Rb module is plugged into the system or not.
Locked	Indicates whether the Rb clock has achieved an internal atomic locked state (different than system lock to GPS).
State	Indicates the current state of the Rb module
Current Adjust	Indicates the current adjustment applied to the Rb clock (in pp15: 1E-15 units), for tracking the GPS.
Digital Adjust	A read-back from the Rb clock that allows cross-check of the clock adjustment value
Rb Clock Status	
Temperature	Indicates the internal temperature of the Rb Clock.
Steering Intervals	
Type	The type of steering interval: Short or Long.
Duration	The elapsed duration of the interval since it started, in seconds.
Samples	The number of measured samples (of the GPS) within the interval since it started (typically a little lower than duration).
Minimum	In Short term intervals: the minimum 1PPS difference within the interval (in nsec). In Long term intervals: the minimum clock adjustment value applied within the interval (in pp15).
Maximum	In Short term intervals: the maximum 1PPS difference within the interval (in nsec). In Long term intervals: the maximum clock adjustment value applied within the interval (in pp15).
Average	In Short term intervals: the average 1PPS difference over the interval so far (in nsec). In Long term intervals: the average clock adjustment value applied over the interval so far (in pp15).
Total Intervals	The total number of intervals elapsed so far, since Rb module was plugged in.
Buttons	**Auto-refresh** :Check this box to enable an automatic refresh of the page at regular intervals. **Refresh:** Click to refresh the page **SyncCenter** : direct link to the relevant page

4.15 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 is able to 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 period of time 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.

Note:Refer to "Fibrolan Falcon Products Matrix"2016" document to find out which Fibrolan units support this subject

---

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 into 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 Telecordia 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)

4.15.1 PTP External Clock Mode

This section allows the user to configure the PTP External clock mode settings

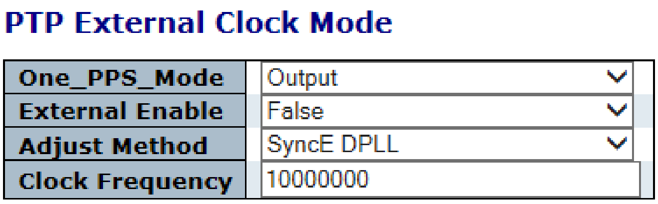


Figure 4-122: PTP External Clock Mode

Table 4-118: PTP External Clock Configuration Parameters

PTP External Clock Configuration	
One_pps_mode	This Selection box will allow you to select the One_pps_mode configuration. The following values are possible: 1. Output : Enable the 1 pps clock output 2. Input: Enable the 1 pps clock input 3. Disable : Disable the 1 pps clock in/out-put
External Enable	This Selection box will allow you to configure the External clock output. The following values are possible: 1. True : Enable the external clock output 2. False : Disable the external clock output
Adjust Method	This Selection box will allow you to configure the Frequency adjustment configuration. 1**. LTC frequency** : Select Local Time Counter (LTC) frequency control 2. **SyncE-DPLL** : Select SyncE DPLL frequency control, if allowed by SyncE 3**. Oscillator** : Select an oscillator independent of SyncE for frequency control, if supported by the HW 4. . **LTC phase** : Select Local Time Counter (LTC) phase control (assumes that the frequency is locked by means of SyncE
Clock Frequency	This will allow setting the Clock Frequency. The possible range of values are 1 - 25000000 (1 - 25MHz)
Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **PTP Monitor**: click on it to go to: PTP Monitor display **Sync center config**: click on it to go to Sync Center config display

One PPS (1PPS) mode of operation.

Network systems require synchronizing with a 1Hz or 1PPS input clock signal.

Such timing signal may also derive from a GPS receiver.

This signal is needed to perform phase synchronization between Master and slave devices

4.15.2 PTP Clock Configuration

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

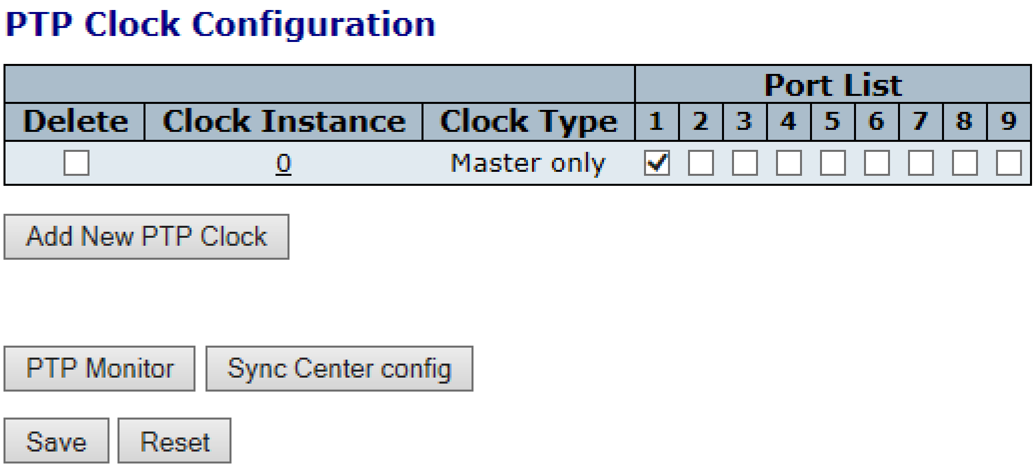


Figure 4-123: PTP Clock Configuration

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

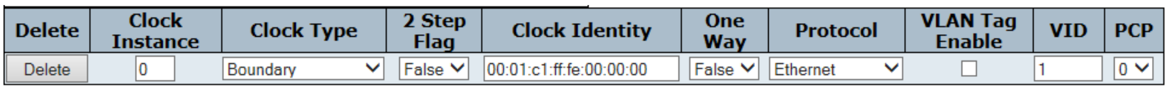


Figure 4-124: PTP Clock expanded Configuration display

Table 4-119: PTP Clock Configuration Parameters (for both above displays)

PTP Clock Configuration	
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.

Cloxk Type	Indicates the Type of the Clock Instance. There are five Device Types: 1.**Boundary** - clock's Type is Ordinary-Boundary Clock. 2. **Transparent** (P2P) - clock's Type is Peer to Peer Transparent Clock. 3**. Transparent (E2E)** - clock's Type is End to End Transparent Clock. 4. **Master Only** - clock's Type is Master Only. 5**. Slave Only** - clock's 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
Port List	Set check mark for each port configured for this Clock Instance.
2 Step Flag	Static member: defined by the system, true if two-step Sync events and P delay_Resp events are used. These messages are used to measure the delay of the path between two clock ports Event message is the timing message Pdelay=path delay
Clock Identity	It shows unique clock identifier
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 if only frequency synchronization is needed. The master always responds to delay requests.
Protocol	Transport protocol used by the PTP protocol engine: **Ethernet PTP over Ethernet multicast** **EthernetMixed PTP using a combination of Ethernet multicast and unicast** **ip4multi PTP over IPv4 multicast** **IPv4Mixed PTP using a combination of IPv4 multicast and unicast** **ip4uni PTP over IPv4 unicast** Note : IPv4 unicast protocol only works in Master and Slave only clocks See parameter Clock Type In a unicast Slave only clock you also need configure which master clocks to request Announce and Sync messages from. See: Unicast Slave Configuration

VLAN Tag Enable	Enables the VLAN tagging for the PTP frames. Note: Packets are only tagged if the port is configured for vlan tagging for the configured VLAN.i.e the VLAN Tag Enable parameter is ignored:
VID	VLAN Identifier used for tagging the PTP frames.
PCP	Priority Code Point value used for PTP frames. **PCP** is an acronym for **P**riority **C**ode **P**oint. It is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as **User Priority.** User Priority: is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as PCP.
Buttons	**Add New PTP Clock**: Click to create a new clock instance **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **PTP Monitor**: click on it to go to: PTP Monitor display **Sync center config**: click on it to go to Sync Center config display

4.15.3 PTP Monitoring

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

Two status displays are shown:

PTP External Clock Mode

PTP Clock Configuration

4.15.3.1 PTP External Clock Mode

PTP External Clock Mode

One_PPS_Mode	Output
External Enable	False
Adjust Method	SyncE DPLL
Clock Frequency	10000000

Figure 4-125: PTP External Clock Mode

Table 4-120: PTP External Clock mode parameters

PTP External Clock Mode	
One_pps_mode	Shows the current configured One_pps_mode. 1. **Output**: Enable the 1 pps clock output 2. **Input**: Enable the 1 pps clock input 3. **Disable** : Disable the 1 pps clock in/out-put
External Enable	Shows the current External clock output configuration. 1. True: Enable the external clock output 2. False : Disable the external clock output
Adjust Method	Shows the current Frequency adjustment configuration 1**. LTC frequency** : Local Time Counter (LTC) frequency control 2. **SyncE-DPLL** : SyncE DPLL frequency control, if allowed by SyncE 3. **Oscillator** : Oscillator independent of SyncE for frequency control, if supported by the HW 4. **LTC phase** : Local Time Counter (LTC) phase control (assumes that the frequency is locked by means of SyncE)
Clock Frequency	Shows the current clock frequency used by the External Clock. The possible range of values are 1 - 25000000 (1 - 25MHz)
Buttons	**Auto-refresh** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page immediately

4.15.3.2 PTP Clock Configuration

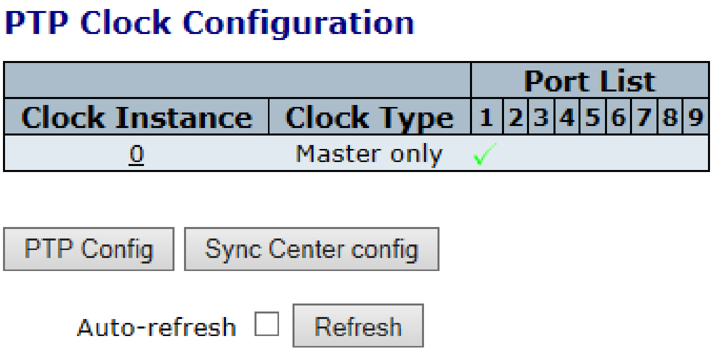


Figure 4-126: PTP Clock Configuration

Table 4-121: PTP Clock Configuration Parameters

PTP Clock Configuration	
Clock Instance	Indicates the Instance of a particular Clock Instance [0...3]. Click on the Clock Instance number to monitor the Clock details.
Clock Type	Indicates the Type of the Clock Instance. There are five Clock Types: 1. **Boundary** – clock's Type is Ordinary-Boundary Clock. 2. **Transparent (P2P)** – Clock's Type is Peer to Peer Transparent Clock. 3**. Transparent (E2E)** – Clock's Type is End to End Transparent Clock 4. **Master Only** - Clock's e Type is Master Only. 5**. Slave Only** - Clock's Type is Slave Only **Definitions:** **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 **master or slave clock.** The OC sends and receive PTP messages It supports the synchronization mechanism.
Port List	It shows the configured ports for the specified Clock Instance.
Buttons	**Auto-refresh** Check this box to enable an automatic refresh of the page at regular intervals. **Refresh:** Click to refresh the page immediately **PTP Config** :click on it to go to PTP Configurat ion display **Sync Center config:** click on it to go to SyncCenter config. display

4.15.3.3 PTP Slave Table

This section shows the Ptp Slave Table

PTP Slave Table

#	IP Address	MAC Address	Status		Sync Packet Rate (PPS)	Delay Request Rate	Current Delay	Description
			Sync	Ann				

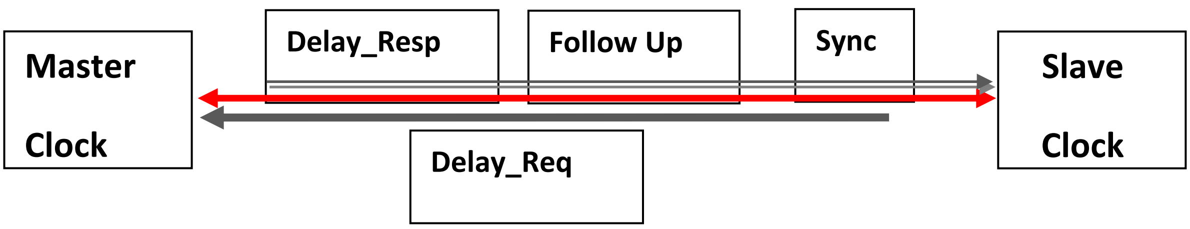
Auto-refresh ☑ Refresh

Figure 4-127: PTP Slave Table

Table 4-122: PTP Slave Table Parameters

PTP Slave Table	
#	Indicates the port number of the slave device
IP Address	Indicates the IP address of the slave device
MAC Address	Indicates the MAC address of the slave device
Status	**Sync**:PTP message used to generate and transmit time information for synchronization **Ann** (Announce):PTP general message (64 bytes) A slave device does not generate an accurate timestamp when sending or receiving a general message Announce message rates:1packet every 16s (min rate);8 packets/s (max rate); 1 packet every 2s (default)
Sync Packet Rate (PPS)	Indicates the actual Sync Packet rate Min rate: 1 packet every 16seconds ; max rate 128 packets per second
Delay Request Rate	Indicates the actual Delay Request rate Min rate: 1 packet every 16s; max rate 128 packets per second
Current Delay	Indicates the current delay
Description	Set a free text description (up to 63 characters).
Buttons	**Auto-refresh** ☐ Check this box to enable an automatic refresh of the page at regular intervals. **Refresh:** Click to refresh the page immediately

Basic working principle of IEEE 1588v2



4.16 Synchronous Ethernet (SyncE)

Overview

This section allows the user to inspect and configure the current SyncE port settings.
SyncE is used to make a Ethernet network 'clock frequency' synchronized.
Mobile network operators have started to deploy 4GLTE 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 in order to support mobile voice.
The µFalcon-MX and Falcon-MX devices are offered with complete precision timing support based on Synchronous Ethernet and 1588-2008 (PTP) for LTE mobile backhaul applications.

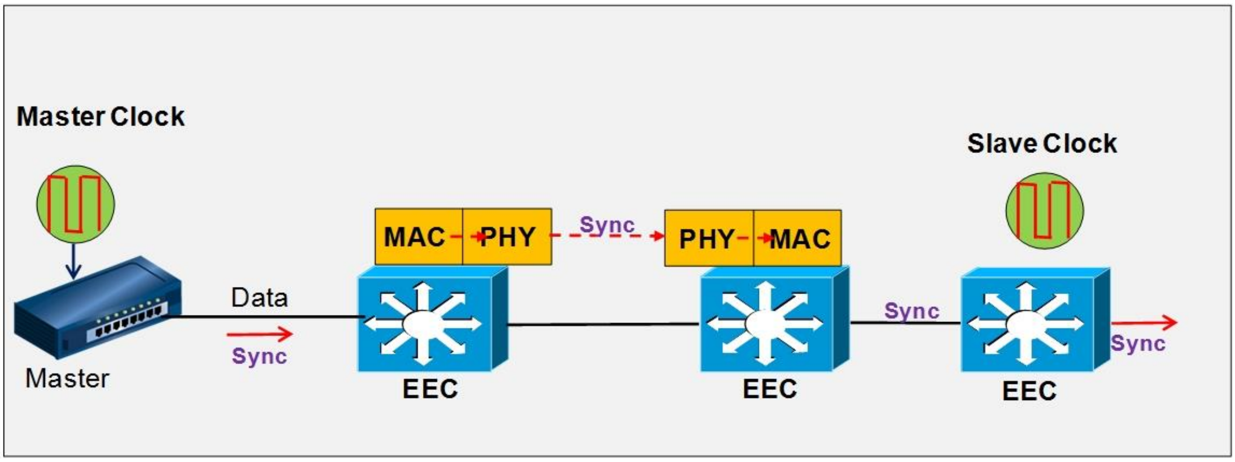
The aim of Synchronous Ethernet is to provide a synchronous signal to network resources that may need such frequency synchronization signal.
SyncE was standardized by the ITU-T and supports the following recommendations:
ITU-T G8261 standard that defines aspects regarding the architecture and performance 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 is able to 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.

Note:Refer to section *"Fibrolan Falcon Products Matrix"2016"* *to find out which Fibrolan units support this subject*

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 M-Class series es includes the following display:

4.16.1 SyncE Ethernet Port Configuration

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

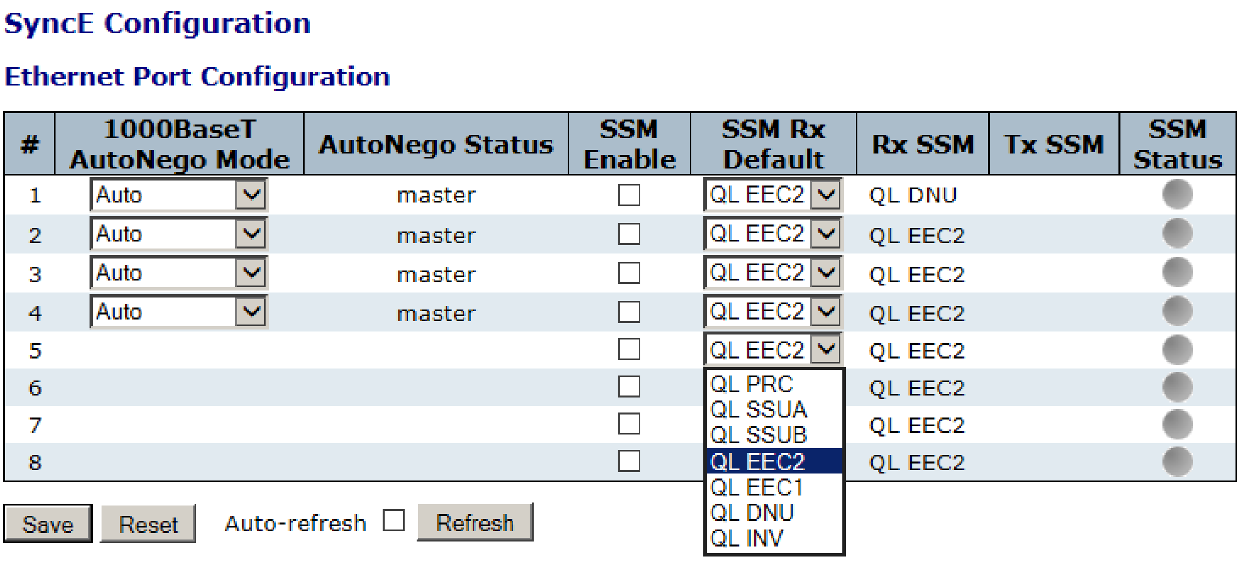
SyncE Configuration

Ethernet Port Configuration

#	1000BaseT AutoNego Mode	AutoNego Status	SSM Enable	SSM Rx Default	Rx SSM	Tx SSM	SSM Status
1	Auto	master	☐	QL EEC2	QL DNU		
2	Auto	master	☐	QL EEC2	QL EEC2		
3	Auto	master	☐	QL EEC2	QL EEC2		
4	Auto Prefer Slave Prefer Master Force Slave	master	☐	QL EEC2	QL EEC2		
5			☐	QL EEC2	QL EEC2		
6			☐	QL EEC2	QL EEC2		
7			☐	QL EEC2	QL EEC2		
8			☐	QL EEC2	QL EEC2		

Save Reset Auto-refresh ☐ Refresh

Figure 4-128: SyncE Ethernet Port Configuration-first display


SyncE Configuration

Ethernet Port Configuration

#	1000BaseT AutoNego Mode	AutoNego Status	SSM Enable	SSM Rx Default	Rx SSM	Tx SSM	SSM Status
1	Auto	master	☐	QL EEC2	QL DNU		
2	Auto	master	☐	QL EEC2	QL EEC2		
3	Auto	master	☐	QL EEC2	QL EEC2		
4	Auto	master	☐	QL EEC2	QL EEC2		
5			☐	QL EEC2	QL EEC2		
6			☐		QL EEC2		
7			☐		QL EEC2		
8			☐		QL EEC2		

Figure 4-129: SyncE Ethernet Port Configuration- second display

Table 4-123: PTP Clock Configuration Parameters

Ethernet Port Configuration	
#	Indicates Ethernet port list
1000BaseT AutoNego Mode	The Auto-negotiation operating mode (master or slave, in the SyncE context) of the port. Applicable to fixed Copper ports only, operating in 1000BaseT mode. Available modes are: **Auto:** the operating mode is automatically agreed by link partners **Prefer Slave:** the port will attempt to operate in slave mode (when the link partner can be a master) **Prefer Master:** the port will attempt to operate in master mode (when the link partner agrees to be a slave) **Force Slave:** the port will operate in slave mode only (i.e. the link partner must be master for proper operation)
AutoNego status	Indicates the Auto-negotiation operating mode (master or slave).
SSM Enabled	Enable and disable of **SSM** signaling (ESMC) on this port. **SSM** is an abbreviation for **Synchronization Status Message** and contains a QL (Quality level) indication

SSM RX Default	This quality (QL) value will be used as the received SSM quality, when no SSM messages are received on the port.Quality Level options are: **QL-PRC** (For Primary Reference Clock accuracy) **QL-SSU-A** (For Synchronization Supply Unit-A accuracy) **QL-SSU-B** (For Synchronization Supply Unit-B accuracy) **QL-SEC** (For SDH Equipment Clock accuracy) **QL-EEC1** (For Ethernet Equipment Clock 1 accuracy) **QL-DNU** (For Do Not Use). **QL – INV** (Invalid followed by a number+`e.g INV1)
RX SSM	The received SSM QL on this port.
Tx SSM	The transmitted (via SSM) clock quality (QL) on the port (when SSM is enabled).
SSM Status	Indicates valid SSM messages are received on the port.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh:** Click to refresh the page immediately **Auto-refresh** ☐ **:** heck this box to enable an automatic refresh of the page at regular intervals.

4.17 Spanning Tree

Spanning Tree Protocol was developed in order 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 uFalcon and Falcon S 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.

4.17.1 Understanding RSTP and MSTP

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 of 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

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.
µFalcon 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.
In all µFalcon models, the IST instance is not supported. The CISTI performs the functions of the IST instance

- 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.

Common and Internal Spanning Tree (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.

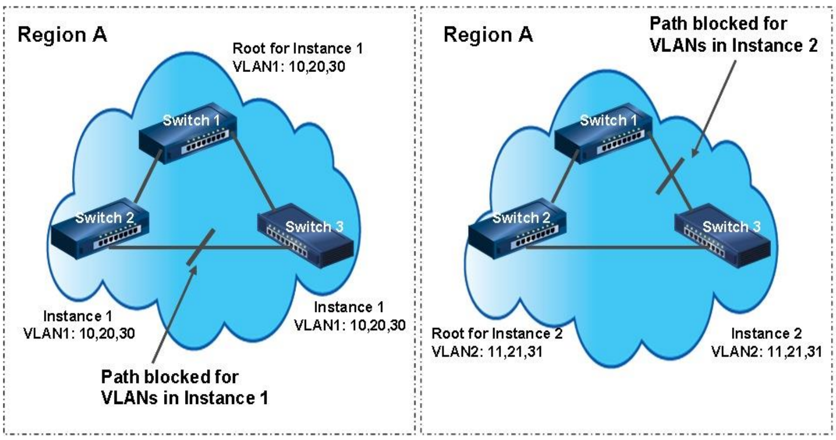
The CIST is created as a result of the STP algorithm running between switches that support the 802.1w, and the 802.ID protocols. MSTP allows for rapid port state transition just like RSTP. MSTP is compatible to STP and RSTP

Example of a Multiple Spanning Tree Application

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

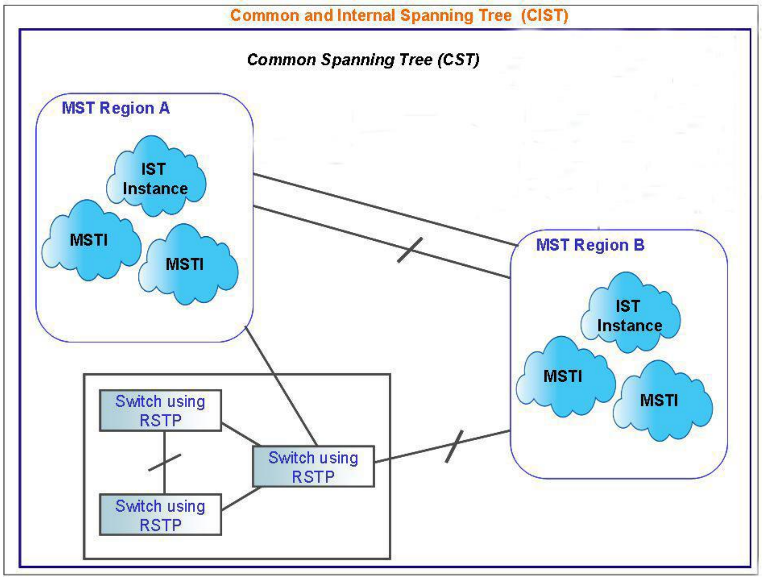
VLAN1 (10, 20, 30) mapped to Instance 1; VLAN2 (11, 21, 31) mapped to Instance 2
The logical topologies shown in the below drawing are the result from the these VLAN/Instance grouping resulting on different blocked links for different VLANs as shown.

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



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

4.17.2 Bridge settings

Spanning Tree protocol version (STP, RSTP or MSTP) is selected according to the networking environment.

M-Class series devices allows STP, RSTP, MSTP system settings configuration as detailed below.

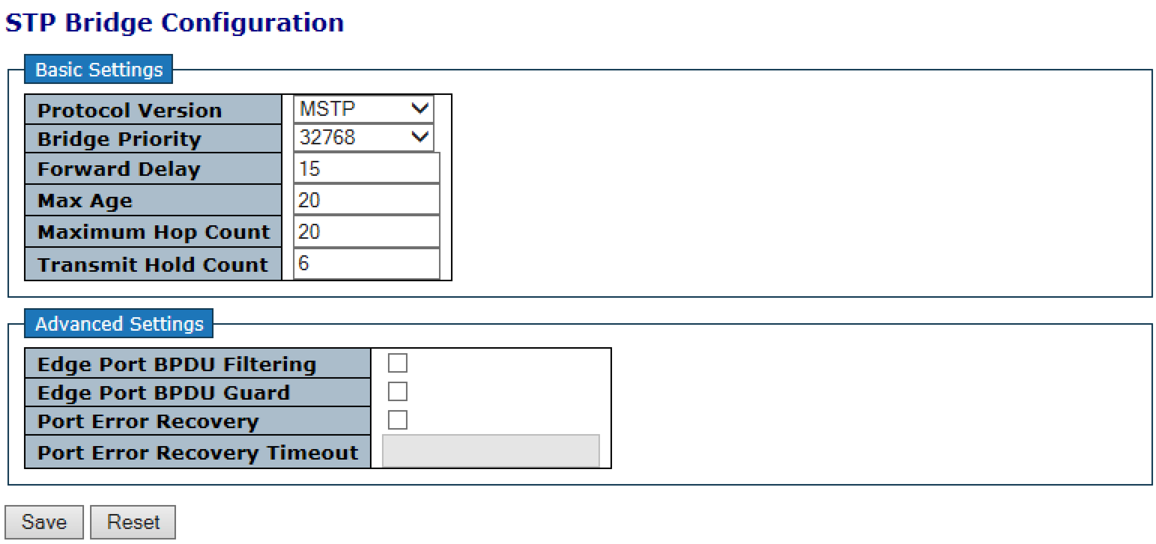


Figure 4-130: STP Bridge Configuration

Table 4-124: 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.
Forward Delay	The delay used by STP Bridges to transition Root and Designated Ports to toForwarding (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 an 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 have to 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 has to pass before a port in the error-disabled state can be enabled. Valid values are between 30 and 86400 seconds (24 hours).
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.17.3 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.

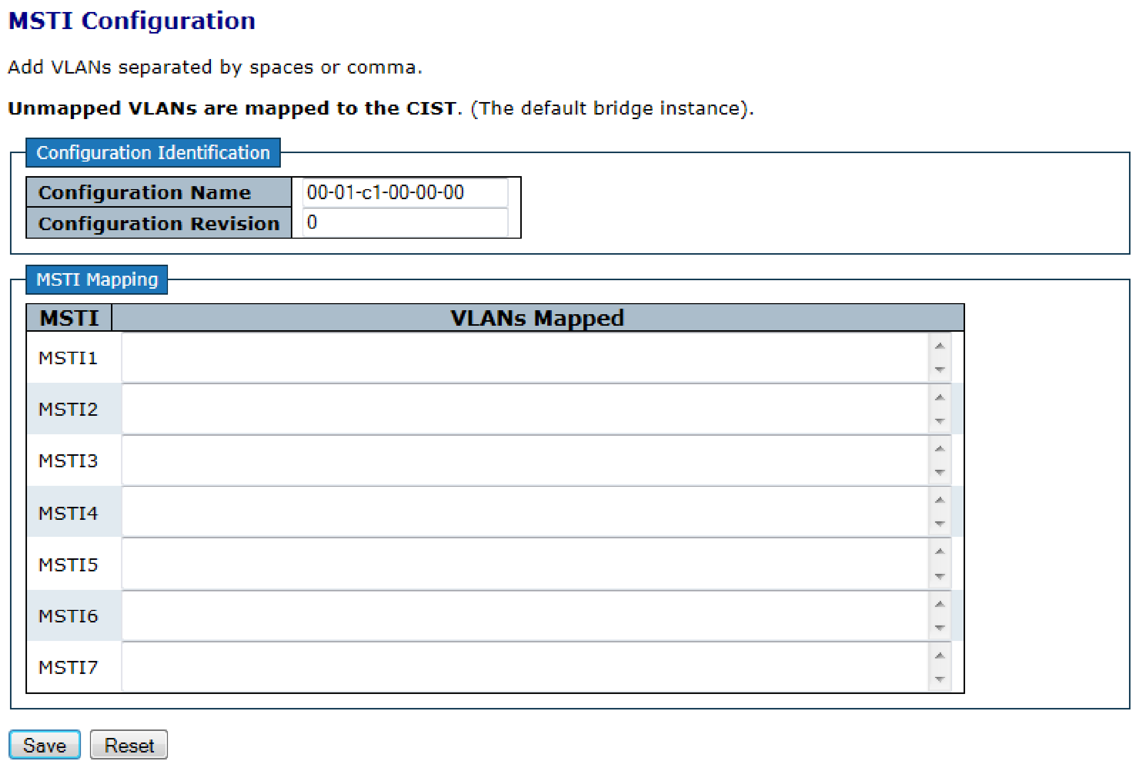


Figure 4-131: MSTI Configuration

Table 4-125: 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**.
Buttons	**Save:**Click to save changes. **Reset:**Click to undo any changes made locally and revert to previously saved values.

4.17.4 MSTI Priority Configuration

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

Figure 4-132: STP MSTI Priority Configuration

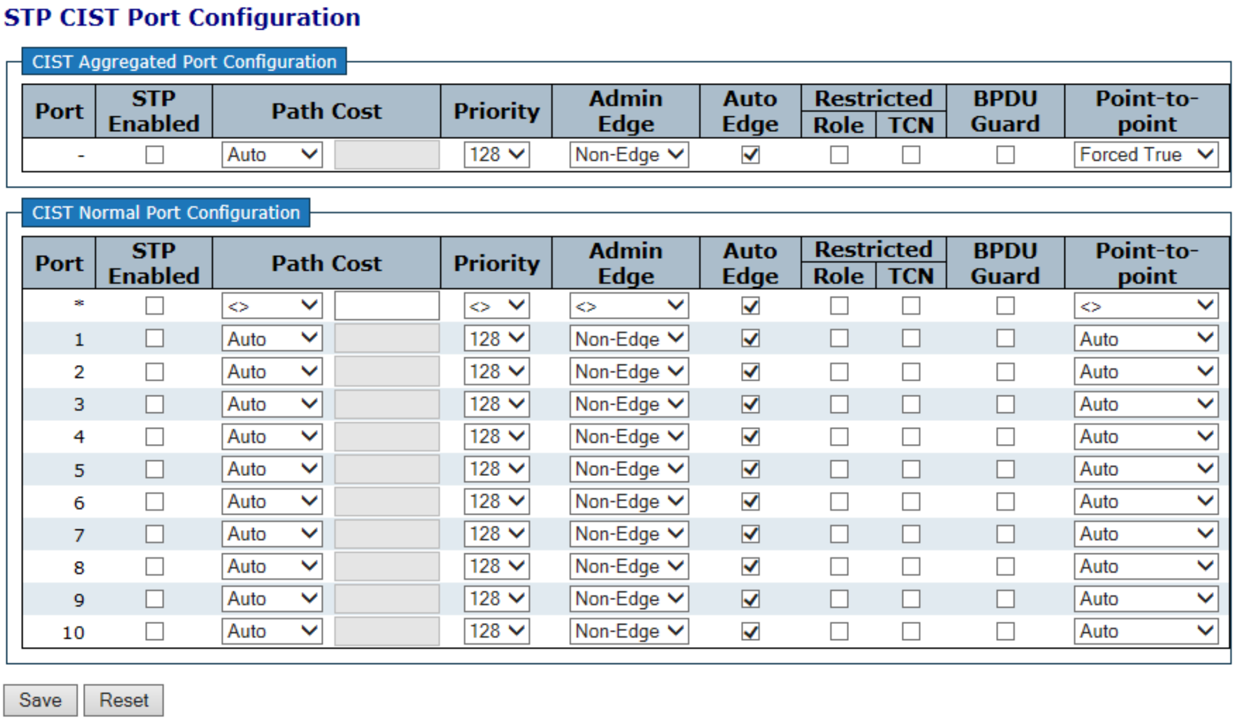
Table 4-126: STP MSTI Priority Configuration Parameters

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.**
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.17.6 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**.



STP CIST Port Configuration

CIST Aggregated Port Configuration

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

CIST Normal Port Configuration

Port	STP Enabled	Path Cost		Priority	Admin Edge	Auto Edge	Restricted Role	Restricted TCN	BPDU Guard	Point-to-point
*	☐	<>		<>	<>	☑	☐	☐	☐	<>
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
7	☐	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
8	☐	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
9	☐	Auto		128	Non-Edge	☑	☐	☐	☐	Auto
10	☐	Auto		128	Non-Edge	☑	☐	☐	☐	Auto

Save Reset

Figure 4-133: CIST Port Configuration displays

Table 4-127: 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.
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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.17.7 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

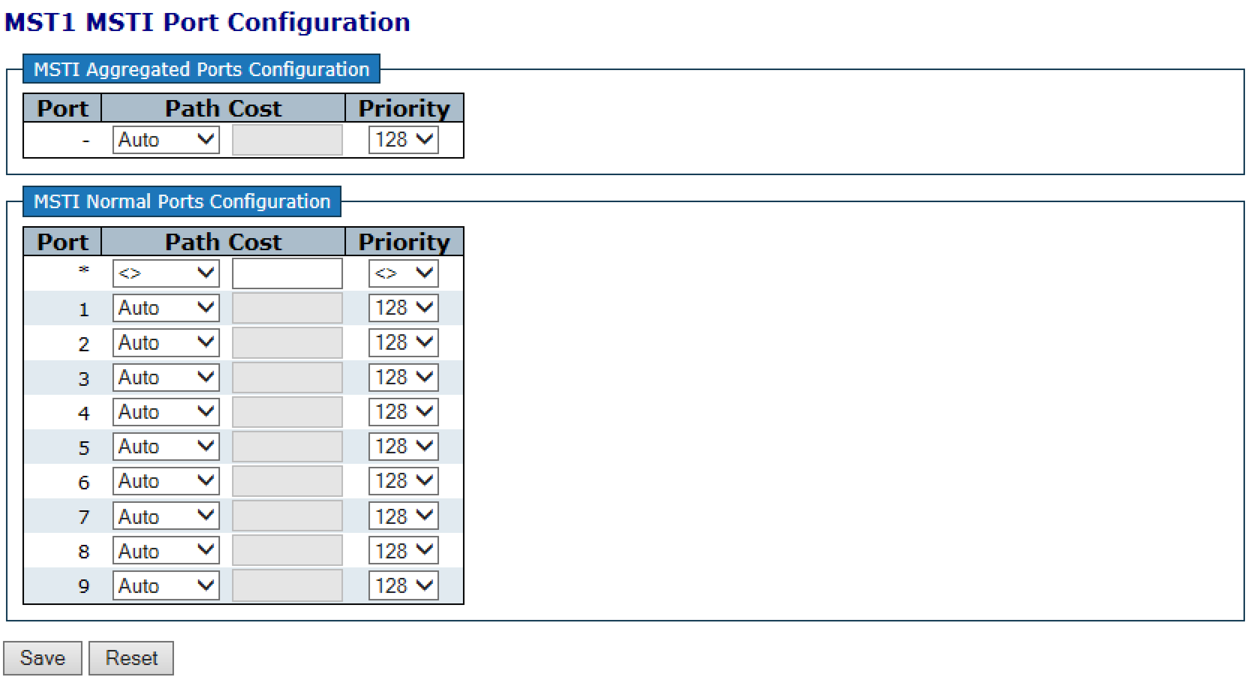


Figure 4-134: MSTI Port Configuration

Table 4-128: 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).
Buttons	**Get**: Click to retrieve settings for a specific MSTI. **Save:** Click to save changes **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.17.8 Spanning Tree Monitoring

This section provides various STP monitoring displays

4.17.8.1 STP Bridges Status

This display provides a status overview of all STP bridge instances

STP Bridges

MSTI	Bridge ID	Root			Topology Flag	Topology Change Last
		ID	Port	Cost		
CIST	80:00-00:05:80:00:11:8A	80:00-00:05:80:00:11:8A	-	0	Steady	-

Auto-refresh ☐ Refresh

Figure 4-135: STP Bridges

Table 4-129: 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.
Buttons	**Refresh**: Click to refresh the page immediately **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds

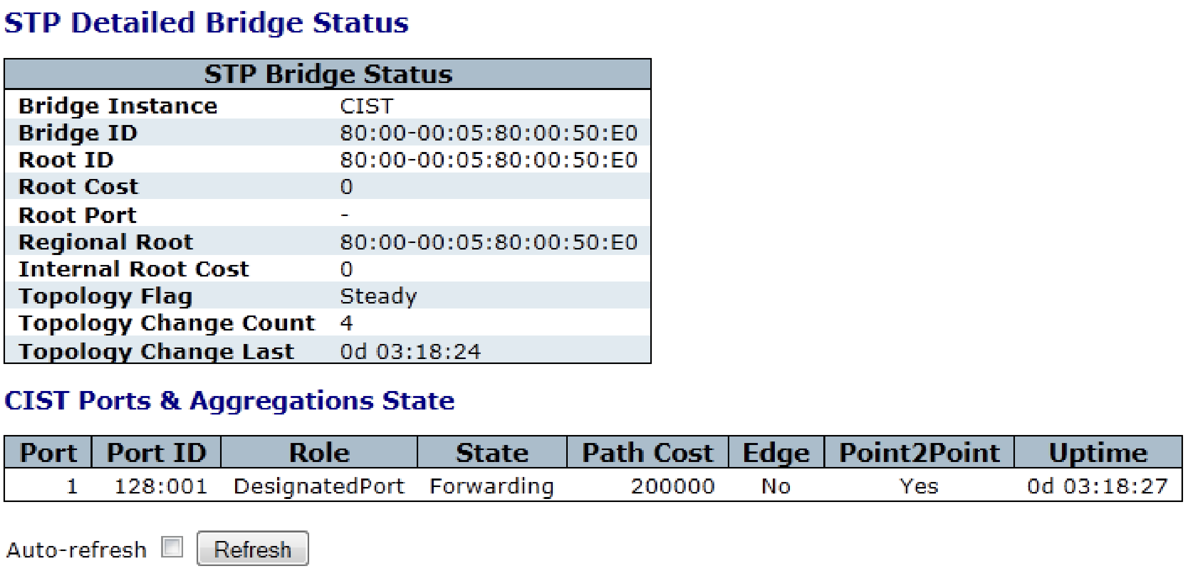
By clicking on CIST on above display, an additional display is shown below

(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

4.17.8.2 STP Detailed Bridge Status

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



STP Detailed Bridge Status

STP Bridge Status	
Bridge Instance	CIST
Bridge ID	80:00-00:05:80:00:50:E0
Root ID	80:00-00:05:80:00:50:E0
Root Cost	0
Root Port	-
Regional Root	80:00-00:05:80:00:50:E0
Internal Root Cost	0
Topology Flag	Steady
Topology Change Count	4
Topology Change Last	0d 03:18:24

CIST Ports & Aggregations State

Port	Port ID	Role	State	Path Cost	Edge	Point2Point	Uptime
1	128:001	DesignatedPort	Forwarding	200000	No	Yes	0d 03:18:27

Figure 4-136: STP Detailed Bridge Status

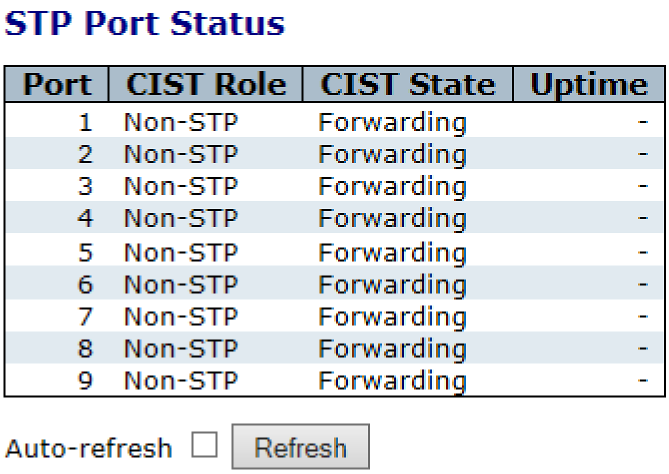
Table 4-130: STP Detailed Bridge Status Parameters

STP Bridge Status	
Bridge Instance	The Bridge instance - **CIST**, **MST1**, ...
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.
Buttons	**Refresh**: Click to refresh the page immediately **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.17.8.3 STP Port Status

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



STP Port Status

Port	CIST Role	CIST State	Uptime
1	Non-STP	Forwarding	-
2	Non-STP	Forwarding	-
3	Non-STP	Forwarding	-
4	Non-STP	Forwarding	-
5	Non-STP	Forwarding	-
6	Non-STP	Forwarding	-
7	Non-STP	Forwarding	-
8	Non-STP	Forwarding	-
9	Non-STP	Forwarding	-

Auto-refresh Refresh

Figure 4-137: STP Port Status

Table 4-131: 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.
Buttons	**Refresh**: Click to refresh the page immediately **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.17.8.4 STP Port Statistics

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

STP Statistics

Port	Transmitted				Received				Discarded	
	MSTP	RSTP	STP	TCN	MSTP	RSTP	STP	TCN	Unknown	Illegal
1	7172	0	0	0	0	12	0	0	0	0

Auto-refresh Refresh Clear

Figure 4-138: STP Statistics

Table 4-132: 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.
Buttons	**Refresh:** Click to refresh the page immediately **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Clear:** Click to reset the counters.

4.18 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 M-Class series and multicast routers in the network. When the M-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 M-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.

4.18.1 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 onnections. 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.

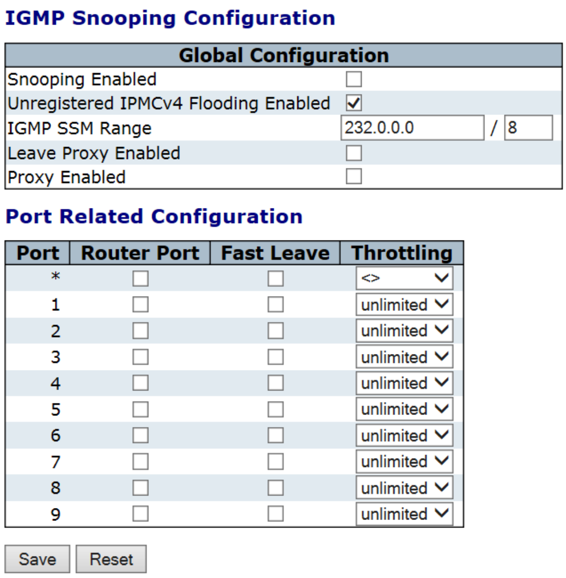


Figure 4-139: IGMP Snooping Configurations

Table 4-133: 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 in spite of 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.18.2 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.

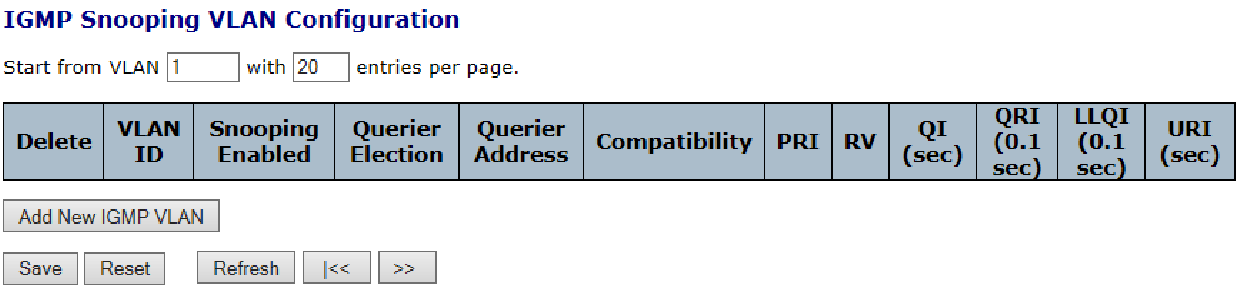


Figure 4-140: IGMP Snooping VLAN Configuration

Table 4-134: IGMP Snooping VLAN Configuration Parameters

Delete	Check to delete the entry. The designated entry will be deleted during the next save.
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 election is used to dedicate the Querier, the only one router sends Query messages, on a particular link. Querier election rule defines that **IGMP Querier** or MLD Querier with the lowest IPv4/IPv6 address wins the election **IGMP Querier**: A router sends IGMP Query messages onto a particular link. This router is called the Querier. There will be only one IGMP Querier that wins Querier election on a particular link. **MLD Querier** :A router sends MLD Query messages onto a particular link. This router is called the Querier. There will be only one MLD Querier that wins Querier election on a particular link.

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	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **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. **Refresh**: Refreshes the displayed table starting from the "VLAN" input fields. **<<:** Updates the table starting from the first entry in the VLAN Table, i.e. the entry with the lowest VLAN ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

Note: by clicking on “Add New IGMP VLAN”, we get the following displsy:

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

Refer to previous table for terminology

4.18.3 IGMP Snooping Port Group Filtering Configuration

IGMP Snooping Port Filtering Profile Configuration

Port	Filtering Profile
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	-
9	-

Save Reset

Figure 4-141: IGMP Snooping Port Group Filtering Configuration

Table 4-135: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.18.4 IGMP Snooping Status

This section provides IGMP Snooping status.

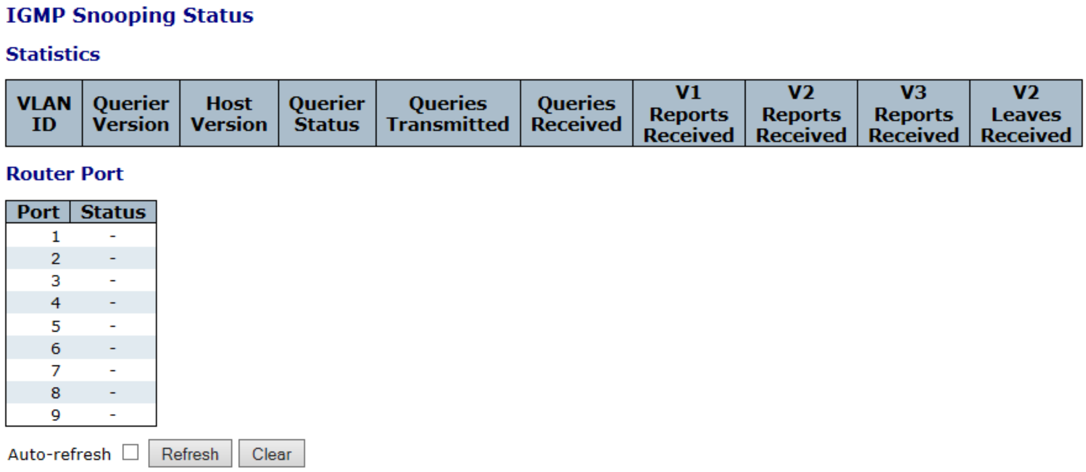


Figure 4-142: IGMP Snooping Status

Table 4-136: IGMP Snooping Status Parameters

Statistics	
VLAN ID	The VLAN ID of the entry.
Querier Version	Currently Working Querier Version.
HostVersion	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 Receive	The number of Received V1 Reports.
V2 Reports Receive	The number of Received V2 Reports.
V3 Reports Receive	The number of Received V3 Reports.
V2 Leave Receive	The number of Received V2 Leave
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.
Buttons	**Refresh:**Click to refresh the screen immediately. **Clear:**Clears the statistic counters. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.18.5 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.

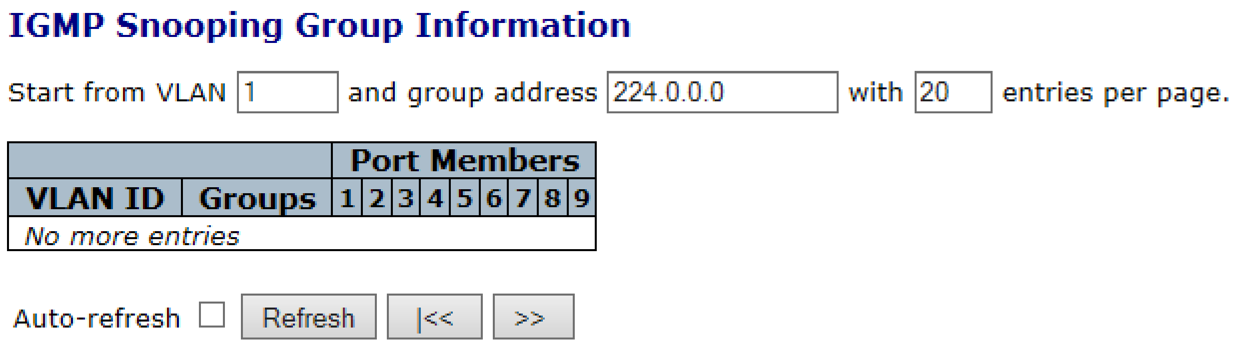


Figure 4-143: IGMP Snooping Groups Information

Table 4-137: IGMP Snooping Groups Parameters

VLAN ID	VLAN ID of the group.
Groups	Group address of the group displayed.
Port Members	Ports under this group.
Buttons	**Refresh:** Refreshes the displayed table starting from the input fields. **Auto-refresh** : Automatic refresh occurs every 3 seconds. **|<<:** Updates the table starting from the first entry in the IGMP Group Table **>>:** Updates the table, starting with the entry after the last entry currently displayed.

4.18.6 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

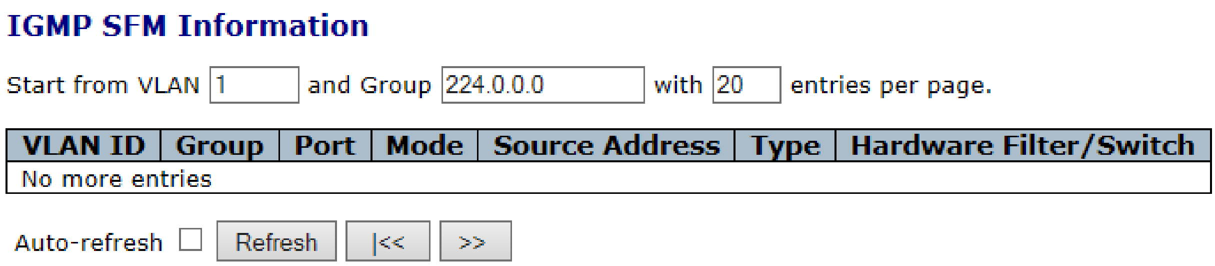


Figure 4-144: IGMP SFM Information

Table 4-138: 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.
Buttons	**Refresh:** Refreshes the displayed table starting from the input fields. **Auto-refresh** : Automatic refresh occurs every 3 seconds. **<<:** Updates the table starting from the first entry in the IGMP Group Table **>>:** Updates the table, starting with the entry after the last entry currently displayed.

4.18.7 MLD Snooping Configuration

This section provides MLD Snooping related configuration.

MLD is an acronym for <u>M</u>ulticast <u>L</u>istener <u>D</u>iscovery 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.

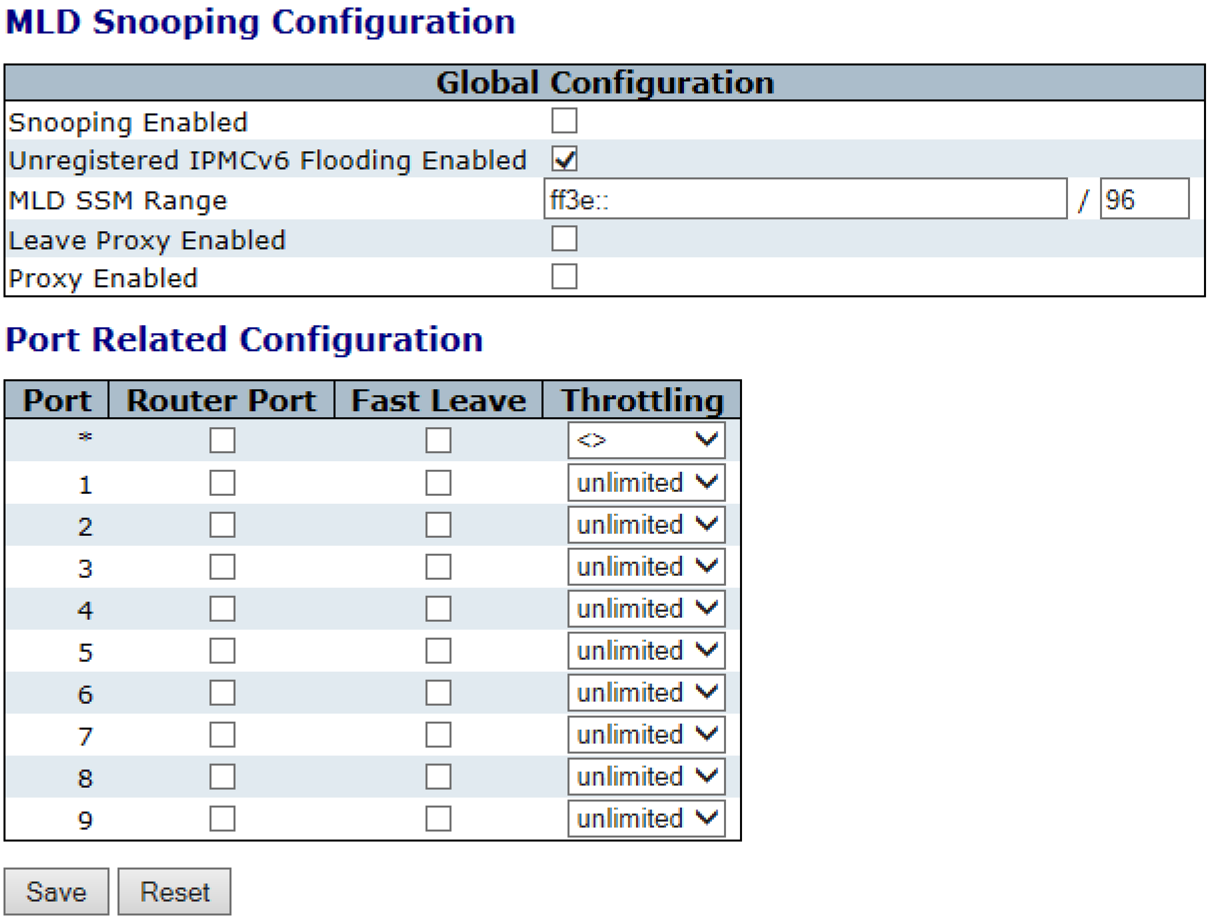


Figure 4-145: MLD Snooping Configurations

Table 4-139: 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 in spite of 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	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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.18.8 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

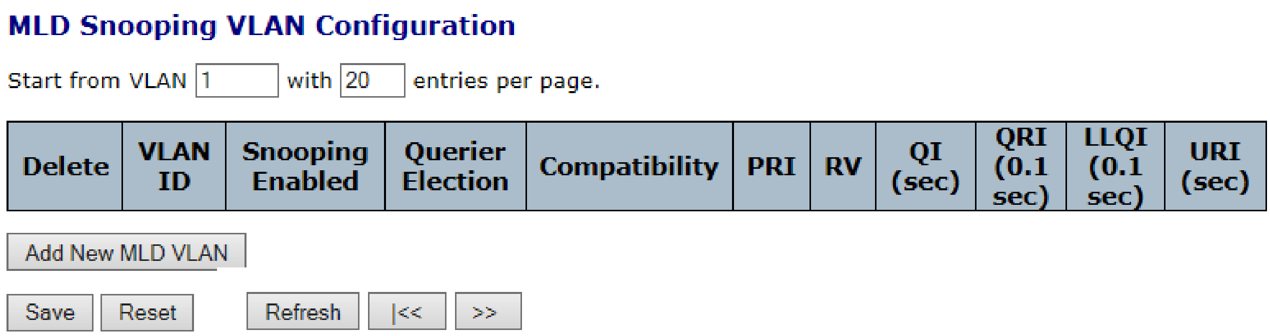


Figure 4-146: MLD Snooping VLAN Configurations

Table 4-140: MLD Snooping VLAN Configurations Parameters

Delete	Check to delete the entry. The designated entry will be deleted during the next save.
VLAN ID	The VLAN ID of the entry. VLAN ID is a 12-bit field specifying the VLAN to which the frame belongs
MLD Snooping Enabled	Enable the per-VLAN MLD Snooping. Up to 32 VLANs can be selected for IGMP 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
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh**: Refreshes the displayed table starting from the "VLAN" input fields. **<<:** Updates the table starting from the first entry in the VLAN Table, i.e. the entry with the lowest VLAN ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed. **Add New MLD VLAN:** Click to add new MLD VLAN. Specify the VID and configure the new entry. Click "Save". The specific MLD VLAN starts working after the corresponding static VLAN is also created.

***Note:** By clicking on the **“Add New MLD VLAN”,** we get the following display:*

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

Refer to previous table for terminology

4.18.9 MLD Snooping Port Group Filtering Configuration

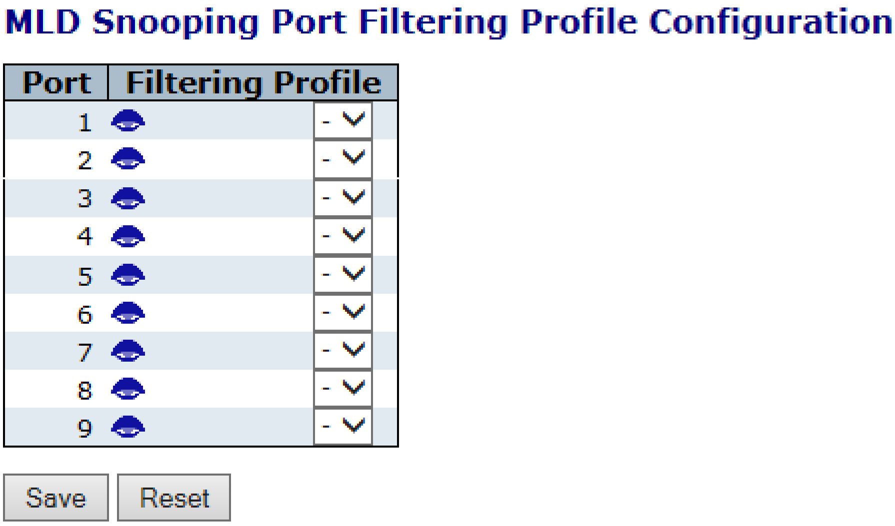


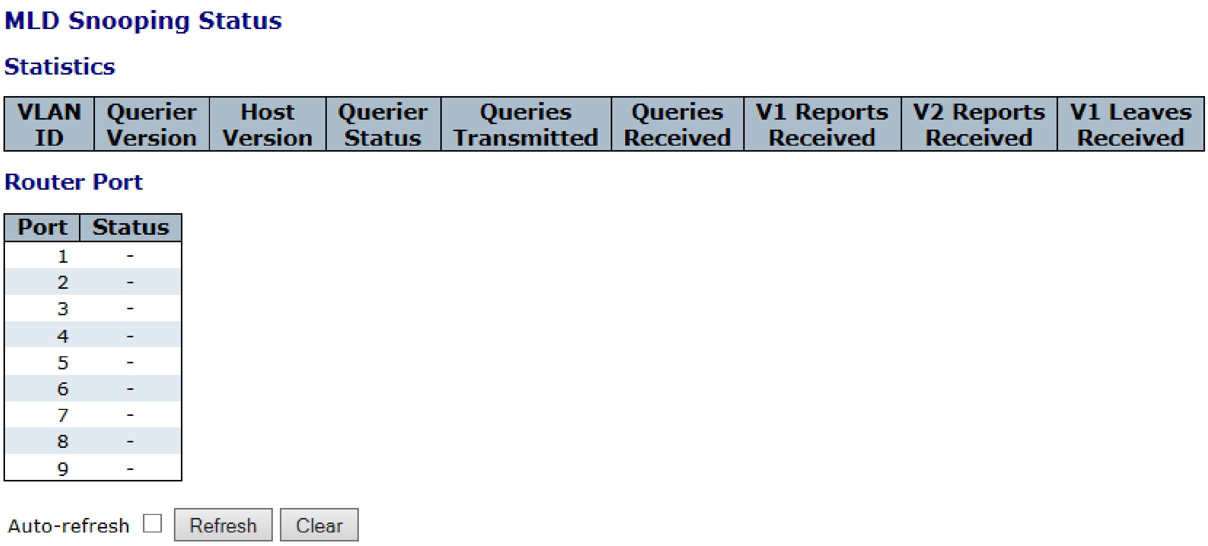
Figure 4-147: MLD Snooping Port Group Filtering Configuration

Table 4-141: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.18.10 MLD Snooping Status

this section provides MLD Snooping status



MLD Snooping Status

Statistics

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	-

Figure 4-148: MLD Snooping Port Group Filtering Configuration

Table 4-142 MLD Snooping Status Parameters

Statistics	
VLAN ID	The VLAN ID of the entry.
Querier Version	Currently Working Querier Version.
HostVersion	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.
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. **MLD Queries:** A router sends MLD Query messages onto a particular link. This router is called the Querier. There will be only one MLD Querier that wins Querier election on a particular link. **Querier Election:** Querier election is used to dedicate the Querier, the only one router sends Query messages, on a particular link. Querier election rule defines that IGMP Querier or MLD Querier with the lowest IPv4/IPv6 address wins the election.	
Port	Switch port number.
Status	Indicate whether specific port is a router port or not.
Buttons	**Refresh:** Click to refresh the section immediately. **Clear:** Clears the statistic counters. **Auto-refresh** : Automatic refresh occurs every 3 seconds.

4.18.11 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.

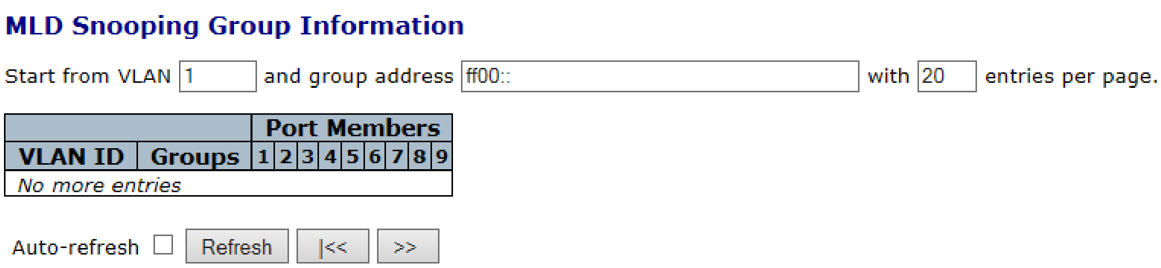


Figure 4-149: MLD Snooping Groups Information

Table 4-143: 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.
Buttons	**Refresh:** Refreshes the displayed table starting from the input fields. **Auto-refresh** : Automatic refresh occurs every 3 seconds .**<<:** Updates the table starting from the first entry in the MLD Group Table **>>:** Updates the table, starting with the entry after the last entry currently displayed.

4.18.12 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.

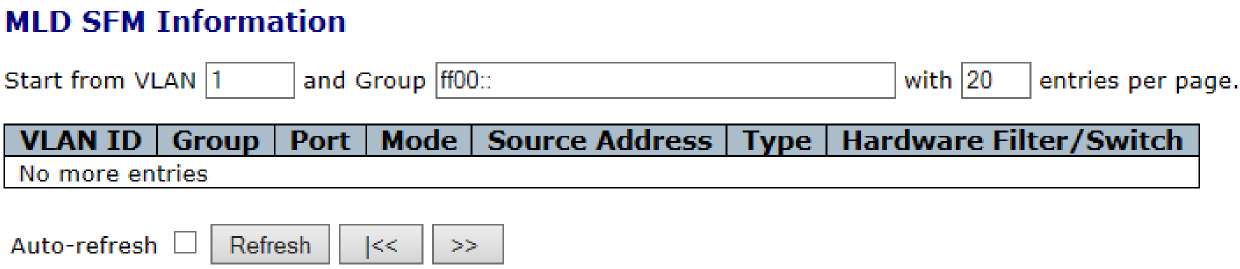


Figure 4-150: MLD SFM Information

Table 4-144: 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.
Buttons	**Refresh:** Refreshes the displayed table starting from the input fields. **Auto-refresh** : Automatic refresh occurs every 3 seconds **|<<:** Updates the table starting from the first entry in the MLD SFM Information Table **>>:** Updates the table, starting with the entry after the last entry currently displayed.

4.19 Link Aggregation

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.

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.

4.19.1 Static Link Aggregation

M-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.

The aggregation hash code contributors settings are global (hashes are calculated when the first connection is established and then kept in the device memory for the session lifetime).

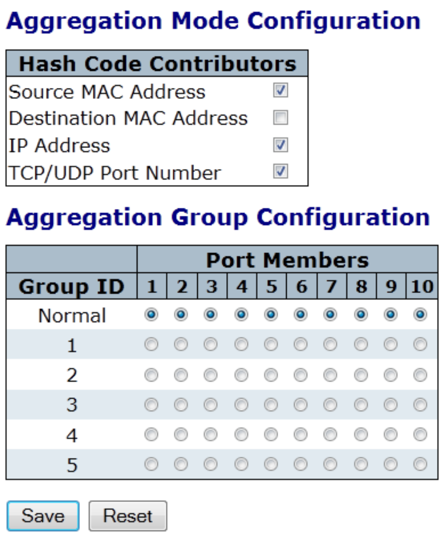
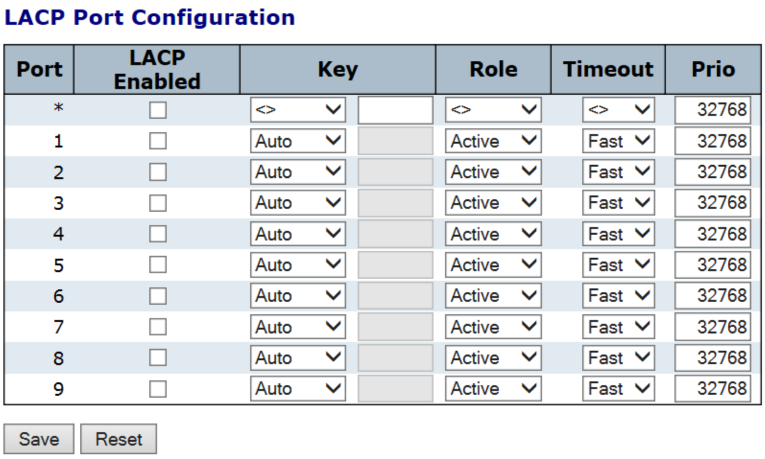


Figure 4-151: Aggregation Mode and Aggregation Group

Table 4-145: Mode and Group 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".
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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.19.2 Link Aggregation Control Protocol (LACP) Port Configuration)



LACP Port Configuration

Port	LACP Enabled	Key		Role	Timeout	Prio
*	☐	<>		<>	<>	32768
1	☐	Auto		Active	Fast	32768
2	☐	Auto		Active	Fast	32768
3	☐	Auto		Active	Fast	32768
4	☐	Auto		Active	Fast	32768
5	☐	Auto		Active	Fast	32768
6	☐	Auto		Active	Fast	32768
7	☐	Auto		Active	Fast	32768
8	☐	Auto		Active	Fast	32768
9	☐	Auto		Active	Fast	32768

Save Reset

Figure 4-152: LACP Port Configuration

Port	The switch port number.
LACP Enabled	Controls LACP is enabled on this switch port. LACP will form an aggregation when two (2) or more ports are connected to the same partner.
Key	This value, incurred by the port, ranges from 1 to 65535. Enter "Auto" or "Specific Key" value settings in the drop-down list. **"**Auto**":** Sets the key as appropriate by the physical link speed; 10Mb = 1, 100Mb = 2, 1Gb = 3. **"**Specific**":** Enter a user-defined value. Ports with the same Key value can participate in the same aggregation group, while ports with different keys cannot.
Role	The "Role" Shows the LACP activity status. **"**Active**"** transmits LACP packets each second. **"**Passive**"** will wait for a LACP packet from a partner (speak if spoken to).
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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.19.3 LACP Monitoring

1. LACP System Status
2. LACP Port Status
3. LACP Port Statistics

4.19.3.1 LACP System Status

This section provides a status overview for all LACP instances

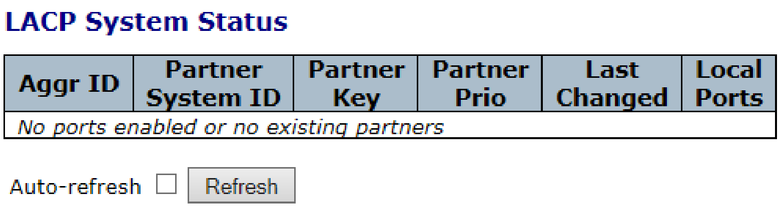


Figure 4-153: LACP System Status

Table 4-146: LACP System Status Parameters

Aggr ID	The Aggregation ID associated with this aggregation instance. For LLAG the id is shown as 'isid:aggr-id' and for GLAGs as 'aggr-id'.
Partner System ID	The system ID (MAC address) of the aggregation partner.
Partner Key	The Key that the partner has assigned to this aggregation ID.
Partner Prio	Indicates the priority of the partner
Last changed	The time since this aggregation changed.
Local Ports	Shows which ports are a part of this aggregation for this
Buttons	**Auto-refresh** : Automatic refresh occurs every 3 seconds. Check this box to enable an automatic refresh of the screen at regular intervals. **Refresh:** Click to refresh the screen immediately.

4.19.3.2 LACP Port Status

This section provides a status overview for LACP status for all ports.

LACP Status

Port	LACP	Key	Aggr ID	Partner System ID	Partner Port	Partner Prio
1	No	-	-	-	-	-
2	No	-	-	-	-	-
3	No	-	-	-	-	-
4	No	-	-	-	-	-
5	No	-	-	-	-	-
6	No	-	-	-	-	-
7	No	-	-	-	-	-
8	No	-	-	-	-	-
9	No	-	-	-	-	-

Auto-refresh ☐ Refresh

Figure 4-154: LACP Status

Table 4-147: LACP Status Parameters

Port	The switch port number.
LACP	'**Yes**' means that LACP is enabled and the port link is up. '**No**' means that LACP is not enabled or that the port link is down. '**Backup**' means that the port could not join the aggregation group but will join if other port leaves. Meanwhile its LACP status is disabled.
Key	The key assigned to this port. Only ports with the same key can aggregate together.
Aggr ID	The Aggregation ID assigned to this aggregation group.
Partner System ID	The partners System ID (MAC address).
Partner Port	The "partners" port number connected to this port.
Partner Prio	The partner's priority
Buttons	**Auto-refresh** ☐ : Automatic refresh occurs every 3 seconds.**:** Check this box to enable an automatic refresh of the screen at regular intervals. **Refresh:** Click to refresh the screen immediately.

4.19.3.3 LACP Statistics

This sub-section provides an overview for LACP statistics for all ports

LACP Statistics

Port	LACP Received	LACP Transmitted	Discarded	
			Unknown	Illegal
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0

Auto-refresh ☐ Refresh Clear

Figure 4-155: LACP Statistics

Table 4-148: LACP Statistics Parameters

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.
Buttons	**Auto-refresh** ☐ : Automatic refresh occurs every 3 seconds. Check this box to enable an automatic refresh of the screen at regular intervals. **Refresh:** Click to refresh the screen immediately. **Clear:** Clears the counters for all ports.

4.20 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 reach-ability 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.

4.20.1 LLDP Configuration

This section allows the user to inspect and configure the current LLDP port settings.

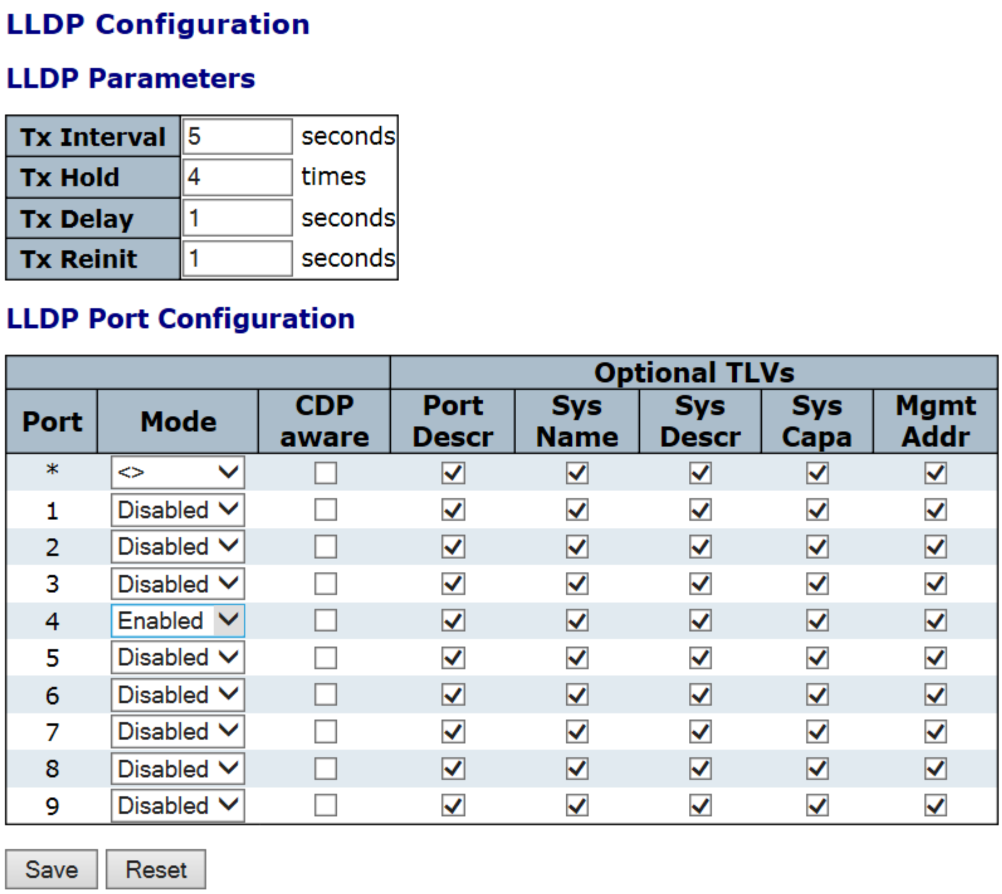


Figure 4-156: LLDP Configuration

Table 4-149: 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 amount of seconds between the shutdown frame and a new LLDP initialization. Valid values are restricted to 1 – 10 seconds.
LLDP Port Configuration	
Port	The switch port number of the logical LLDP port.
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 doesn't 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. Note: 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. **Note: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.20.2 LLDP-MED Configuration

This section allows you to configure the LLDP-MED. This function applies to VoIP devices which support LLDP-MED.

LLDP-MED is an extension of IEEE 802.1ab and is defined by the telecommunication industry association (TIA-1057).

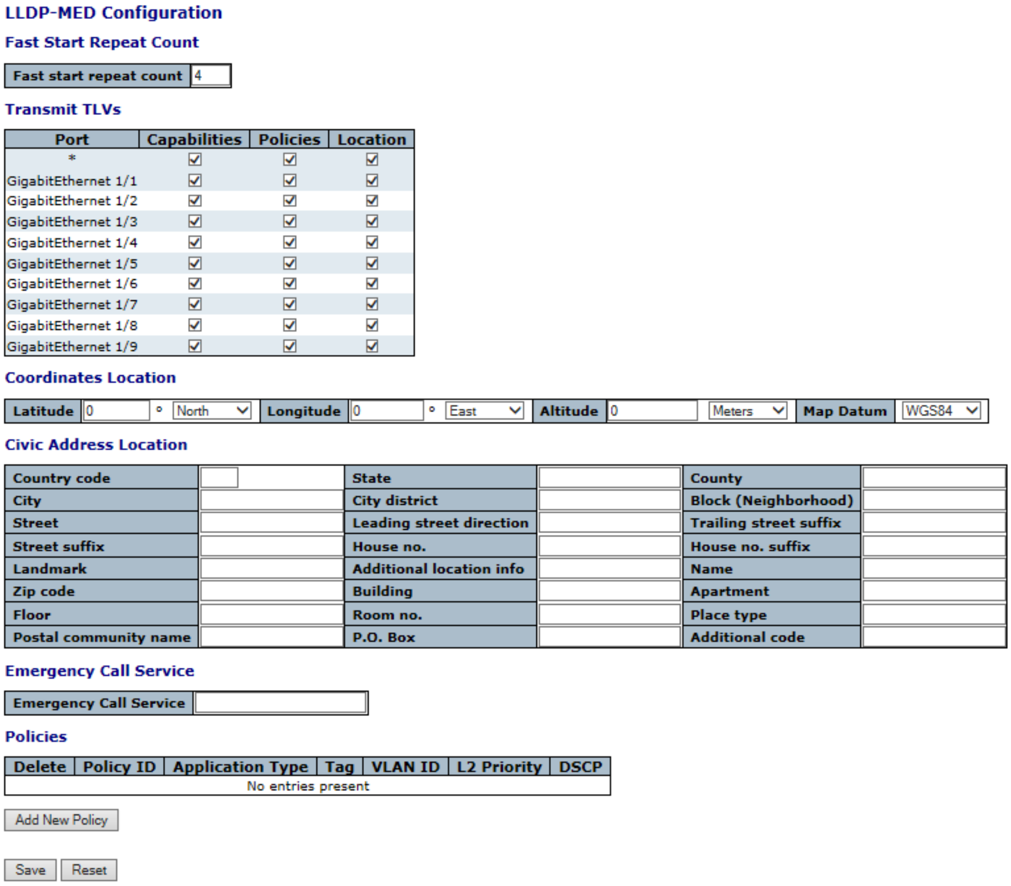


Figure 4-157: LLDP-MED Configuration displays

Table 4-150: LLDP MED Configuration Parameters

Fast start repeat count	
Fast start repe	Rapid startup and Emergency Call Service Location Identification D endpoints is a critically important aspect of VoIP systems in genera it is best to advertise only those pieces of information which are sp particular endpoint types (for example only advertise the voice net permitted voice-capable devices), both in order to conserve the lim and to reduce security and system integrity issues that can come w knowledge of the network policy. With this in mind LLDP-MED defines an LLDP-MED Fast Start intera protocol and the application layers on top of the protocol, in order related properties. Initially, a Network Connectivity Device will only transmit LLDP TLV Only after an LLDP-MED Endpoint Device is detected, will an LLDP- Network Connectivity Device start to advertise LLDP-MED TLVs in o on the associated port. The LLDP-MED application will temporarily speed up the transmissi to start within a second, when a new LLDP-MED neighbour has bee share LLDP-MED information as fast as possible to new neighbors. Because there is a risk of an LLDP frame being lost during transmis neighbors', it is recommended to repeat the fast start transmission increase the possibility of the neighbors' receiving the LLDP frame. With **Fast start repeat count** it is possible to specify the number start transmission would be repeated. The recommended value is 4 LLDP frames with a 1 second interval will be transmitted, when an new information is received. It should be noted that LLDP-MED and the LLDP-MED Fast Start m intended to run on links between LLDP-MED Network Connectivity Endpoint Devices, and as such does not apply to links between LAN elements, including Network Connectivity Devices, or other types o
Transmit TLVs	
It is possible to select which LLDP-MED information that shall be transmitted to the the checkbox is checked the information is included in the frame transmitted to the	
Port	The port name to which the configuration applies.
Capabilities	When checked the switch's capabilities is included in LLDP-MED info
Policies	When checked the configured policies for the interface is included in information transmitted
Location	When checked the configured location information for the switch is i MED information transmitted

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 digits. 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 addtion 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 Distric	City division, borough, city district, ward, chou (Japan).
Block (Neighbourhood)	Neighbourhood, 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 very 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 Diffserv 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: 1. Voice 2. Guest Voice 3. Softphone Voice 4. Video Conferencing 5. Streaming Video

	6. Control / Signalling (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 Signalling** (conditional) - for use in network topologies that require a different policy for the voice signalling 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 Signalling** (conditional) - for use in network topologies that require a different policy for the guest voice signalling 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 Signalling** (conditional) - for use in network topologies that require a separate policy for the video signalling 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 behaviour 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.	
Port	The port 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 chec-kboxes that corresponds to the policies
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

By clicking on "Add new policy" the following display is shown:

Delete	Policy ID	Application Type	Tag	VLAN ID	L2 Priority	DSCP
Delete	0	Voice	Tagged	1	0	0

Add 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

Refer to the previous table for the terms definition

4.20.3 LLDP Monitoring

LLDP Monitoring is implemented by collecting:

- LLDP Neighbour Information
- LLDP-MED Neighbour Information
- EEE
- Port Statistics

4.20.3.1 LLDP Neighbour Information

Falcon devices provide a status overview for all LLDP neighbors.
The displayed table contains a row for each port on which an LLDP neighbor is detected.

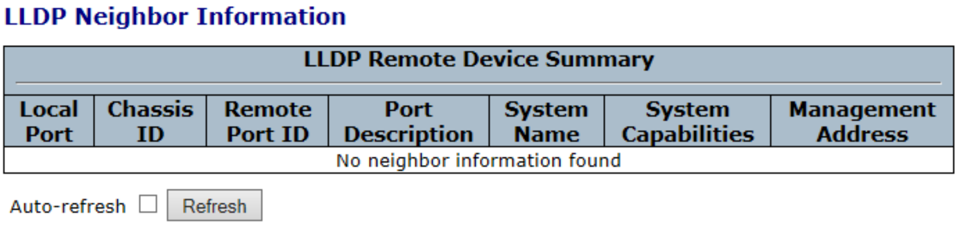


Figure 4-158: LLDP – Neighbor Information

Table 4-151: LLDP Neighbor Information Parameters

Local Port	The port on which the LLDP frame was received.
Chassis ID	The **Chassis ID** is the identification of the neighbour'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 284eighbor unit.
System Name	**System name** is the name advertised by the neighbor unit.
System Capabilities	Describes the 284eighbor unit's capabilities. The possible capabilities are: 1. Other 2. Repeater 3. Bridge 4. WLAN Access Point 5. Router 6. Telephone 7. DOCSIS cable device 8. Station only 9. 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.

Buttons	**Refresh:** Click to refresh the screen immediately. **Auto-refresh** : Automatic refresh occurs every 3 seconds. Check this box to enable an automatic refresh of the screen at regular intervals.

.

4.20.3.2 LLDP-MED Neighbour Information

This section provides a status overview of all LLDP-MED neighbours. The displayed table contains a row for each port on which an LLDP 285eighbor is detected. This function applies to VoIP devices which support LLDP-MED. The columns hold the following information.

Figure 4-159: LLDP MED - Neighbour Information

Table 4-152: LLDP MED Neighbour Parameters

Local Port	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: 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 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 neighbour unit's LLDP-MED capabilities. The possible capabilities are: 1. LLDP-MED capabilities 2. Network Policy 3. Location Identification 4. Extended Power via MDI – PSE 5. Extended Power via MDI - PD 6. Inventory 7. 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. 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 Signalling** - for use in network topologies that require a different policy for the voice signalling than for the voice media 3. **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 4. **Guest Voice Signalling** - for use in network topologies that require a different policy for the guest voice signalling than for the guest voice media. 5. **Softphone Voice** - for use by softphone applications on typical data centric devices, such as PCs or laptops. 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 Signalling** - for use in network topologies that require a separate policy for the video signalling 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.
Buttons	**Refresh:** Click to refresh the screen immediately. **Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds.

4.20.3.3 LLDP Neighbours EEE Information

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

LLDP Neighbors EEE Information

Local Port	Tx Tw	Rx Tw	Fallback Receive Tw	Echo Tx Tw	Echo Rx Tw	Resolved Tx Tw	Resolved Rx Tw	EEE in Sync
No LLDP EEE information found								

Auto-refresh ☐ Refresh

Figure 4-160: LLDP Neighbors EEE Information

Table 4-153: LLDP Neighbors EEE Parameters

LLDP Neighbors EEE Information	
The displayed table contains a row for each interface. If the interface does not supports 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 transmit 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 receive 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 or not 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
Buttons	**Refresh:** Click to refresh this section immediately. **Auto-refresh** ☐ :Automatic refresh occurs every 3 seconds. Check this box to enable an automatic refresh of the screen at regular intervals.

4.20.3.4 LLDP Port Statistics

The M-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.

LLDP Global Counters

Global Counters	
Clear global counters	☑
Neighbor entries were last changed	2016-06-08T09:49:51+00:00 (88695 secs. ago)
Total Neighbors Entries Added	0
Total Neighbors Entries Deleted	0
Total Neighbors Entries Dropped	0
Total Neighbors Entries Aged Out	0

LLDP Statistics Local Counters

Local Port	Tx Frames	Rx Frames	Rx Errors	Frames Discarded	TLVs Discarded	TLVs Unrecognized	Org. Discarded	Age-Outs	Clear
*	*	*	*	*	*	*	*	*	☑
GigabitEthernet 1/1	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/2	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/3	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/4	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/5	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/6	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/7	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/8	0	0	0	0	0	0	0	0	☑
GigabitEthernet 1/9	0	0	0	0	0	0	0	0	☑

Auto-refresh ☐ Refresh Clear

Figure 4-161: LLDP Traffic Statistics

Table 4-154: LLDP Traffic 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 some kind of 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 value.
Org. Discarded	The number of organizationally received TLVs.
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.
Buttons	**Refresh:** Click to refresh the screen immediately. **Clear:** Clears the counters. **Auto-refresh** ☐ :Automatic refresh occurs every 3 seconds. Check this box to enable an automatic refresh of the screen at regular intervals.

4.21 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.

M-Class series can communicate with any neighbour 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:

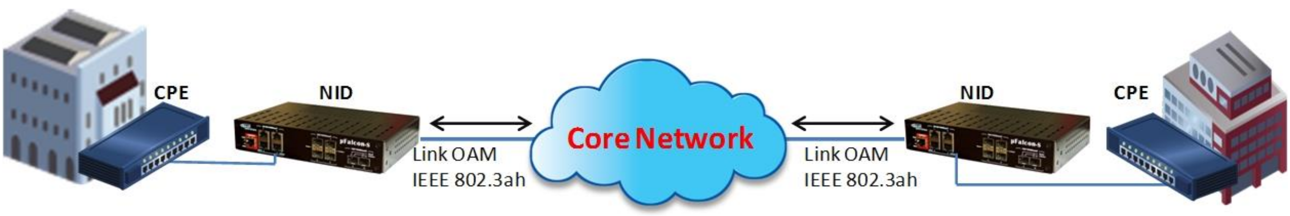


Figure 4-162: Sample Network with OAM functionality

4.21.1 Link OAM Port Configuration

This section allows the user to inspect the current Link OAM port configurations, and change them as well.

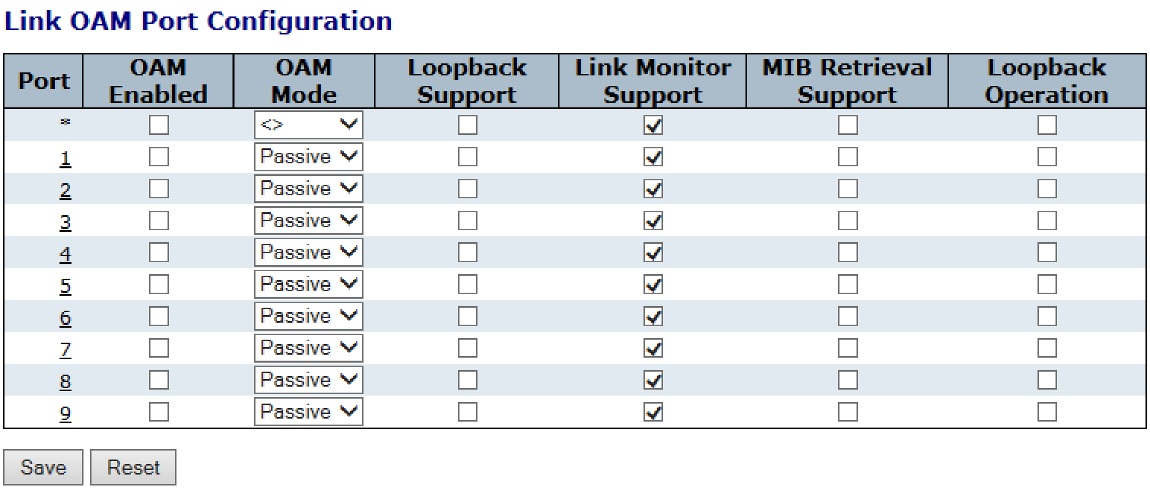


Figure 4-163: Link OAM Port Configuration

Table 4-155: 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.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.21.2 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.

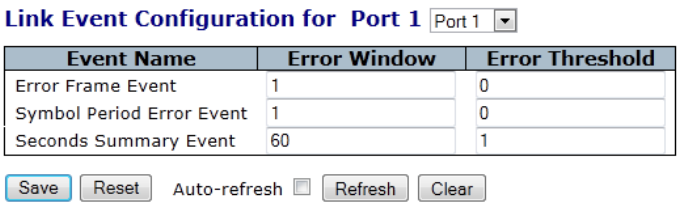


Figure 4-164: Link Event Configuration for selected port

Table 4-156: Link Event Configuration for selected port Parameters

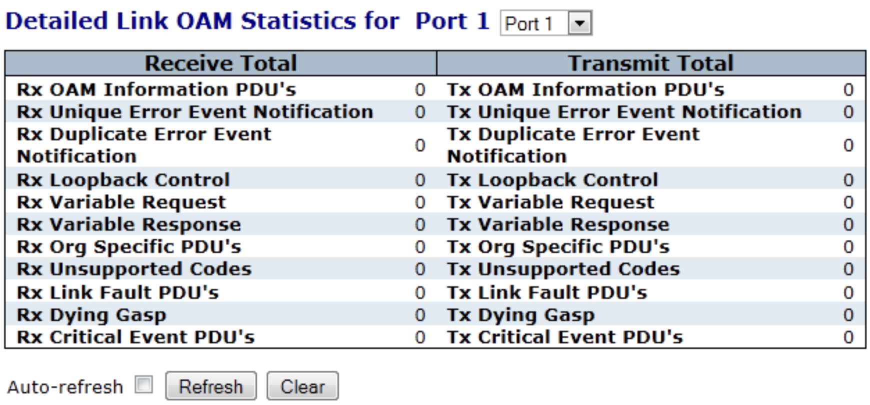
Port	The switch port number.
Event name	Name of the Link Event which is being configured.
Error Window	Represents the window period in the order of 1 sec for the observation of various link events.
Error Threshold	Represents the threshold value for the window period for the appropriate Link event so 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'.
Buttons	The port select box determines which port is affected by clicking the buttons. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.21.3 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.


Detailed Link OAM Statistics for Port 1 Port 1

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

Auto-refresh Refresh Clear

Figure 4-165: Detailed Link OAM Statistics for selected port

Table 4-157: Detailed Link OAM Statistics for selected port Parameters

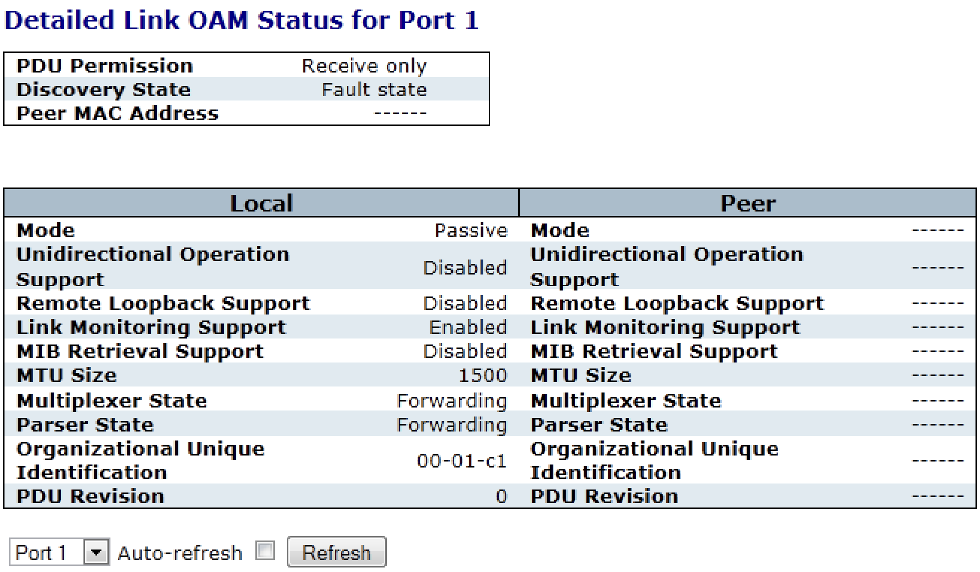
Receive Total and Transmit Total	
Rx and Tx OAM Information PDU's	The number of received and transmitted OAM Information PDU's. Discontinuities of this counter can occur at re-initialization of the management system.
Rx and Tx Unique Error Event Notification	A count of the number of unique Event OAMPDUs 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	Rx and Tx Link fault PDU's
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.
Buttons	The port select box determines which port is affected by clicking the buttons. **Auto-refresh** : Check this box to enable an automatic refresh. Automatic refresh occurs every 3 second **Refresh**: Click to refresh the page immediately. **Clear**: Click to undo any changes made locally and revert to previously saved values.

4.21.4 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.



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	00-01-c1	**Organizational Unique Identification**	------
PDU Revision	0	**PDU Revision**	------

Figure 4-166: Detailed Link OAM Status for selected port

Table 4-158: 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. Incase 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.
Buttons	The port select box determines which port is affected by clicking the buttons. **Auto-refresh** ☐ : Check this box to enable an automatic refresh. Automatic refresh occurs every 3 second **Refresh**: Click to refresh the page immediately.

4.21.5 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.

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
Symbol frame period errors	0	Symbol frame period errors	0
Symbol frame period error events	0	Symbol frame period error events	0
Local Event Seconds Summary Status		**Remote Event Seconds Summary Status**	
Event Seconds Summary Time Stamp	0	Event Seconds Summary Time Stamp	0
Event Seconds Summary Window	0	Event Seconds Summary Window	0
Event Seconds Summary Threshold	0	Event Seconds Summary Threshold	0
Event Seconds Summary Events	0	Event Seconds Summary Events	0
Event Seconds Summary Error Total	0	Event Seconds Summary Error Total	0
Event Seconds Summary Event Total	0	Event Seconds Summary Event Total	0

Port 1 Auto-refresh Refresh Clear

Figure 4-167: Detailed Link OAM Link Status Events for selected port

Table 4-159: 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.
Symbol frame period errors	This eight-octet field indicates the sum of symbol errors since the OAM sublayer was reset.
Symbol frame 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.

Event Seconds Summary Time Stamp	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
Event Seconds Summary Window	This two-octet field indicates the duration of the period in terms of 100 ms intervals, encoded as a 16-bit unsigned integer
Event Seconds Summary 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.
Event Seconds Summary Events	This two-octet field indicates the number of errored frame seconds in the period, encoded as a 16-bit unsigned integer
Event Seconds Summary Error Total	This four-octet field indicates the sum of errored frame seconds that have been detected since the OAM sublayer was reset.
Event Seconds Summary Event Total	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.
Buttons	The port select box determines which port is affected by clicking the buttons. **Auto-refresh** : Check this box to enable an automatic refresh. Automatic refresh occurs every 3 second **Refresh**: Click to refresh the page immediately. **Clear:** Click to clear the data

4.22 Service OAM Standards

Service OAM" is a common term for the ITU-T Y.1731, IEEE802.1ag, all covering Operation, Administration and Maintenance These standards cover monitoring and error detection functionalities, which are key weaknesses in the standard Ethernet.
Service Level Agreement (SLA) Management is a necessary tool for carriers, required to ensure that customers are getting the service they have purchased. It is valuable to manage services from the perspective of the end-user in addition to providing element and network management capabilities. The correlation and tracking of QoS per service allow the network operator to offer end-users active reports on the health, status and SLA adherence of their service over time. Planned network maintenance, active outage detection and identification of users or services affected by network events are facilitated across all network layers and allow operators to detect, diagnose and prioritize failure or degradation events with network active monitor, and mitigate problems.
Fault Management implements a service-layer OAM based on the IEEE 802.1ag protocol and the ITU Y.1731 protocol, which complement each other and enable full service OAM.
Service OAM contains a suite of OAM functionalities which can be divided into two main groups: Fault management and Performance Management.

- **OAM functions for Fault Management**
- Ethernet Continuity Check (ETH-CC)
- Ethernet Loopback (ETH-LB)
- Ethernet Link Trace (ETH-LT)
- Ethernet Alarm Indication Signal (ETH-AIS)
- Ethernet Remote Defect Indication (ETH-RDI)
- Ethernet Locked Signal (ETH-LCK)
- Ethernet Test Signal (ETH-Test)
- Ethernet Automatic Protection Switching (ETH-APS)

- **OAM Functions for Performance Monitoring (Y.1731 Only)**
- Frame Loss Measurement (ETH-LM)
- Frame Delay Measurement (ETH-DM)
- Throughput Measurement

The "Service OAM" allows an operator to detect, locate and verify faults for an Ethernet service. The Connectivity Check protocol allows the operator to monitor the services continuously through data-path. Once a failure is detected, the Loopback and Link trace protocols are used on-demand to further diagnose the failure. The Service OAM is useful for multipoint as well as point-to-point Ethernet services.
Scalability of the Service OAM is accomplished via the use of maintenance domains. A maintenance domain is defined by the network operator as a network area with its own management and administration requirements. Maintenance domains can be defined in hierarchical order to distinguish between different types of network users (e.g. Customer Domain, Service-provider Domain, Operator Domain, etc.).

4.22.1 OAM Service Multi-Domain Levels

A Service Instant creates a Maintenance Association (MA, or MEG: Maintenance Entity Group) between various end paths which consist of "Maintenance End Points" (MEPs) located at the edge of each domain and Ethernet hops or ports referred to as Maintenance Intermediate points (MIP).

There are eight levels defined and classified:

Classification	**ME (or MEG) Level**
Customer Domain level	7,6,5
Service Provider domain	4,3
Operator Domain level	2,1,0

These levels provide a hierarchy for the service OAM operation, and helps in the fault isolation and the domain allocation at which a faulty event has occurred.
The highest level 7 always represents the whole connection path from the customers' point of view, whereas the lowest level, level 0, represents mainly the Ethernet section (the physical links).

The figure below illustrates the multi-domain levels concept.

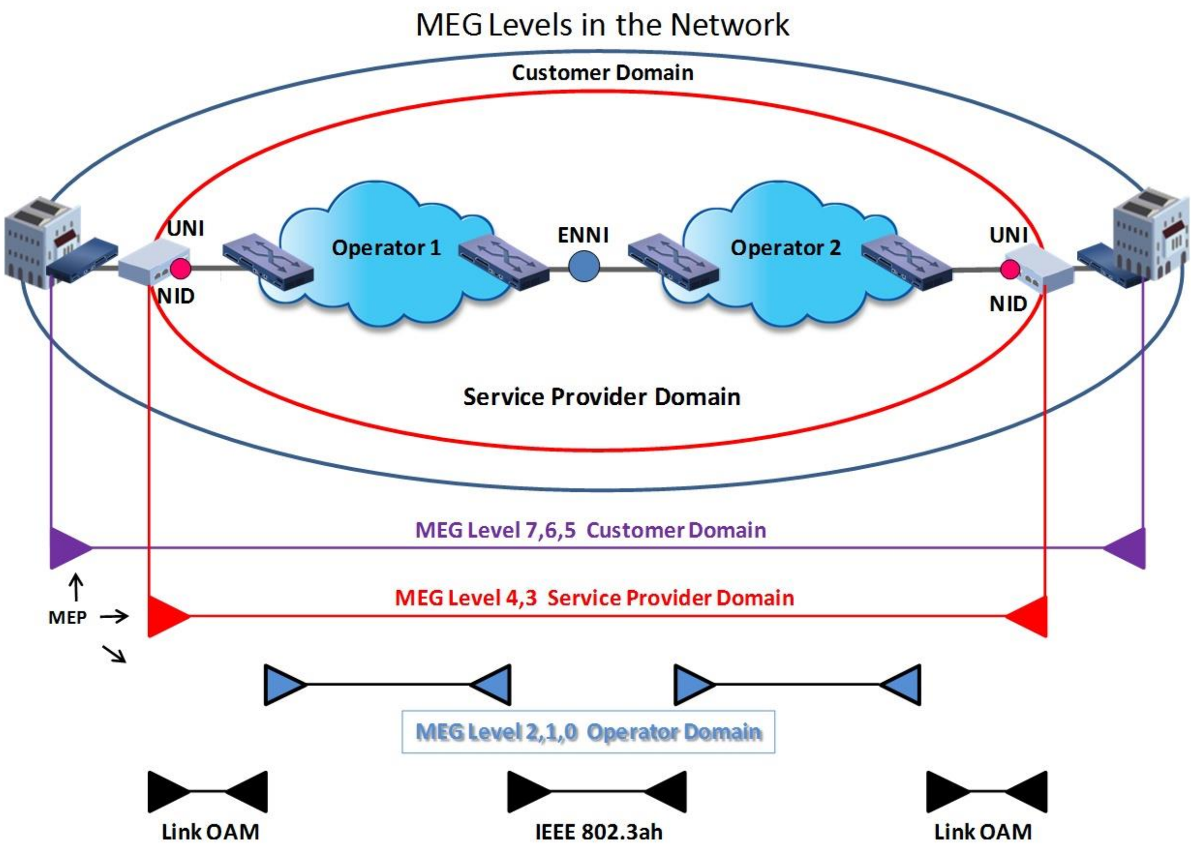


Figure 4-168: MEG Levels in the Network

4.22.2 Ethernet Connectivity Fault Management

Ethernet Fault Management is an end-to-end per-service Ethernet layer OAM protocol that includes proactive connectivity monitoring, fault verification, and fault isolation.

Monitoring and troubleshooting carrier networks offering Ethernet Layer 2 services is challenging. Customers contract with service providers for end-to-end Ethernet service, and service providers may subcontract with operators to provide equipment and networks. Compared to enterprise networks, where Ethernet traditionally has been implemented, these constituent networks belong to distinct organizations or departments, are substantially larger and more complex, and have a wider user base.

Ethernet Fault Management provides a competitive advantage to service providers, for whom the operational management of service uptime and timeliness of isolating and responding to failures is crucial to daily operations.

The following sections explain and illustrate the basic terms of Fault Management functions.

Customer Service Instance

A customer service instance is an Ethernet Virtual Connection (EVC), which is identified by an S-VLAN within an Ethernet provider network, and is recognized by a globally unique service ID (which is the S-VLAN tag). A customer service can be either Point-to-Point (PTP) or Multipoint-to-Multipoint (MPTMP). See the following figures

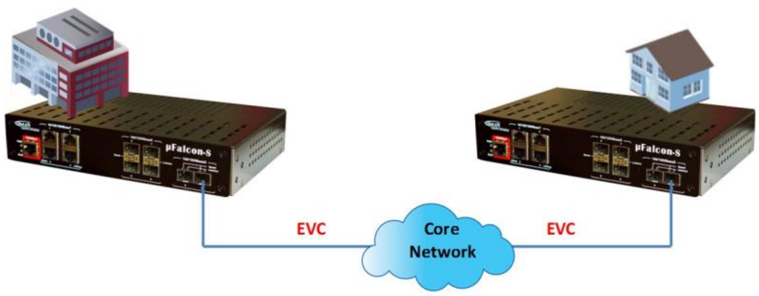


Figure 4-169: Customer PTP Service Instance

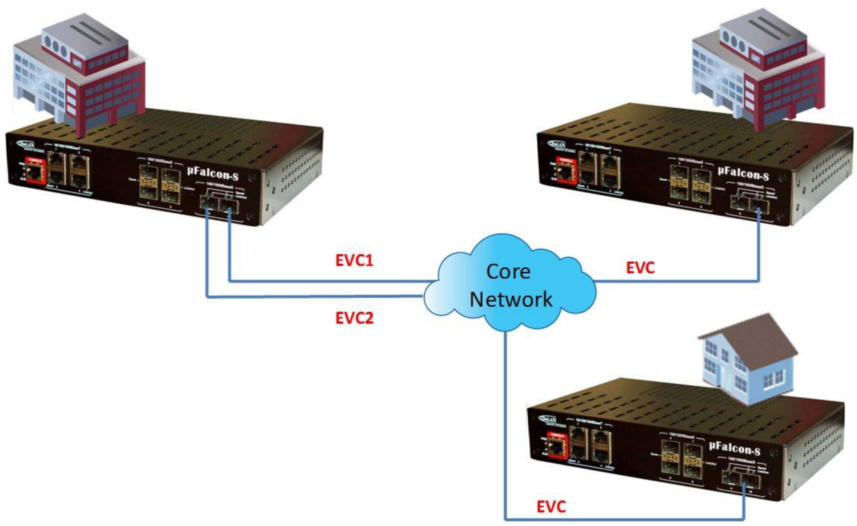


Figure 4-170: Customer MP2MP Service Instance

4.22.2.1 Maintenance Domain

A maintenance domain is a management space for the purpose of managing and administering a network. A domain is owned and operated by a single entity and defined by the set of devices and ports internal to it and at its boundary. The following drawing illustrates a typical maintenance domains topology.

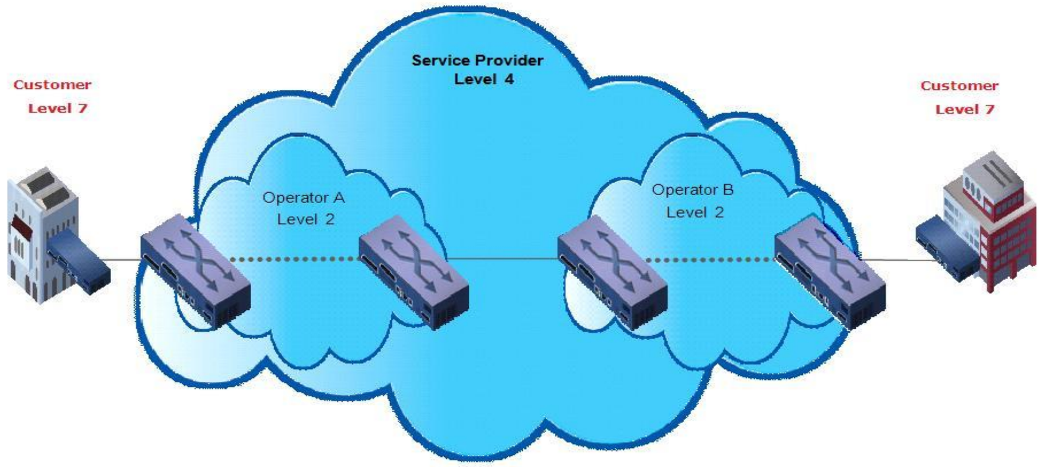


Figure 4-171: Service OAM Maintenance Domains

A unique maintenance level in the range of 0 to 7 is assigned to each domain by a network administrator. Levels and domain names are useful for defining the hierarchical relationship that exists among domains. The hierarchical relationship of these domains parallels the structure of the customer, service provider, and operator. The larger the domain the higher the level value!

For example: Typically, customers are allocated with the largest domains while operators have the smallest domains with the service provider domains between them in size. The customer domain may have a maintenance level of 7 and the operator domain may have a maintenance level of 0. All levels of the hierarchy must operate together.

Domains should not intersect because intersecting would mean management by more than one entity, which is not allowed. Domains may nest or touch but when two domains nest, the outer domain must have a higher maintenance level than the domain nested within it.

Nesting maintenance domains is useful in the business model where a service provider contracts with one or more operators to provide Ethernet service to a customer. Each operator would have its own maintenance domain and the service provider would define its domain—a superset of the operator domains. Furthermore, the customer has its own end-to-end domain which is in turn a superset of the service provider domain. Maintenance levels of various nesting domains should be communicated among the administering organizations. For example, one approach would be to have the service provider assign maintenance levels to operators.

Service OAM exchanges messages and performs operations on a per-domain basis. For example: running Service OAM at the operator level does not allow discovery of the network by the higher provider and customer levels. **Network designers decide on domains and configurations**.

4.22.2.2 Maintenance Point: MPE/MIP

A maintenance point is a demarcation point on a port that participates in Service OAM within a maintenance domain. Maintenance points on device ports act as filters that confine Service OAM frames within the bounds of a domain by dropping frames that do not belong to the correct level (domain). Maintenance points must be explicitly configured on µFalcon devices.

Two classes of maintenance communication points exist:

1. Maintenance Endpoints (MEPs)
2. Maintenance Intermediate Points (MIPs)

Maintenance Endpoints (MEPs)

Maintenance Endpoints (MEPs) have the following characteristics:

- Per maintenance domain (level) and service provider VLAN (S-VLAN).
- At the edge of a domain, define the boundary.
- Within the bounds of a maintenance domain, confine Service OAM messages.
- When configured to do so, proactively transmit Service OAM continuity check messages (CCMs).
- At the request of an administrator, transmit Link trace and loopback messages.

Maintenance Endpoints communicate through the Bridge Relay function (Inward Facing – the switch performs forwarding and sends it to the destination port) or the wire (Outward Facing – sent directly out of the port).

Inward Facing MEPs

Inward facing means the MEP communicates through the Bridge Relay function and uses the Bridge-Brain MAC address. An inward facing MEP performs the following functions:

- Sends and receives CFM frames at its level through the relay function, not via the wire connected to the port on which the MEP is configured.
- Drops all Service OAM frames at its level (or lower level) that come from the wire side.
- Processes all Service OAM frames at its level coming from the direction of the relay function.
- Drops all Service OAM frames at a lower level coming from the direction of the relay function.
- Transparently forwards all Service OAM frames at a higher level, independent of whether they come in from the relay function side or the wire side.
- If the port on which the inward MEP is configured is blocked by Spanning-Tree Protocol, the MEP can no longer transmit or receive Service OAM messages.

Outward Facing MEPs

Outward facing means that the MEP communicates through the wire. Outward facing MEPs use the port MAC address, not the Bridge-Brain MAC address used by inward facing MEPs. An outward facing MEP performs the following functions:

- Sends and receives Service OAM frames at its level via the wire connected to the port where the MEP is configured.
- Drops all Service OAM frames at its level (or at a lower level) that come from the relay function side.
- Processes all Service OAM frames at its level coming from the direction of the wire.
- Drops all Service OAM frames at a lower level coming from the direction of the wire.
- Transparently forwards all Service OAM frames at levels higher than the level of the outward facing MEP, independent of whether they come in from the relay function side or the wire side. Not applicable to routed ports.
- If the port on which the outward MEP is configured is blocked by Spanning-Tree Protocol, the MEP can still transmit and receive Service OAM messages via the wire.

Maintenance Intermediate Points (MIP)

MIPs have the following characteristics:

- Per maintenance domain (level) and for all enabled or allowed S-VLANs on a port.
- Internal to a domain, not at the boundary.
- Service OAM frames received from MEPs and other MIPs are cataloged and forwarded, using both the wire and the relay function.
- All Service OAM frames at a lower level are stopped and dropped, independent of whether they originate from the wire or relay function.
- All Service OAM frames at a higher level are forwarded, independent of whether they arrive from the wire or relay function.
- Passive points, respond only when triggered by Service OAM traceroute and loopback messages.
- Bridge-Brain MAC addresses are used.
- If the port on which a MIP is configured is blocked by the Spanning-Tree Protocol, the MIP cannot receive Service OAM messages or relay them toward the relay function side. The MIP can, however, receive and respond to Service OAM messages from the wire.
- A MIP has only one level associated with it and the command-line interface (CLI) does not allow you to configure a MIP for a domain that does not exist.

A Service – Maintenance Association (MA)

A service is defined in the Service OAM as a Maintenance Association. It is a group of two or more MEPs (and may include MIPS as well). A point-to-point service will have exactly two MEPs. A multipoint service will have more than two MEPs.

The figure below illustrates a customer service built of two MEPs (green triangles), one in each customer location.

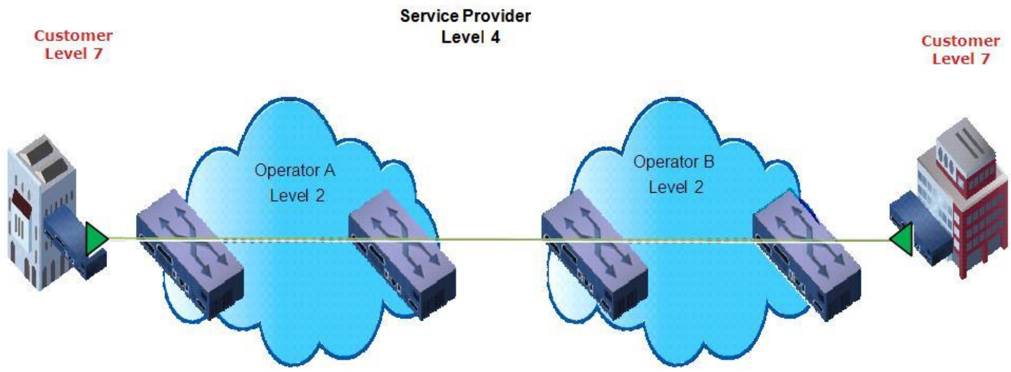


Figure 4-172: Maintenance Association

4.22.2.3 OAM Messages

Service OAM uses standard Ethernet frames Service OAM frames are distinguishable by Ether Type and for multicast messages by MAC address. Service OAM frames are sourced, terminated, processed, and relayed by bridges. Routers can support only limited Service OAM functions. Bridges that cannot interpret Service OAM messages forward them as normal data frames. All Service OAM messages are confined to a maintenance domain and to an S-VLAN (PE-VLAN or Provider-VLAN) and support three types of messages:

- Continuity Check
- Loopback
- Link Trace

Continuity Check Messages (CCM)

CFM Continuity Check Messages (CCMs) are multicast heartbeat messages exchanged periodically among MEPs. They allow MEPs to discover other MEPs within a domain and allow MIPs to discover MEPs. CCMs are confined to a domain and S-VLAN. Service OAM CCMs have the following characteristics:

- Transmitted at a configurable periodic interval by MEPs. The interval is defined in milliseconds and can be set to values from 10 milliseconds to 10 minutes (600000 mS), the default is 1 second (1000 mS).
- Contain a configurable hold-time value to indicate to the receiver the validity of the message. The default is 2.5 times the transmit interval.
- Catalogued by MIPs at the same maintenance level.
- Terminated by remote MEPs at the same maintenance level.
- Unidirectional and do not solicit a response.
- Carry the status of the port on which the MEP is configured.

Loopback Messages

Service OAM loopback messages are unicast frames that a MEP transmits, at the request of an administrator, to verify connectivity to a particular maintenance point. A reply to a loopback message indicates whether a destination is reachable but does not allow hop-by-hop discovery of the path. A loopback message is similar in concept to an Internet Control Message Protocol (ICMP) Echo (ping) message.

A Service OAM loopback message can be generated on demand using the CLI. The source of a loopback message must be a MEP; the destination may be a MEP or a MIP. Service OAM loopback messages are unicast; replies to loopback messages also are unicast. Service OAM loopback messages specify the destination MAC address, VLAN, and maintenance domain.

Link Trace Messages

Link trace is used to discover and monitor the path from one MEP to another MEP or MIP by its MAC address, and to all MIPs at the same domain level
A MEP sends link trace frames (LTM) and when received by a MIP, the MIP responds to the transmitting MEP and forwards the link trace frame. The receiving MEP will also send a link trace reply (LTR), so the transmitting MEP is able to build a list of MAC addresses of the MIPs and MEP reached. When there is a network fault, the Link Trace may be used to isolate the specific location of the fault.

.

4.22.2.4 MEP/MIP Hierarchical View

The drawing below shows an example of a service provider network built of two operator networks (operator A and operator B) with a single point-to-point customer service.

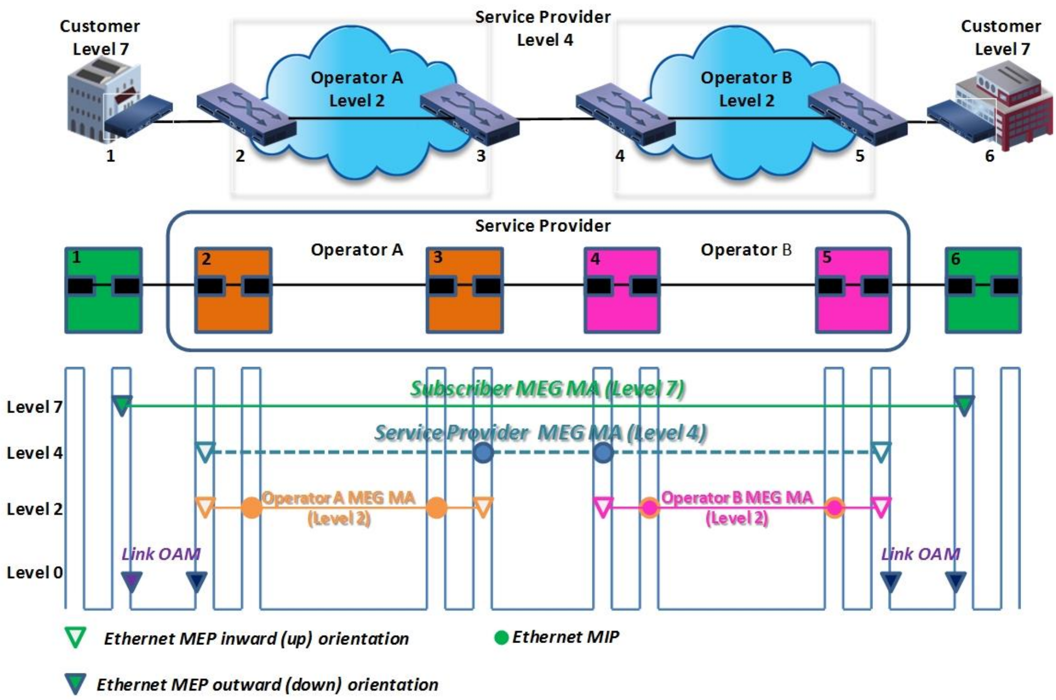


Figure 4-173: Typical MEP/MIP Hierarchical View

Recall that level values follows the convention where levels 5, 6, 7 are assigned to customers, levels 3, 4 are assigned to service providers, and levels 0, 1, 2 are assigned to operators (level 0 is assigned to link-level).

4.22.3 MEP Configuration Management

The following functions are described in this section:

Maintenance Entity Point

MEP Configuration which includes the following displays

Instance Data

Instance Configuration

Peer MEP Configuration

Functional Configuration

TLV Configuration

TLV Status

Link State Tracking

4.22.3.1 Maintenance Entity Point

The Maintenance Entity Point instances are configured here.

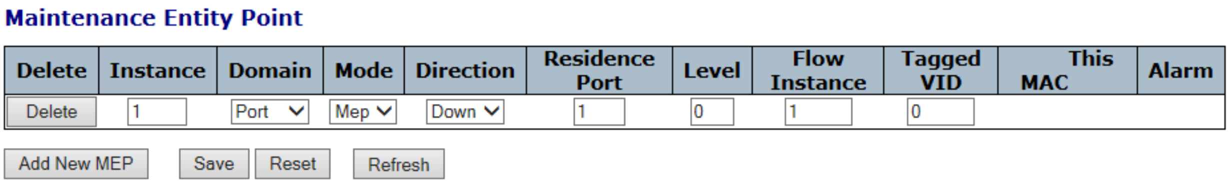


Figure 4-174: Maintenance Entity Point display

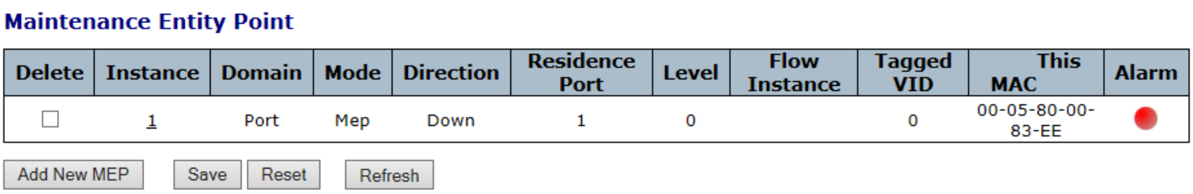
Table 4-160: Maintenance Entity Point commands

Delete	This box is used to mark a MEP for deletion in the next Save operation. MEP is an acronym for **M**aintenance **E**ntity **E**ndpoint and is an endpoint in a Maintenance Entity Group (ITU-T Y.1731).
Instance	The ID of the MEP. Click on the ID of a MEP to enter the configuration page. The range is from 1 through 100
Domain	**Port:** This is a MEP in the Port Domain. **EVC:** This is a MEP in the EVC Domain. 'Flow Instance' is a EVC.The EVC must be created **VLAN:** This is a MEP in the VLAN Domain. 'Flow Instance' is a VLAN. In case of Up-MEP the VLAN must be created
Mode	**MEP:** This is a Maintenance Entity End Point. **MIP:** This is a Maintenance Entity Intermediate Point.
Direction	**Down** This is a Down MEP - monitoring ingress traffic on 'Residence Port' **Up:** This is a Up MEP - monitoring egress traffic on 'Residence Port'
Residence Port	The port where MEP is monitoring - see 'Direction'. For a EVC MEP the port must be a port in the EVC. For a VLAN MEP the port must be a VLAN member.
Level	The MEG level of this MEP.

Flow Instance	The MEP is related to this flow - See 'Domain'. This is not relevant and not shown in case of Port MEP.
Tagged VID	**Port MEP:** An outer C/S-tag (depending on VLAN Port Type) is added with this VID. Entering '0' means no TAG added. **EVC MEP**: This is not used **VLAN MEP:** This is not used **EVC MIP**: On Serval, this is the Subscriber VID that identify the subscriber flow in this EVC where the MIP is active.
This MAC	The MAC of this MEP - can be used by other MEP when unicast is selected (Info only).
Alarm	There is an active alarm on the MEP.
Buttons	**Add New MEP**: Click to add a new MEP entry. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Refresh**: Click to refresh the page immediately.

In the previous display you may change theparameters for Instance 1

When you do Save, the following display is shown:

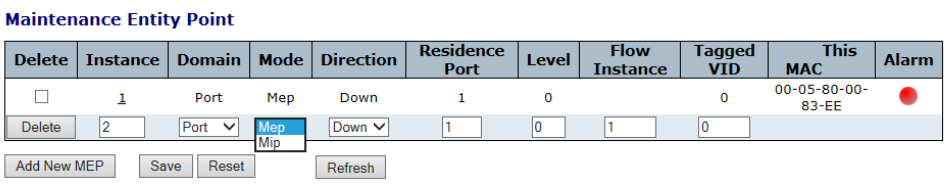

Maintenance Entity Point

Delete	Instance	Domain	Mode	Direction	Residence Port	Level	Flow Instance	Tagged VID	This MAC	Alarm
☐	1	Port	Mep	Down	1	0		0	00-05-80-00-83-EE	

When adding a new MEP (Click on “**Add New MEP”)**

The various Parameters for Instance 2 can be configured according to previous table

You need to perform a Save operation if you need to create a new Instance 2


Maintenance Entity Point

Delete	Instance	Domain	Mode	Direction	Residence Port	Level	Flow Instance	Tagged VID	This MAC	Alarm
☐	1	Port	Mep	Down	1	0		0	00-05-80-00-83-EE	
Delete	2	Port	Mep Mip	Down	1	0	1	0		

Figure 4-175: Adding a New MEP

When clicking on Instance 1 (the ID of the MEP) on the last display, we enter the following MEP configuration displays:

4.22.4 MEP Configuration Displays

This section allows the user to inspect and configure the current **MEP** Instance.

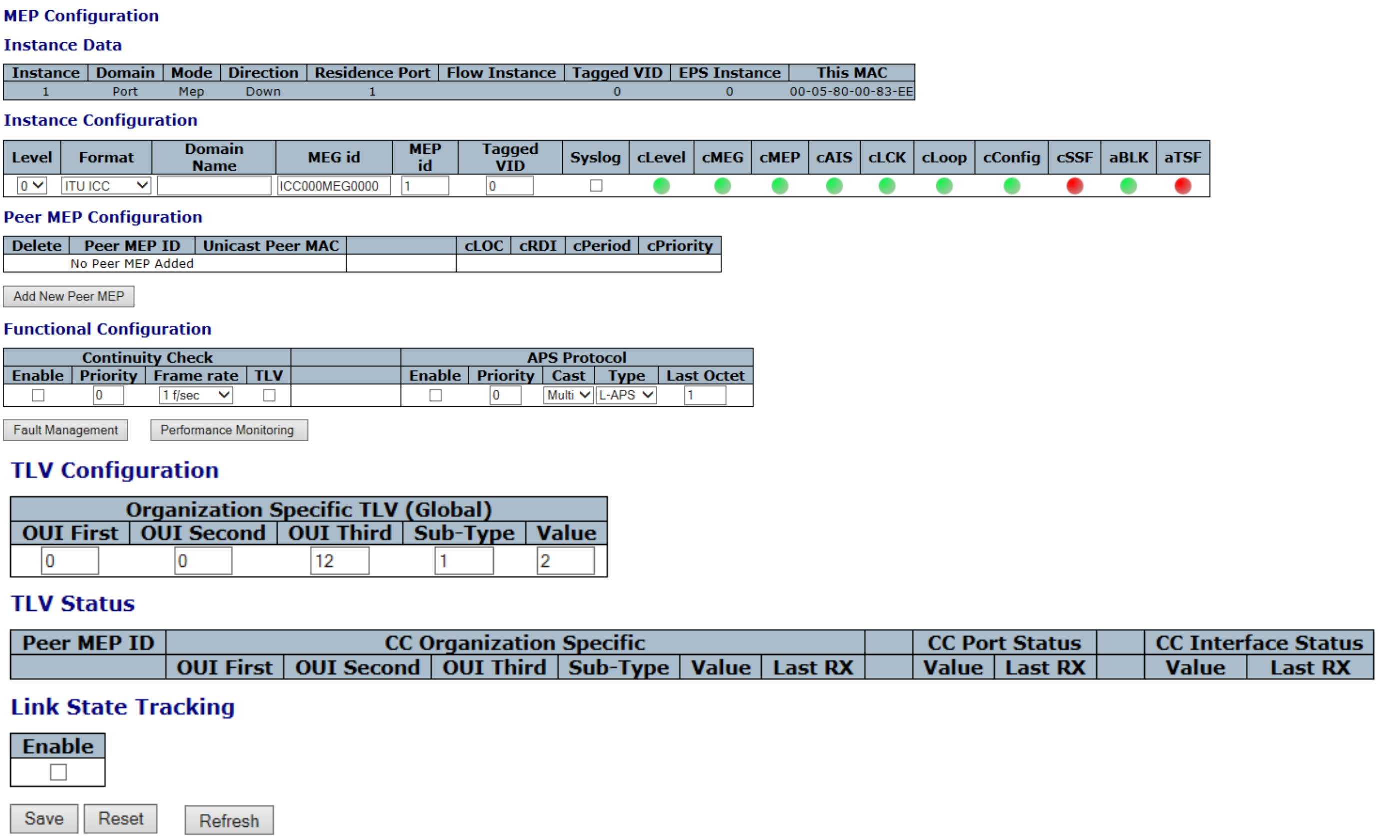


Figure 4-176: MEP Configuration Display

The above configurations are explained in the next pages

4.22.4.1 Instance Data

This section allows the user to inspect and configure the current **MEP** Instance

Instance Data

Instance	Domain	Mode	Direction	Residence Port	Flow Instance	Tagged VID	EPS Instance	This MAC
1	Port	Mep	Down	1		0	0	00-05-80-00-83-EE

Figure 4-177: Instance Data

Table 4-161: Instance Data Parameters

The table allows the user to inspect and configure the current MEP Instance.

Instance	The ID of the MEP.
Domain	See help on MEP create WEB.
Mode	See help on MEP create WEB.
Direction	See help on MEP create WEB.
Residence Port	See help on MEP create WEB..
Flow Instance	See help on MEP create WEB.
Tagged VID	See help on MEP create WEB.
This MAC	See help on MEP create WEB.

4.22.4.2 Instance Configuration

Instance Configuration

Level	Format	Domain Name	MEG id	MEP id	Tagged VID	Syslog	cLevel	cMEG	cMEP	cAIS	cLCK	cLoop	cConfig	cSSF	aBLK	aTSF
0	ITU ICC		ICC000MEG0000	1	0	☐										

Figure 4-178: Instance Configuration

Table 4-162: Instance Configuration Parameters

EVC QoS	This is only relevant for a **EVC MEP**. This is the QoS of the EVC and used for getting QoS counters for Loss Measurement.
Level	See help on MEP create WEB.
Format	This is the configuration of the two possible Maintenance Association Identifier formats. **ITU ICC:** This is defined by ITU (Y1731 Fig. A3). 'Domain Name' is not used. 'MEG id' must be max. 13 char. **IEEE String:** This is defined by IEEE (802.1ag Section 21.6.5). 'Domain Name' can be max. 16 char. 'MEG id' (Short MA Name) can be max. 16 char. **ITU CC ICC:** This is defined by ITU (Y1731 Fig. A5). 'Domain Name' is not used. 'MEG id' must be max. 15 char. **CC:** is an acronym for <u>C</u>ontinuity <u>C</u>heck. 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:** is an acronym for <u>C</u>ontinuity <u>C</u>heck <u>M</u>essage. It is a OAM frame transmitted from a MEP to it's peer MEP and used to implement CC functionality.

Domain Name	This is the IEEE Maintenance Domain Name and is only used in case of 'IEEE String' format. This string can be empty giving Maintenance Domain Name Format 1 - Not present. This can be max 16 char.
MEG Id	This is either ITU MEG ID or IEEE Short MA Name - depending on 'Format'. See 'Format'. In case of ITU ICC format this must be 13 char. In case of ITU CC ICC format this must be 15 char. In case of IEEE String format this can be max 16 char.
MEP Id	This value will become the transmitted two byte CCM MEP ID.
Tagged VID	This value will be the VID of a TAG added to the OAM PDU.
VOE	This will attempt to utilize VOE HW for MEP implementation. Not all platforms support VOE.
clevel	Fault Cause indicating that a CCM is received with a lower level than the configured for this MEP.
cMEG	Fault Cause indicating that a CCM is received with a MEG ID different from configured for this MEP.
cMEP	Fault Cause indicating that a CCM is received with a MEP ID different from all 'Peer MEP ID' configured for this MEP.
cAIS	Fault Cause indicating that AIS PDU is received.
cLCK	Fault Cause indicating that LCK PDU is received.
cSSF	Fault Cause indicating that server layer is indicating Signal Fail.
aBLK	The consequent action of blocking service frames in this flow is active.
aTSF	The consequent action of indicating Trail Signal Fail to-wards protection is active

4.22.4.3 Peer MEP Configuration

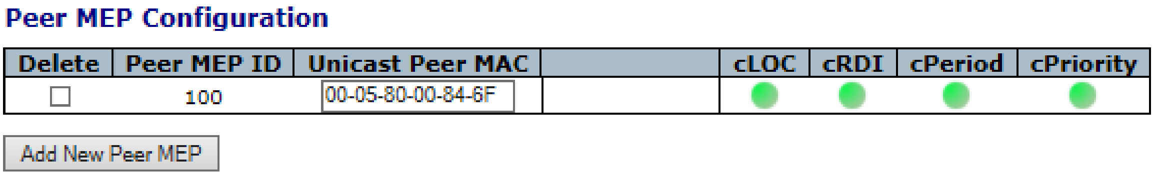


Figure 4-179: Peer MEP Configuration

Table 4-163: I Peer MEP e Configuration Parameters

Delete	This box is used to mark a Peer MEP for deletion in next Save operation
Peer MEP ID	This value will become an expected MEP ID in a received CCM - see 'cMEP'.
Unicast Peer MAC	This MAC will be used when unicast is selected with this peer MEP. Also this MAC is used to create HW checking of receiving CCM PDU (**LOC** detection) from this MEP. **LOC:** is an acronym for **L**oss **O**f **C**onnectivity and is detected by a MEP and is indicating lost connectivity in the network.
cLOC	Fault Cause indicating that no CCM has been received (in 3,5 periods) - from this peer MEP.
cRDI	Fault Cause indicating that a CCM is received with Remote Defect Indication - from this peer MEP.
cPeriod	Fault Cause indicating that a CCM is received with a period different what is configured for this MEP - from this peer MEP.
cPriority	Fault Cause indicating that a CCM is received with a priority different what is configured for this MEP - from this peer MEP.
Buttons	**Add New Peer MEP**: Click to add a new peer MEP

4.22.4.4 Functional Configuration

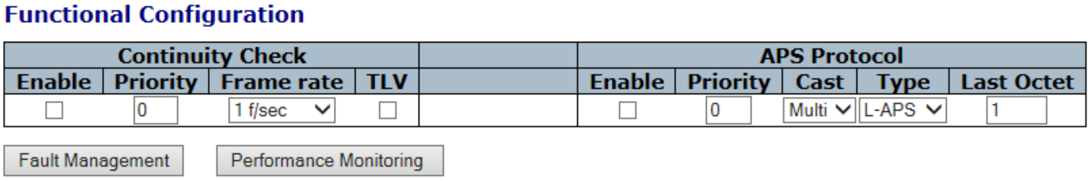


Figure 4-180: Functional Configuration

Table 4-164: Functional Configuration Parameters

Continuity Check	
Enable	Continuity Check based on transmitting/receiving CCM PDU can be enabled/disabled. The CCM PDU is always transmitted as Multi-cast Class 1.
Priority	The priority to be inserted as **PCP** bits in TAG (if any). In case of enable of Continuity Check and Loss Measurement both implemented on SW based CCM, 'Priority' has to be the same.
Frame rate	Selecting the frame rate of CCM PDU. This is the inverse of transmission period as described in Y.1731. This value has the following uses: * The transmission rate of the CCM PDU * Fault Cause cLOC is declared if no CCM PDU has been received within 3.5 periods - see 'cLOC'. * Fault Cause cPeriod is declared if a CCM PDU has been received with different period - see 'cPeriod' Selecting 300f/sec or 100f/sec will configure HW based CCM (if possible). Selecting other frame rates will configure SW based CCM. In case of enable of Continuity Check and Loss Measurement both implemented on SW based CCM, 'Frame Rate' has to be the same.
TLV	Enable/disable of TLV insertion in the CCM PDU. **TLV**: 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.
APS Protocol	
Enable	Automatic Protection Switching protocol information transportation based on transmitting/receiving R-APS/L-APS PDU can be enabled/disabled. Must be enabled to support **ERPS**/ELPS implementing APS. This is only valid with one Peer MEP configured.
Priority	The priority to be inserted as PCP bits in TAG (if any).
Cast	Selection of APS PDU transmitted unicast or multi-cast. The unicast MAC will be taken from the 'Unicast Peer MAC' configuration. Unicast is only valid for L-APS - see 'Type'. The R-APS PDU is always transmitted with multi-cast MAC described in G.8032.
Type	**R-APS:** APS PDU is transmitted as R-APS - this is for ERPS. **L-APS:** APS PDU is transmitted as L-APS - this is for ELPS.
Last Octet	This is the last octet of the transmitted and expected RAPS multi-cast MAC. In G.8031 (03/2010) a RAPS multi-cast MAC is defined as 01-19-A7-00-00-XX. In current standard the value for this last octet is '01' and the usage of other values is for further study.
Buttons	**Fault Management**: Click to go to Fault Management page **Performance Monitoring**: Click to go to Performance Monitor page. **Refresh**: Click to refresh the page immediately **Save:** Click to save changes **Reset:** Click to undo any changes made locally and revert to previous saved

4.22.4.5 TLV Configuration

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.

Configuration of the OAM PDU TLV. Currently only TLV in the CCM is supported.

TLV Configuration

Organization Specific TLV (Global)				
OUI First	**OUI Second**	**OUI Third**	**Sub-Type**	**Value**
0	0	12	1	2

Figure 4-181: TLV Configuration

Table 4-165: TLV Configuration Parameters

OUI First	The transmitted first value in the OS TLV OUI field.
OUI Second	The transmitted second value in the OS TLV OUI field.
OUI Third	The transmitted third value in the OS TLV OUI field.
Sub Type	The transmitted value in the OS TLV Sub-Type field.
Value	The transmitted value in the OS TLV Value field.
Buttons	**Refresh**: Click to refresh the page immediately **Save:** Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values

4.22.4.6 TLV Status

TLV Status

Peer MEP ID	CC Organization Specific							CC Port Status			CC Interface Status	
	OUI First	OUI Second	OUI Third	Sub-Type	Value	Last RX		Value	Last RX		Value	Last RX
100	0	0	0	0	0			0			0	

Figure 4-182: TLV Status

Table 4-166: TLV Status Parameters

Peer MEP ID	Peer MEP Identifier
CC Organization Specific	
OUI First	The last received first value in the OUI field.
OUI Second	The last received second value in the OS TLV OUI field.
OUI Third	The last received third value in the OS TLV OUI field.
Sub Type	The last received value in the OS TLV Sub-Type field.
Value	The last received value in the OS TLV Value field.
Last RX	PS TLV was received in the last received CCM PDU.
CC Port Status	
Value	The last received value in the PS TLV Value field.
Last RX	PS TLV was received in the last received CCM PDU.
CC Interface Status	
Value	The last received value in the IS TLV Value field.
Last RX	IS TLV was received in the last received CCM PDU.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values

4.22.4.7 Link State Tracking

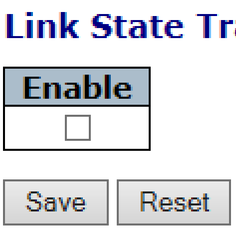


Figure 4-183: TLV Status

Table 4-167: TLV Status Parameters

Enable	When LST is enabled in an instance, Local SF or received 'isDown' in CCM Interface Status TLV, will bring down the residence port. Only valid in Up-MEP.

4.22.5 Ethernet Continuity Check

Ethernet Continuity Check (ETH-CC) is used for fault detection and protection switching.
It is used to detect Loss of continuity (LOC) between any pair of MEPs in a MEG.

A MEP periodically transmits CCM frames according to the configured transmission period.

A MEP periodically transmits CCM frames as often as the configured transmission

period. as follows:

- 3.33 ms: Default transmission period for protection switching application
- 10 ms: (Transmission rate of 100 frames / sec)
- 100 ms: Default transmission period for performance monitoring application
- 1 s: Default transmission period for fault management application
- 10 s: (Transmission rate of 6 frames / minute)
- 1 min: (Transmission rate of 1 frame / minute)
- 10 min: (Transmission rate of 6 frames / hour)
  - When a MEP does not receive CC information from a peer MEP, within an interval of 3.5
  - times the CC transmission period, it detects loss of continuity (LOC) to that peer MEP.
  - When a MEP receives a CC frame the flowing is being checked:
- MEG Level corresponds to its own MEG Level
- MEP ID is in the list of peers
- If RDI flag is set, then RDI alarm is raised
- The period is same as set for the transmission
- VLAN Priority is correct

Use the following displays in order to implement MEP configuration and CC Fault Conditions.

At the beginning, you need to use and configure the MEG End-Point instance (refer to the previous section 4.15.3) and afterwards configure the following displays.

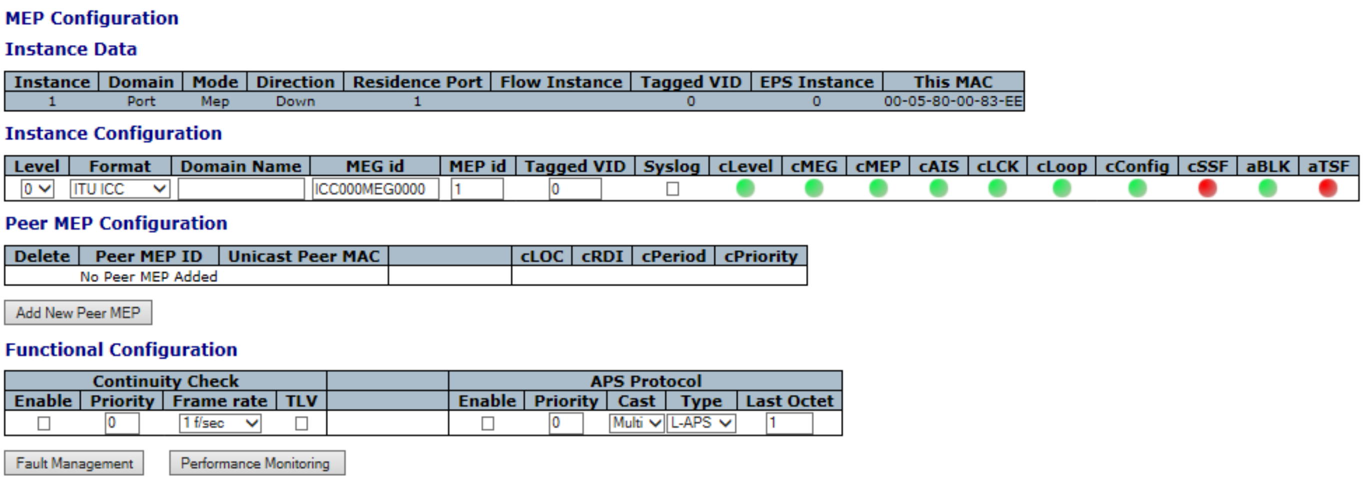


Figure 4-184: MEP Configuration displays

The Continuity Check is configured via the Functional Configuration

The drawing below shows the CCM Continuity Check Messages operation

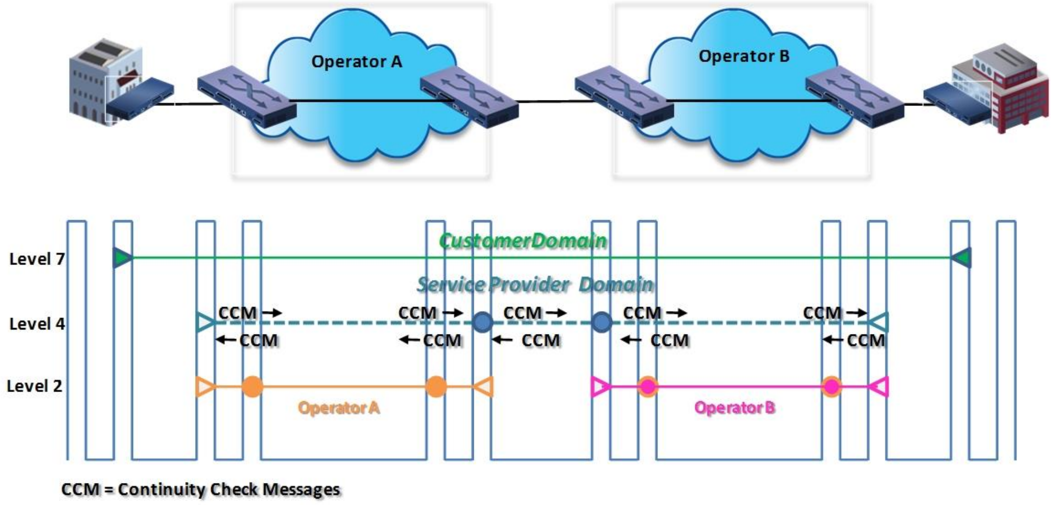


Figure 4-185: Continuity Check Messages

4.22.6 Continuity Check Messages with Network Fault

The drawing below illustrates a fault in the network.

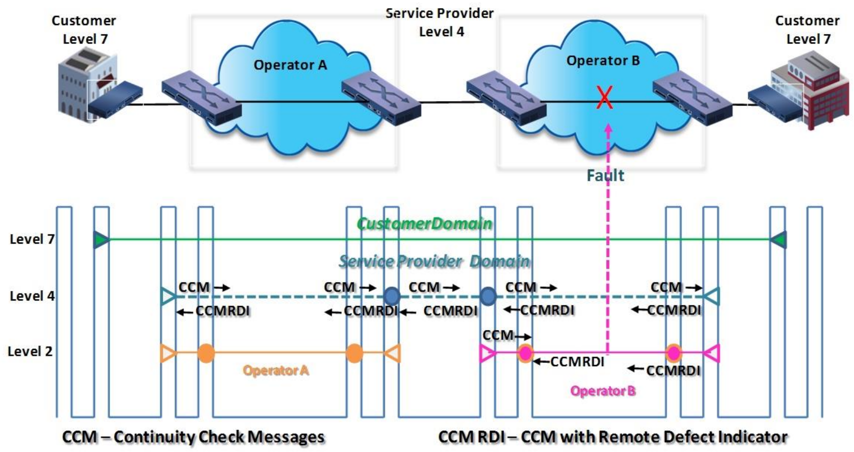


Figure 4-186: Continuity Check Messages with Network Fault

The fault in this case, is uni-directional or one way fault and its location is unknown.

MEPs notify each other of the faults they detect using the remote Defect indicator (RDI) flag in the CCM message.

A MEP, upon detecting a fault condition, sets the RDI field in the CCM frame until the fault condition is repaired. When a CCM frame is received, the MEP will examine it to verify that the MEP sender belongs to its same domain level and that the RDI field is set.
Once the last unit on the right has not received 3 consecutive CCM messages, it will send an alarm to the network manager and transmit CCM frames marked with RDI flag, notifying the remote MEP receiving the CCM messages that there is a loss of service. The MEPs will try to allocate the fault by using the Loopback and the Link Trace functions.

4.22.7 Fault Detection Management

This section allows the user to inspect and configure the Fault Management of the current MEP Instance. By clicking on 'Fault Management" button located in the Functional Configuration display you get the following Fault Management Configuration displays:

Loop Back, Link Trace, Test Signal, Client Configuration, AIS, and LOCK. As shown below

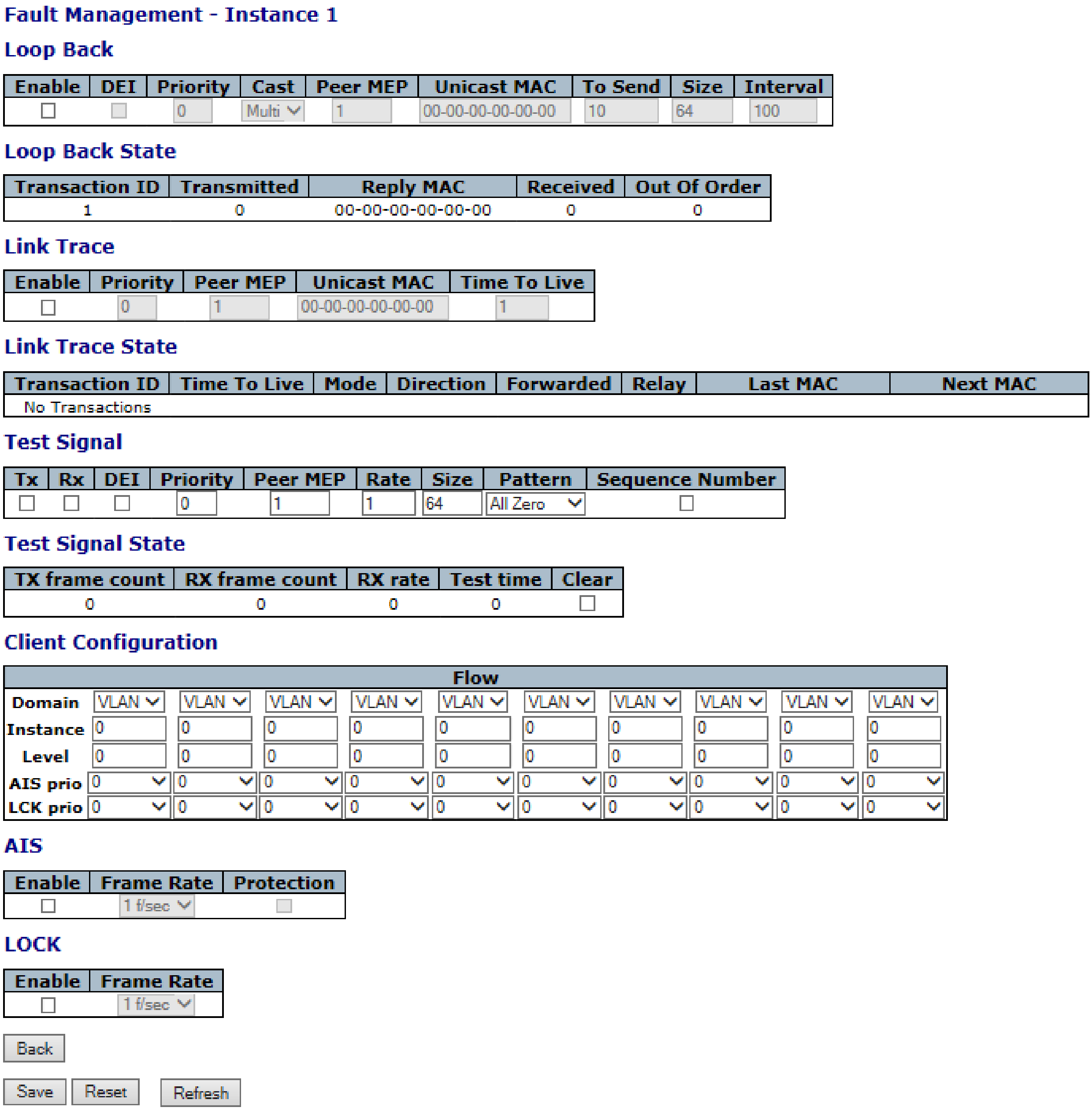


Figure 4-187: Fault Management displays

These functions are described in the following paragraphs

4.22.7.1 Ethernet Loop back

Loopback is an on-demand way of fault detection.

OAM loopback is used to verify connectivity with a MIP or peer MEP and is similar to the ping" command in an IP network. Loopback frames are transmitted from a MEP either as multicast or unicast and the receiving MIP/MEP will send back a reply. Note: a MIP will only reply if unicast addressing is used. The administrator initiates Loopback Message (LBM) to the peer MEP to ensure connectivity. The LBM can also be initiated to MIP. The MEP/MIP receiving the LBM verifies that the LBM is destined to it and responds with a Loopback Reply message (LBR).
ITU-T Y.1731 also defines multicast LBM, which can be used to discover the peer MEPs and learn their MAC addresses when CC is not in use. MIPs are transparent and don't respond to multicast LBMs.

Loopback frames can contain a data block of configurable length.

Loop Back

Enable	DEI	Priority	Cast	Peer MEP	Unicast MAC	To Send	Size	Interval
☐	☐	0	Multi	1	00-00-00-00-00-00	10	64	100

Loop Back State

Transaction ID	Transmitted	Reply MAC	Received	Out Of Order
1	0	00-00-00-00-00-00	0	0

Figure 4-188: Loop Back displays

Table 4-168: Loop-Back Parameters

Loop Back	
Enable	Loop Back based on transmitting/receiving LBM/LBR PDU can be enabled/disabled. Loop Back is automatically disabled when all 'To Send' LBM PDU has been transmitted - waiting 5 sec. for all LBR from the end
Dei	The DEI to be inserted as PCP bits in TAG (if any). DEI is an acronym for **D**rop **E**ligible **I**ndicator. It is a 1-bit field in the VLAN tag. PCP is an acronym for **P**riority **C**ode **P**oint. It is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as User Priority.
Priority	The priority to be inserted as PCP bits in TAG (if any).
Cast	Selection of LBM PDU transmitted unicast or multi-cast. The unicast MAC will be configured through 'Peer MEP' or 'Unicast Peer MAC'. To-ward off MIP, only unicast Loop Back is possible.
Peer MEP	This is only used if the 'Unicast MAC' is configured to all zero. The LBM unicast MAC will be taken from the 'Unicast Peer MAC' configuration of this peer.
Unicast MAC	This is only used if NOT configured to all zero. This will be used as the LBM PDU unicast MAC. This is the only way to configure Loop Back to-ward off a MIP.
To Send	The number of LBM PDU to send in one loop test. The value 0 indicate infinite transmission (test behaviour). This is HW based LBM/LBR and Requires VOE.

Size	The LBM frame size. This is entered as the wanted size (in bytes) of a un-tagged frame containing LBM OAM PDU - including CRC (four bytes). Example when 'Size' = 64=> Un-tagged frame size = DMAC(6) + SMAC(6) + TYPE(2) + LBM PDU LENGTH(46) + CRC(4) = **64 bytes** The transmitted frame will be four bytes longer for each tag added - 8 bytes in case of a tunnel EVC. There are two frame MAX sizes to consider: **Switch RX frame MAX size:** The MAX frame size (all inclusive) accepted on the switch port of 9600 Bytes **CPU RX frame MAX size:** The MAX frame size (all inclusive) possible to copy to CPU of 1526 Bytes Consider that the Peer MEP must be able to handle the selected frame size. Consider that In case of SW based MEP, the received LBR PDU must be copied to CPU Warning will be given if selected frame size exceeds the CPU RX frame MAX size Frame MIN Size is 64 Bytes.
Interval	The interval between transmitting LBM PDU. In 10ms. in case 'To Send' != 0 (max 100 - '0' is as fast as possible) In 1us. in case 'To Send' == 0 (max 10.000)",
Loop Back State	
Transaction ID	The transaction id of the first LBM transmitted. For each LBM transmitted (To Send) the transaction id in the PDU is incremented.
Transmitted	The total number of LBM PDU transmitted.
Reply MAC	The MAC of the replying MEP/MIP. In case of multi-cast LBM.replies can be received from all peer MEP in the group This MAC is not shown in case of 'To Send' == 0.
Received	The total number of LBR PDU received from this 'Reply MAC'.
Out Of Order	The number of LBR PDU received from this 'Reply MAC' with incorrect 'Transaction ID'.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back**: Click to go back to this MEP instance main page.

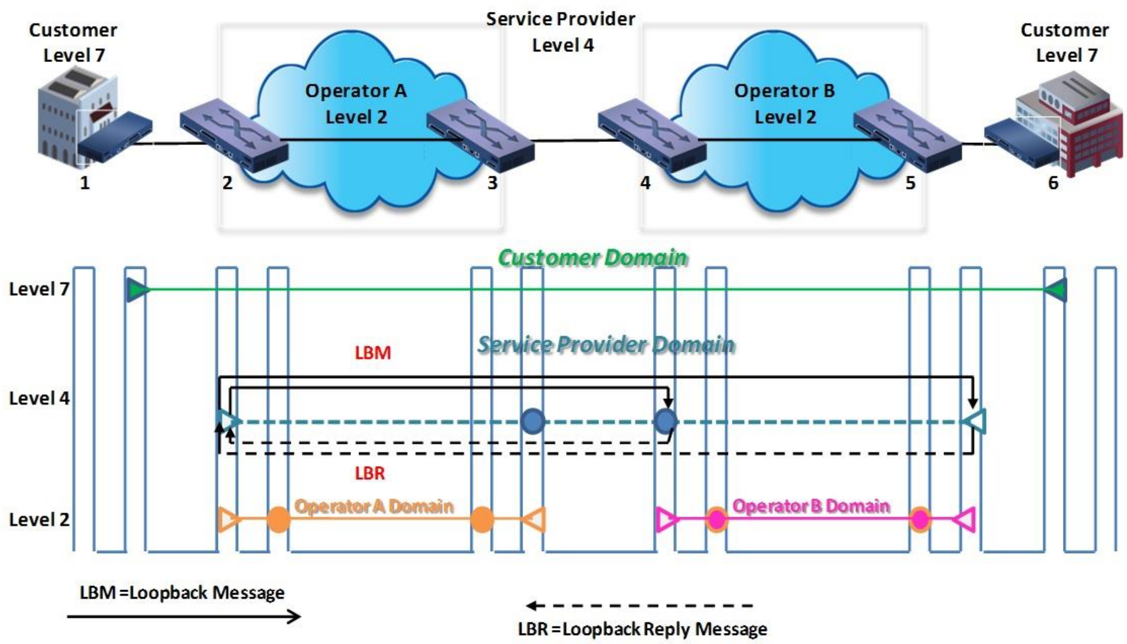
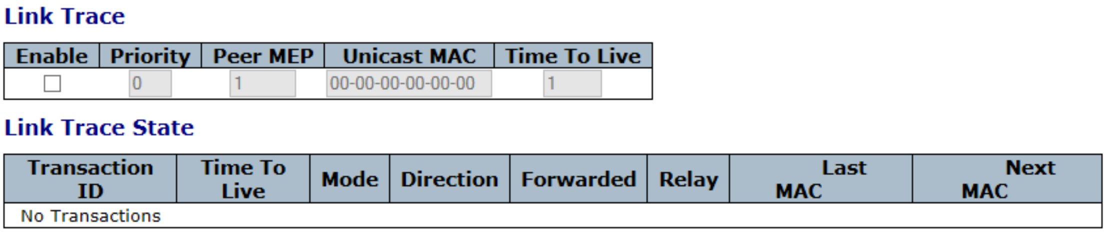


Figure 4-189: Connectivity check to a MIP and MEP using Loopback function

4.22.7.2 Link Trace

Link trace is used to discover and monitor the path between two MEPs
A MEP sends link trace frames (LTM) and when received by a MIP, the MIP responds to the transmitting MEP and forwards the link trace frame. The receiving MEP will also send a link trace reply (LTR), so the transmitting MEP is able to build a list of MAC addresses of the MIPs and MEF reached. The Link Trace with MAC addresses will be displayed in the following figure when the Link Trace operation is implemented.



Link Trace

Enable	Priority	Peer MEP	Unicast MAC	Time To Live
☐	0	1	00-00-00-00-00-00	1

Link Trace State

Transaction ID	Time To Live	Mode	Direction	Forwarded	Relay	Last MAC	Next MAC
No Transactions							

Figure 4-190: Link Trace display

Table 4-169: Link Trace Parameters

Link Trace	
Enable	Link Trace based on transmitting/receiving LTM/LTR PDU can be enabled/disabled Link Trace is automatically disabled when all 5 transactions are done with 5 sec. interval - waiting 5 sec. for all LTR in the end. The LTM PDU is always transmitted as Multi-cast Class 2.
Priority	The priority to be inserted as PCP bits in TAG (if any).
Peer MEP	This is only used if the 'Unicast MAC' is configured to all zero. Link Trace Target MAC will be taken from the 'Unicast Peer MAC' configuration of this peer.
Unicast MAC	This is only used if NOT configured to all zero. This will be used as the Link Trace Target MAC. This is the only way to configure a MIP as Target MAC.
Time to Live	This is the LTM PDU TTL value as described in Y.1731. This value is decremented each time forwarded by a MIP. Will not be forwarded reaching zero.
Link Trace State	
Transaction ID	The transaction id is incremented for each LTM send. This value is inserted the transmitted LTM PDU and is expected to be received in the LTR PDU. Received LTR with wrong transaction id is ignored. There are five transactions in one Link Trace activated.
Time To Live	This is the TTL value taken from the LTM received by the MIP/MEP sending this LTR - decremented as if forwarded.
Mode	Indicating if is was a MEP/MIP sending this LTR.
Direction	Indicating if MEP/MIP sending this LTR is ingress/egress.
Forwarded	Indicating if MEP/MIP sending this LTR has relayed/forwarded the LTM.
Relay	The Relay action can be one of the following: **MAC:** The was a hit on the LT Target MAC **FDB:** LTM is forwarded based on hit in the Filtering DB **MFDB:** LTM is forwarded based on hit in the MIP CCM DB CCM is an acronym for <u>C</u>ontinuity <u>C</u>heck <u>M</u>essage. It is a OAM frame transmitted from a MEP to it's peer MEP and used to implement CC functionality. CC is an acronym for <u>C</u>ontinuity <u>C</u>heck.

	It is a MEP functionality that is able to detect loss of continuity in a network by transmitting CCM frames to a peer MEP.
Last MAC	The MAC identifying the last sender of the LBM causing this LTR - initiating MEP or previous MIP forwarding.
Next Mac	The MAC identifying the next sender of the LBM causing this LTR - MIP forwarding or terminating MEP.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back**: Click to go back to this MEP instance main page.

Link Trace Operation diagram

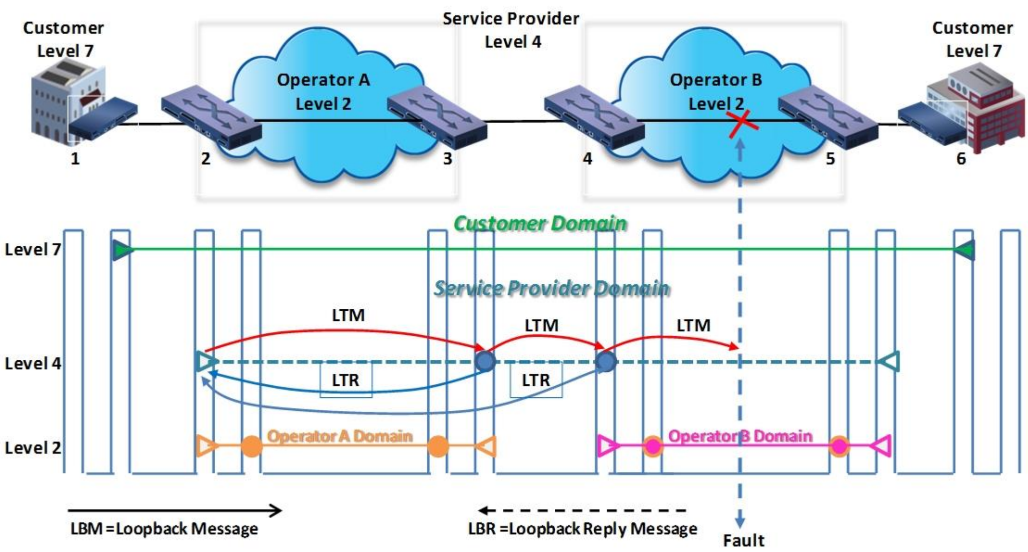


Figure 4-191: Link Trace operation

In the above example, the last MIP to respond with a LTR is at the edge of the Operator B. Therefore the network manager can isolate the location of the fault to the Operator B
The Operator B can also initiate a Link Trace operation from the MEP at the edge of his MEP to isolate the fault within the network. As already mentioned, the Link Trace can also be used to determine a physical network path during service initialization by identifying relationships between remote MEPs and MIPs at the same domain level.

4.22.7.3 Ethernet Test Signal

This function is used to perform one-way demand diagnostics tests.
Thus it is possible to verify bandwidth throughput, frame loss, bit errors, etc.
When configured to implement such tests, a MEP inserts suitable frames with ETH Test information with specified throughput, frame size and transmission patters.

A test signal generator associated with a MEP can transmit TST frames according to the Parameters configuration as depicted in the next Test Signal display and Parameters TST table

When a MEP receives TST frames, it examines them to ensure that the MEG Level corresponds to its own configured Level. If the receiving MEP is configured for ETH-TST function, the test signal detector associated with the MEP detects bit errors from the pseudo-random bit sequence of the received TST frames and reports such errors.

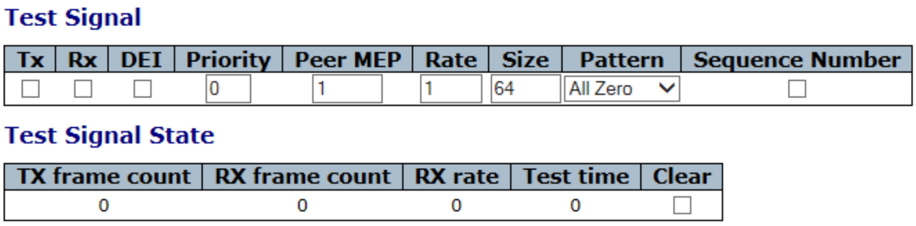


Figure 4-192: Test Signal display

Table 4-170: Test Signal Parameters

Test Signal	
Enable	Test Signal based on transmitting TST PDU can be enabled/disabled.
DEI	The DEI to be inserted as PCP bits in TAG (if any).
Priority	The priority to be inserted as PCP bits in TAG (if any)
Peer MEP	The TST frame destination MAC will be taken from the 'Unicast Peer MAC' configuration of this peer
Rate	The TST frame transmission bit rate - in Mega bits per. second. Limit is 400 Mbps. This is the bit rate of a standard frame without any encapsulation. If 1 Mbps rate is selected in a EVC MEP, the added tag will give a higher bitrate on the wire.
Size	The TST frame size. This is entered as the wanted size (in bytes) of a un-tagged frame containing TST OAM PDU - including CRC (four bytes). Example when 'Size' = 64 => Un-tagged frame size = DMAC(6) + SMAC(6) + TYPE(2) + TST PDU LENGTH(46) + CRC(4) = 64 bytes The transmitted frame will be four bytes longer for each tag added - 8 bytes in case of a tunnel EVC. There are two frame MAX sizes to consider. **Switch RX frame MAX size:** The MAX frame size (all inclusive) accepted on the switch port of 9600 Bytes

	CPU RX frame MAX size: The MAX frame size (all inclusive) possible to copy to CPU of 1526 Bytes Consider that the Peer MEP must be able to handle the selected frame size. Consider that in order to calculate the 'RX rate' a received TST PDU must be copied to CPU Warning will be given if selected frame size exceeds the CPU RX frame MAX size Frame MIN Size is 64 Bytes. TLV 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.
Pattern	The 'empty' TST PDU has the size of 12 bytes. In order to achieve the configured frame size a data TLV will be added with a pattern. Example when 'Size' = 64 => Un-tagged frame size = DMAC(6) + SMAC(6) + TYPE(2) + TST PDU LENGTH(46) + CRC(4) = 64 bytes The TST PDU needs to be 46 bytes so a pattern of 46-12=34 bytes will be added. **All Zero:** Pattern will be '00000000' **All One:** Pattern will be '11111111' **10101010:** Pattern will be '10101010'
Test Signal State	
TX frame count	The number of transmitted TST frames since last 'Clear'
RX frame count	The number of received TST frames since last 'Clear'.
RX rate	The current received TST frame bit rate in Kbps. This is calculated on a 1 s. basis, starting when first TST frame is received after 'Clear'. The frame size used for this calculation is the first received after 'Clear'
Test time	The number of seconds passed since first TST frame received after last 'Clear'
Clear	This will clear all Test Signal State. Transmission of TST frame will be restarted. Calculation of 'Rx frame count', 'RX rate' and 'Test time' will be started when receiving first TST frame.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back**: Click to go back to this MEP instance main page.

4.22.7.4 Client Configuration

Only a Port MEP is able to be a server MEP with flow configuration.

The Priority in the client flow is always the highest priority configured in the EVC.

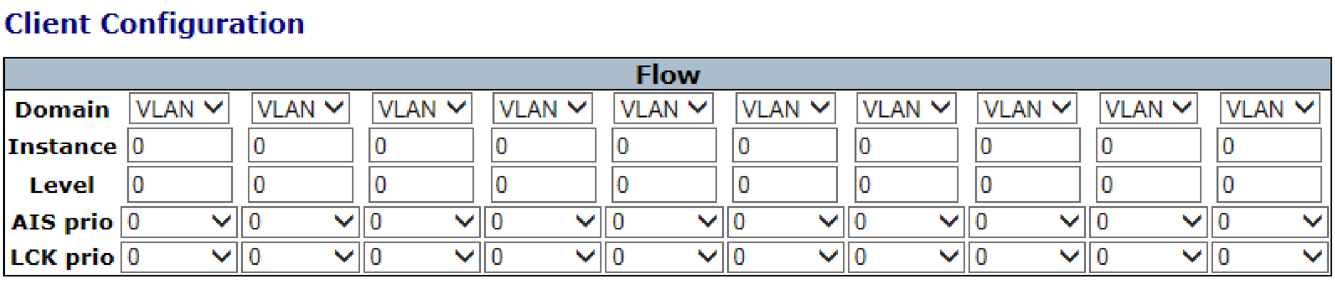


Figure 4-193: Client Configurationl display

Table 4-171: Client Configuration parameters

Flow	
Domain	The number of transmitted TST frames since last 'Clear'
Instance	The number of received TST frames since last 'Clear'.
Level	Client layer level - AIS and LCK PDU transmitted in this client layer flow will be on this level.
AIS Prio	The priority to be used when transmitting AIS in each client flow. Priority resulting in highest possible PCP can be selected.
LCK Prio	The priority to be used when transmitting LCK in each client flow. Priority resulting in highest possible PCP can be selected.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back**: Click to go back to this MEP instance main page.

4.22.7.5 Ethernet Alarm Indicator Signal (IAS)

It is important for the customer/service provider to know if a fault has occurred in his domain or it is due to a fault that has occurred in another domain

Let us assume that a fault has occurred in the operator's domain, which also results in service provider domain MEPs detecting faults. For the administrator of the service provider domain, he has no knowledge of the fault that has occurred in the operator's domain unless he coordinates with the operator. AIS signal will notify the higher layer MEPs of the fault that has occurred in the lower level.

The MEP on detecting a fault raises alarm indications using the Alarm Indication Signal (AIS) message2 to notify about the fault to its higher level MEPs. The MEPs receiving AIS should suppress any alarms, since the fault reported is due to side effect of a fault in the lower level.

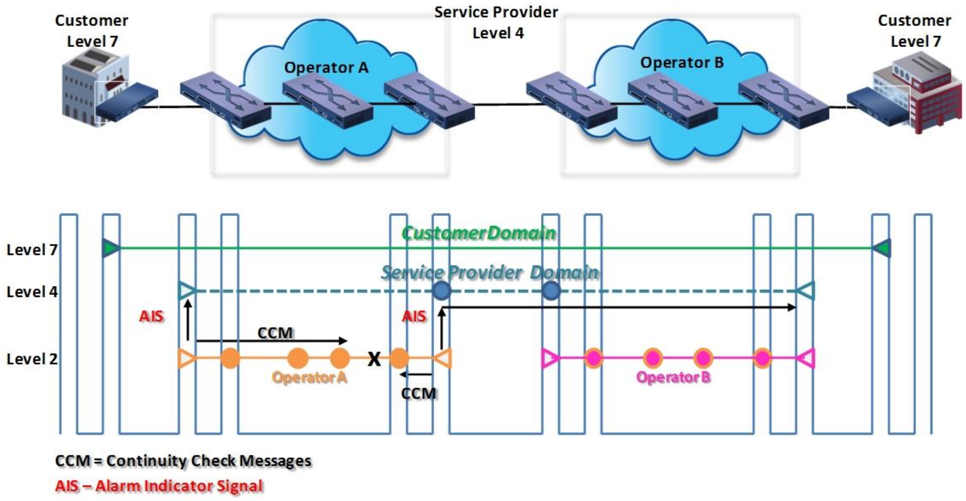


Figure 4-194: MEP generating AIS on detecting loss of CCMs

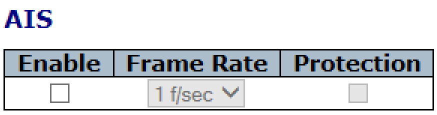


Figure 4-195: AIS Display

Table 4-172: AIS Configuration Parameters

AIS	
Enable	Insertion of AIS signal (AIS PDU transmission) in client layer flows, can be enable/disabled.
Frame Rate	Selecting the frame rate of AIS PDU. This is the inverse of transmission period as described in Y.1731.:
Protection	Selecting this means that the first 3 AIS PDU is transmitted as fast as possible - in case of using this for protection in the end point.
Buttons	**Refresh:** Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back**: Click to go back to this MEP instance main page.

4.22.7.6 Ethernet Locked Signal

In the same way that AIS is used to distribute fault conditions, Ethernet Locked signal is used to block reaction to a fault situation. ETH-LCK is normally used in test situations where a change to the network should not result in a protected switch.

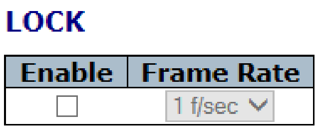


Figure 4-196: LOCK Display

Table 4-173: LOCK Configuration Parameters

LOCK	
Enable	Insertion of LOCK signal(LCK PDU transmission) in client layer flows, can be enable/disabled.
Frame Rate	Selecting the frame rate of LCK PDU. This is the inverse of transmission period as described in Y.1731.
Buttons	**Refresh:** Click to refresh the page immediately. **Back**: Click to go back to this MEP instance main page. **Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

Note the various Buttons commands are applicable to Loopback, Link trace, Test Signal, AIS and LOCK Fault Management displays

4.22.8 Performance Monitor

This section allows the user to inspect and configure the performance monitor of the current MEP Instance. ITU-T Y.1731 has added performance measurement and monitoring in order to provide the Service providers the tools to measure frame loss, frame delay and frame delay variation
The following performance Parameters are described in this section:

- **Single ended frame loss measurement**
- **Dual ended frame loss measurement**
- **One way frame delay measurement**
- **Two way frame delay measurement**

By clicking on the Performance Monitor button at MEP Configuration Displays , the following displays are shown:

Performance Monitor - Instance 1

Performance Monitoring Data Set

Enable
☐

Loss Measurement

Enable	Priority	Frame rate	Cast	Ended	FLR Interval
☐	0	1 f/sec	Multi	Single	5

Loss Measurement State

Tx	Rx	Near End Loss Count	Far End Loss Count	Near End Loss Ratio	Far End Loss Ratio	Clear
0	0	0	0	0	0	☐

Delay Measurement

Enable	Priority	Cast	Peer MEP	Ended	Tx Mode	Calc	Gap	Count	Unit	D2forD1	Counter Overflow Action
☐	0	Multi	1	Single	Standardize	Flow	10	10	us	☐	Keep

Delay Measurement State

	Tx	Rx	Rx Timeout	Rx Error	Av Delay Tot	Av Delay last N	Delay Min.	Delay Max.	Av Delay-Var Tot	Av Delay-Var last N	Delay-Var Min.	Delay-Var Max.	Overflow	Clear
One-way														
F-to-N	0	0	0	0	0	0	0	0	0	0	0	0	0	
N-to-F	0	0	0	0	0	0	0	0	0	0	0	0	0	
Two-way	0	0	0	0	0	0	0	0	0	0	0	0	0	☐

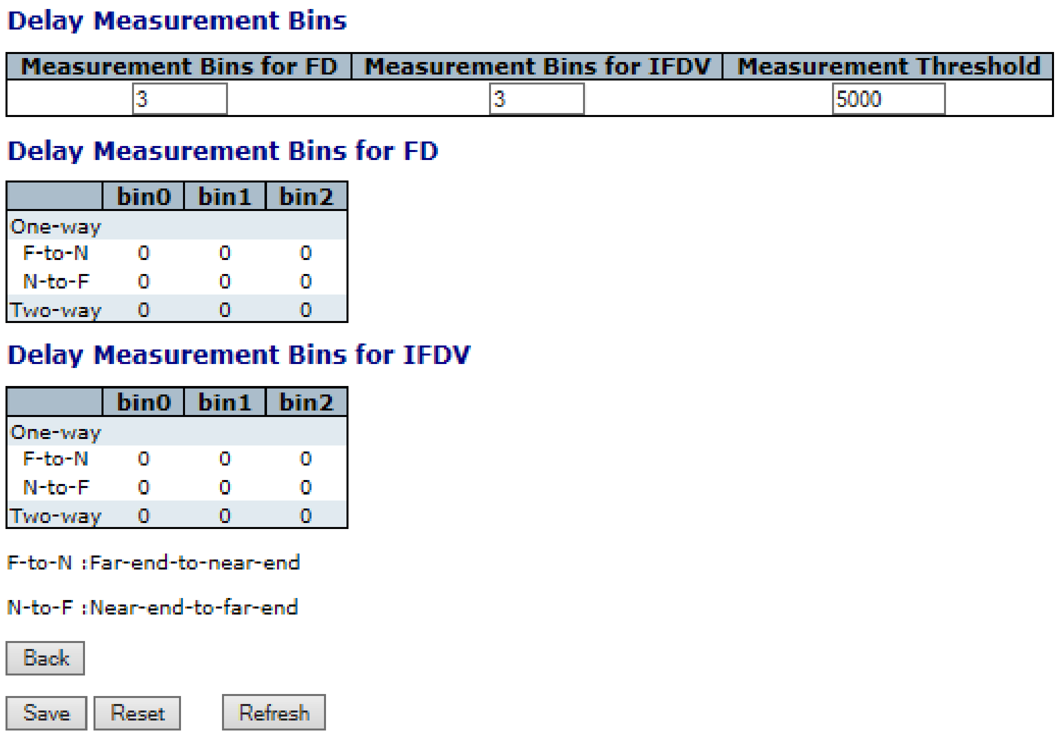


Figure 4-197: Performance Monitor Displays

4.22.8.1 Performance Monitoring Data Set

Enable	When enabled this MEP instance will contribute to the 'PM Data Set' gathered by the PM Session.

4.22.8.2 Loss Measurement LM

A MEP has two local counters: a TX frame counter and an RX frame counter.
Frame loss measurement is performed by two peer MEPs exchanging these counters.
There are two methods for loss frame measurement: single and dual frame loss measurement

Single ended LM

This method is used as on – demand tool to measure the frame loss factor.
MEPs use LMM (Loss Measurement Message) and LMR (Loss measurement Return) to deliver information on number of service frames transmitted and received.

The MEP starts the measurement by transmitting a LMM towards its peer MEP. The peer MEP transmits a LMR in response to the received LMM. Then, the initiator MEP measures the loss at its own end (near-end loss) and loss at peer's end (far-end loss) based on the information contained in the LMR and the local counters.

Dual ended LM

This method is a proactive tool to measure the frame loss. MEPs use CCM messages to deliver the information on number of service frames transmitted and received.
Each MEP measures Near-end loss and Far-end loss based on the counters contained in CCM message from its peer and the local counters.

It should be noted that measurement of frame loss based on service frames applies only to point-to-point service.

The various mentioned parameters are reported in the below displays and related tables.

Loss Measurement

Enable	Priority	Frame rate	Cast	Ended	FLR Interval
☐	0	1 f/sec	Multi	Single	5

Loss Measurement State

Tx	Rx	Near End Loss Count	Far End Loss Count	Near End Loss Ratio	Far End Loss Ratio	Clear
0	0	0	0	0	0	☐

Figure 4-198: Loss Measurement Displays

Table 4-174: Loss Measurement Parameters

Loss Measurement	
Enable	Loss Measurement based on transmitting/receiving CCM or LMM/LMR PDU can be enabled/disabled - see 'Ended'. This is only valid with one Peer MEP configured. **CCM** is an acronym for **C**ontinuity **C**heck **M**essage. It is a OAM frame transmitted from a MEP to it's peer MEP and used to implement CC functionality.
Priority	The priority to be inserted as PCP bits in TAG (if any). In case of enable of Continuity Check and Loss Measurement both implemented on SW based CCM, 'Priority' has to be the same.
Frame Rate	Selecting the frame rate of CCM/LMM PDU. This is the inverse of transmission period as described in Y.1731. Selecting 300f/sec or 100f/sec is not valid. In case of enable of Continuity Check and Loss Measurement both implemented on SW based CCM, 'Frame Rate' has to be the same.
Cast	Selection of CCM or LMM PDU transmitted unicast or multicast. The unicast MAC will be taken from the 'Unicast Peer MAC' configuration. In case of enable of Continuity Check and dual ended Loss Measurement both implemented on SW based CCM, 'Cast' has to be the same.
Ended	**Single:** Single ended Loss Measurement implemented on LMM/LMR. **Dual:** Dual ended Loss Measurement implemented on SW based CCM
FLR Interval	This is the interval in seconds where the FLR (Frame Loss Ratio) is calculated.
Loss Measurement State	
Near End Loss Count	The accumulated near end frame loss count - since last 'clear'.
Far End Loss Count	The accumulated far end frame loss count - since last 'clear'.

Near End Loss Ratio	The near end frame loss ratio calculated based on the near end frame loss count and far end frame transmitted - in the latest 'FLR Interval'. The result is given in percent.
Far End Loss Ratio	The far end frame loss ratio calculated based on the far end frame loss count and near end frame transmitted - in the latest 'FLR Interval'. The result is given in percent.
Clear	Set of this check and save will clear the accumulated counters and restart ratio calculation.
Buttons	**Refresh**: Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back:** Click to go back to this MEP instance main page

Frame Loss Measurement Calculation

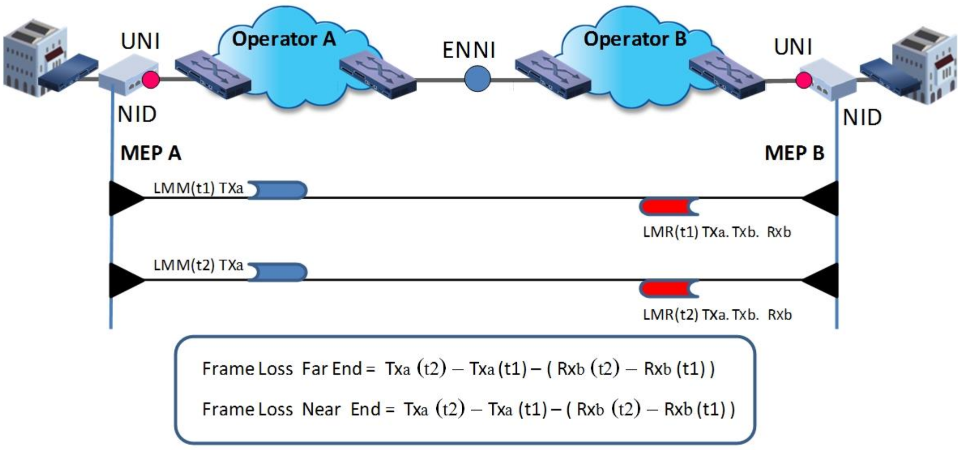


Figure 4-199: Loss Measurement Calculation

In dual ended frame loss measurement, both ends calculate the Frame loss.

Since the time for reading the counters in MEP-A is done before the readout in MEP-B, there is an inaccuracy in the calculation. This can be averaged out by averaging over some time intervals.

Also note that this loss measurement is valid for low loss ratios (<20%). If the loss ratio is too high, LMM/LMR frames are lost and the calculation will be incorrect

4.22.8.3 Delay Measurement

Frame Delay (FD) and Frame Delay Variation (FDV) are important factors in QoS.
The FD and FDV requirements will be different for each service>

Frame Delay is defined as the time elapsed since the start of transmission of the first bit from the source until the reception of last bit of the frame at the destination.
Frame Delay Variation is the difference in the Frame Delay between two successive frames. . The following methods are defined to measure the FD and FDV:

One way frame delay measurement

Two away frame delay measurement

4.22.8.4 One way frame delay measurement

Used to measure the frame delay and delay variation in one-direction. The MEP transmits 1DM frame. It carries the timestamp at the time of transmission of 1DM. The MEP receiving the 1DM frame timestamps the reception time and measures the delay by calculating the elapsed time between the transmission and reception of the 1DM frame.

Frame delay=RxTimeStamp — TxTimeStamp

To use this method, the clocks on both the ends need to be synchronized by IEEE1588 PTP protocol.

4.22.8.5 Two way frame delay measurement

Used to measure the round-trip delay and delay variation of the frame. This is obtained using the DMM and DMR frames. Timestamp of DMM transmission is carried in the DMM frame which is reflected back in the DMR frame.

If not possible to have the two MEPs synchronized, a two-way delay measurement can be used. Here the MEP sends ETH-DM request with TxTimeStampf to the peer MEP which replies with the time of the request arrival (RxTimeStampf) and the transmission time of the reply (TxTimeStampb). With the recording of the arrival time of the reply the frame delay is calculated as:

Frame Delay = (RxTimeb–TxTimeStampf) – (TxTimeStampb–RxTimeStampf)

The following display and related table include the required Parameters and statuses of both operations.

Delay Measurement and Delay Measurement State displays are shown on next page

Delay Measurement

Enable	Priority	Cast	Peer MEP	Ended	Tx Mode	Calc	Gap	Count	Unit	D2forD1	Counter Overflow Action
☐	0	Multi	1	Single	Standardize	Flow	10	10	us	☐	Keep

Delay Measurement State

	Tx	Rx	Rx Timeout	Rx Error	Av Delay Tot	Av Delay last N	Delay Min.	Delay Max.	Av Delay-Var Tot	Av Delay-Var last N	Delay-Var Min.	Delay-Var Max.	Overflow	Clear
One-way														
F-to-N	0	0	0	0	0	0	0	0	0	0	0	0	0	
N-to-F	0	0	0	0	0	0	0	0	0	0	0	0	0	
Two-way	0	0	0	0	0	0	0	0	0	0	0	0	0	☐

Figure 4-200: Delay Measurement

Table 4-175: Delay Measurement Parameters

Delay Measurement	
Enable	Delay Measurement based on transmitting 1DM/DMM PDU can be enabled/disabled. Delay Measurement based on receiving and handling 1DM/DMR PDU is always enabled.
Priority	The priority to be inserted as PCP bits in TAG (if any).
Cast	Selection of 1DM/DMM PDU transmitted unicast or multicast. The unicast MAC will be configured through 'Peer MEP'.
Peer MEP	This is only used if the 'Cast' is configured to Uni. The 1DM/DMR unicast MAC will be taken from the 'Unicast Peer MAC' configuration of this peer.
Way	**One-Way:** One-Way Delay Measurement implemented on 1DM. **Two-Way:** Two-Way Delay Measurement implemented on DMM/DMR.
Tx Mode	**Standardize:** Y.1731 standardize way to transmit 1DM/DMR **Proprietary:** proprietary way with follow-up packets to transmit 1DM/DMR
Calc	This is only used if the 'Way' is configured to Two-way. **Round trip:** The frame delay calculated by the transmitting and receiving timestamps of initiators. Frame Delay = RxTimeb-TxTimeStampf **Flow:** The frame delay calculated by the transmitting and receiving timestamps of initiators and remotes. Frame Delay = (RxTimeb-TxTimeStampf)-(TxTimeStampb-RxTimeStampf)
Gap	The gap between transmitting 1DM/DMM PDU in 10ms. The range is 10 to 65535.
Count	The number of last records to calculate. The range is 10 to 2000.
Unit	The time resolution
D2forD1	Enable to use DMM/DMR packet to calculate one-way DM. If the option is enabled, the following action will be taken. When DMR is received, two-way delay (roundtrip or flow) and both near-end-to-far-end and far-to-near-end one-way delay are calculated. When DMM or 1DM is received, only far-end-to-near-end one-way delay is calculated.

Counter Overflow Action	The action to counter when overflow happens.
Buttons	**Refresh**: Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back:** Click to go back to this MEP instance main page
Delay Measurement State	
Tx	The accumulated transmit count - since last 'clear'.
Rx	The accumulated receive count - since last 'clear'.
Rx Timeout	The accumulated receive timeout count for two-way only - since last 'clear'.
Rx Error	The accumulated receive error count - since last 'clear'. The frame delay is larger than 1 second(timeout
Av Delay Tot	The averagetoal delay - since last 'clear'.
Av Delay last N	The average delay of the last n packets - since last 'clear'.
Delay Min	The minimum delay - since last 'clear'.
Delay Max	The maximum delay - since last 'clear'
Av Delay Var Tot	The average **delay variation** - since last 'clear'. The unit is microsecond.
Av Deay Var Var last N	The average delay variation of the last n packets - since last 'clear'..
Dealy Var Min.	The minimum delay variation - since last 'clear'.
Dealy Var Max.	The maximum delay variation - since last 'clear'.
Overflow	The number of counter overflow - since last 'clear'.
Clear	Set of this check and save will clear the accumulated counters.
Far-end-to-near-end one-way delay	The one-way delay is from remote devices to the local devices. Here are the conditions to calculate this delay. 1. 1DM received. 2. DMM received with D2forD1 eanbled. 3. DMR received with D2forD1 eanbled
Near-end-to-near-end one-way delay	The one-way delay is from the local devices to remote devieces. The only case to calculate this delay is below. DMR received with D2forD1 eanbled
Buttons	**Refresh**: Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back:** Click to go back to this MEP instance main page

4.22.9 Delay Measurements Bins

A Measurement Bin is a counter that stores the number of delay measurements falling within a specified range, during a Measurement Interval.

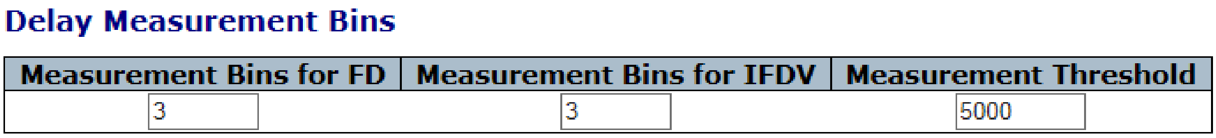


Figure 4-201: Delay Measurement Bins

Table 4-176**:** Delay Measurement Bins Parameters

Measurement Bins for FD	
Configurable number of Inter-Frame Delay Variation Measurement Bins per Measurement Interval. The minimum number of FD Measurement Bins per Measurement Interval supported is 2. The maximum number of FD Measurement Bins per Measurement Interval supported is 10. The default number of FD Measurement Bins per Measurement Interval supported is 3.	
Measurement Bins forIFDV	
Configurable number of Inter-Frame Delay Variation Measurement Bins per Measurement Interval. The minimum number of FD Measurement Bins per Measurement Interval supported is 2. The maximum number of FD Measurement Bins per Measurement Interval supported is 10. The default number of FD Measurement Bins per Measurement Interval supported is 2.	
Measurement Threshold	
Configurable the Measurement Threshold for each Measurement Bin. The unit for a measurement threshold is in microseconds (us). The default configured measurement threshold for a Measurement Bin is an increment of 5000 us.	
Buttons	**Refresh**: Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back:** Click to go back to this MEP instance main page

4.22.10 Delay Measurements Bins forFD

A Measurement Bin is a counter that stores the number of delay measurements falling within a specified range, during a Measurement Interval.

Delay Measurement Bins for FD

	bin0	bin1	bin2
One-way			
F-to-N	0	0	0
N-to-F	0	0	0
Two-way	0	0	0

Figure 4-202: Delay Measurement Bins for FD

Bin	Threshold	Range
Bin0	0 us	0 us <= measurement < 5,000 us
Bin1	5,000 us	5,000 us <= measurement < 10,000 us
Bin2	10,000 us	10,000 us <= measurement < 15,000 us
Bin3	15,000 us	15,000 us <= measurement < infinite us

4.22.11 Delay Measurements Bins for IFDV

A Measurement Bin is a counter that stores the number of delay measurements falling within a specified range, during a Measurement Interval

Delay Measurement Bins for IFDV

	bin0	bin1	bin2
One-way			
F-to-N	0	0	0
N-to-F	0	0	0
Two-way	0	0	0

Figure 4-203: Delay Measurement Bins for IFDV

Bin	Threshold	Range
Bin0	0 us	0 us <= measurement < 5,000 us
Bin1	5,000 us	5,000 us <= measurement < 10,000 us
Bin2	10,000 us	10,000 us <= measurement < 15,000 us
Bin3	15,000 us	15,000 us <= measurement < infinite us

F-to-N :Far-end-to-near-end

N-to-F :Near-end-to-far-end

Buttons	**Refresh**: Click to refresh the page immediately **Save**: Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values **Back:** Click to go back to this MEP instance main page

4.23 RMON (Remote Network Monitoring)

The Remote Network Monitoring (RMON) MIB was developed by the IETF to support monitoring and protocol analysis of LANs.

M-Class series support RMON 1 (RFC2819) groups 1, 2, 3 and 9.

4.23.1 ARMON Alarm Configuration

This section provides configuration of RMON Alarm table. The entry index key is **ID**.

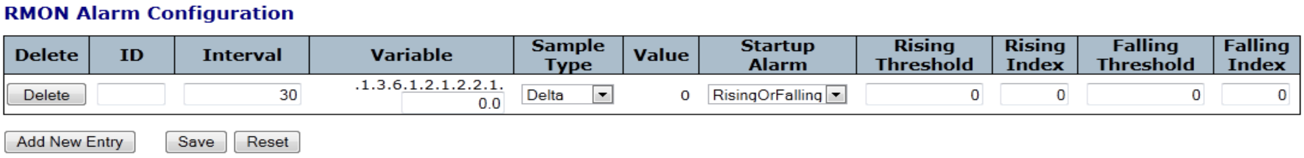


Figure 4-204: RMON Alarm Configuration

Table 4-177: 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 particular 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 discarded event the packets is normal. **OutErrors**: The 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. Falling 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).
Buttons	**Add New Entry:** Click to add a new community entry **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.23.2 RMON Event Configuration

Configure RMON Event table on this section. The entry index key is `ID`.

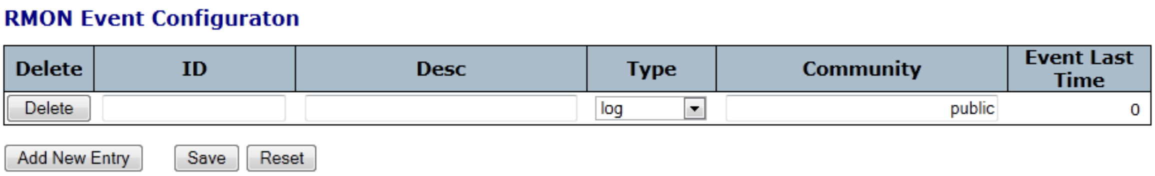


Figure 4-205: RMON Event Configuration

Table 4-178: 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**: The total number of octets received on the interface, including framing characters. **log** The number of uni-cast packets delivered to a higher-layer protocol. **snmptrap**: The number of broad-cast and multi-cast packets delivered to a higher-layer protocol. **logandtrap**: The number of inbound packets that are discarded even the packets are normal
Community	Specify the community when trap is sent, the string length is from 0 to 127, default is "public".
Event Last Time	Indicates the value of sysUpTime at the time this event entry last generated an event.
Buttons	**Add New Entry:** Click to add a new community entry **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

4.23.3 RMON Statistics Configuration

Configure RMON Statistics table on this section. The entry index key is `ID`.

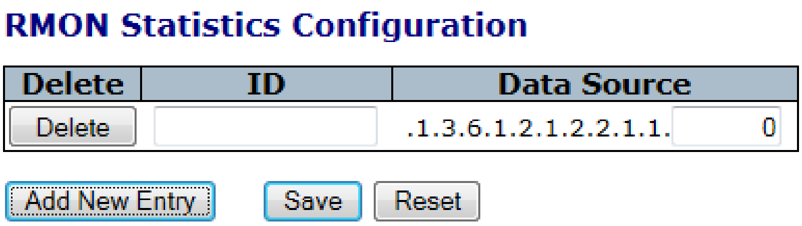


Figure 4-206: RMON Statistics Configuration

Table 4-179: 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
Buttons	**Add New Entry**: Click to add a new community entry **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.23.4 RMON History Configuration

Configure RMON History table on this section. The entry index key is **ID**.

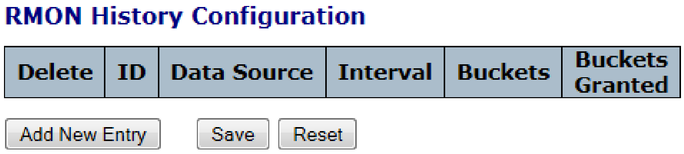


Figure 4-207: RMON History Configuration

Table 4-180: 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 has 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 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.
Buttons	**Add New Entry**: Click to add a new community entry **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.24 Loop Guard

This section allows the user to inspect the current Loop Guard (Loop protection) configurations, and possibly change them as well.

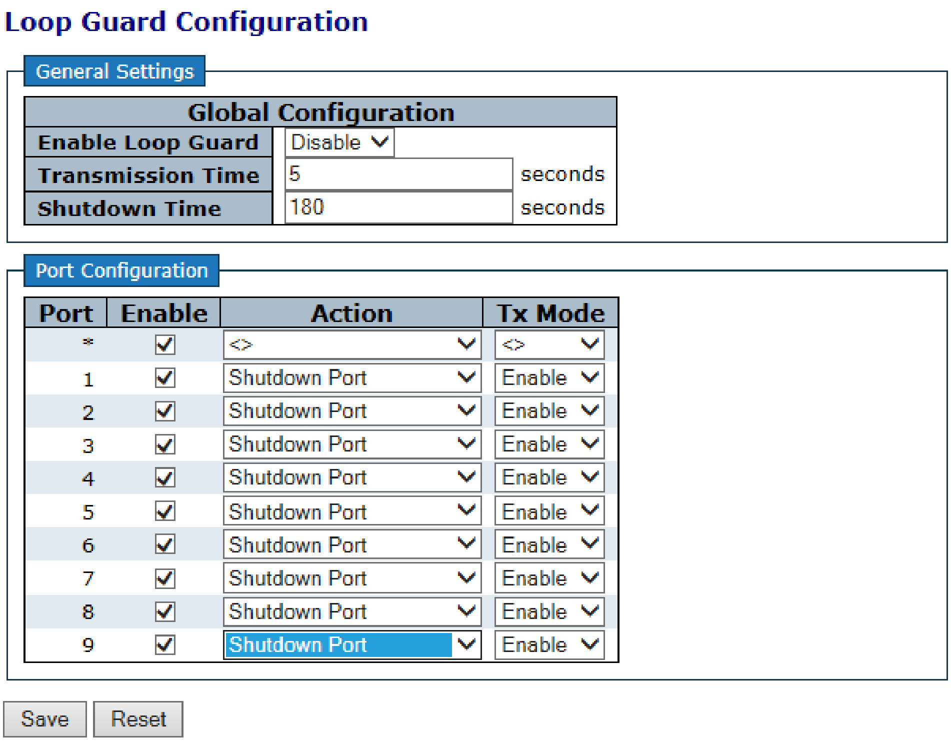


Figure 4-208: Loop Guard Configuration

Table 4-181: Loop Guard Configuration Parameters

General Settings Global Configuration	
Enable Loop Guard	Controls whether loop guard is enabled (as a whole).
Transmission Time	The interval between each loop guard 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 guard 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 guard PDU's, or whether it is just passively looking for looped PDU's.
Buttons	**Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.24.1 Loop Guard Status

This section displays the loop guard status of selected port

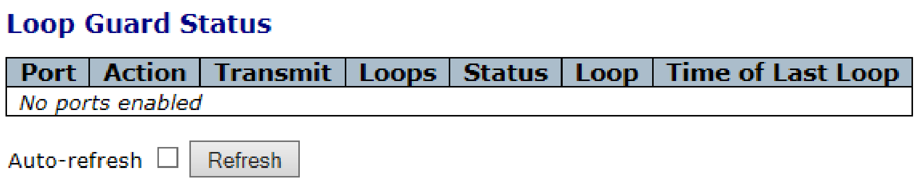


Figure 4-209: Loop Guard Status

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 guard 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.
Buttons	**Refresh:** Click to refresh the page immediately. **Auto-refresh** : Check this box to enable an automatic refresh of the page at regular intervals.

Table 4-182: Loop Guard Status Parameters

4.25 EPS (Ethernet Protection Switching)

The Ethernet (Linear) Protection Switch instances are configured here

The EPS is supported by the G.8031 standard

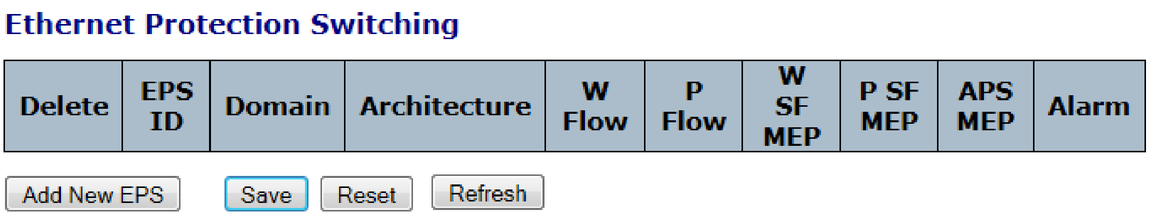


Figure 4-210: Ethernet Protection Switching

Table 4-183: Ethernet Protection Switching Parameters

Delete	This box is used to mark an EPS for deletion in next Save operation.
EPS ID	The ID of the EPS. Click on the ID of an EPS to enter the configuration page.
Domain	**Port:** This will create a EPS in the Port Domain. 'W/P Flow' is a Port.
Architecture	**Port:** This will create a 1+1 EPS. **Port:** This will create a 1:1 EPS.
W Flow	The working flow for the EPS - See 'Domain'.
P Flow	The protecting flow for the EPS - See 'Domain'.
W SF MEP	The working Signal Fail reporting MEP.
P SF MEP	The protecting Signal Fail reporting MEP.
APS MEP	The APS PDU handling MEP. APS is an acronym for **A**utomatic **P**rotection **S**witching. This protocol is used to secure that switching is done bidirectional in the two ends of a protection group, as defined in G.8031
Alarm	There is an active alarm on the EPS.
Buttons	**Add New EPS:** Click to add a new EPS entry **Refresh**: Click to refresh the page immediately. **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values

4.26 Ethernet Ring Protection Switching

The ERPS (Ethernet Ring Protection Switch) instances are configured here.

The ERPS is supported by the G.8032v2 standard

Ethernet Ring Protection Switching

Delete	ERPS ID	Port 0	Port 1	Port 0 APS MEP	Port 1 APS MEP	Port 0 SF MEP	Port 1 SF MEP	Ring Type	Interconnected Node	Virtual Channel	Major Ring ID	Alarm

Add New Protection Group | Save | Reset | Refresh

Figure 4-211: Ethernet Ring Protection Switching

Table 4-184: Ethernet Ring Protection Switching Parameters

Delete	This box is used to mark an ERPS for deletion in next Save operation.
ERPS ID	The ID of the created Protection group. It must be an integer value between 1 and 64. The maximum number of ERPS Protection Groups that can be created are 64. Click on the ID of an Protection group to enter the configuration page.
Port 0	This will create a Port 0 of the switch in the ring
Port 1	This will create "Port 1" of the switch in the Ring. As interconnected sub-ring will have only one ring port, "Port 1" is configured as "0" for interconnected sub-ring. "0" in this field indicates that no "Port 1" is associated with this instance
Port 0 SF MEP	The Port 0 Signal Fail reporting MEP.
Port 1 SF MEP	The Port 1 Signal Fail reporting MEP. As only one SF MEP is associated with interconnected sub-ring without virtual channel, it is configured as "0" for such ring instances. "0" in this field indicates that no Port 1 SF MEP is associated with this instance.
Port 0 APS MEP	The Port 0 APS PDU handling MEP.
Port 1 APS MEP	The Port 1 APS PDU handling MEP. As only one APS MEP is associated with interconnected sub-ring without virtual channel, it is configured as "0" for such ring instances. "0" in this field indicates that no Port 1 APS MEP is associated with this instance.
Ring Type	Type of Protecting ring. It can be either major ring or sub-ring.
Interconnected Node	Interconnected Node indicates that the ring instance is interconnected. Click on the checkbox to configure this. "Yes" indicates it is an interconnected node for this instance. "No" indicates that the configured instance is not interconnected.
Virtual Channel	Sub-rings can either have virtual channel or not on the interconnected node. This is configured using "Virtual Channel" checkbox. "Yes" indicates it is a sub-ring with virtual channel. "No" indicates, sub-ring doesn't have virtual channel.
Major Ring ID	Major ring group ID for the interconnected sub-ring. It is used to send topology change updates on major ring. If ring is major, this value is same as the protection group ID of this ring
Alarm	There is an active alarm on the ERPS.
Buttons	**Add New ERPS:** Click to add a new EPS entry **Refresh**: Click to refresh the page immediately. **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values

4.27 Loopback Configuration

This section displays current loopback configuration. (L2 and/or L3 frame type)

Loopbacks can also be configured here.

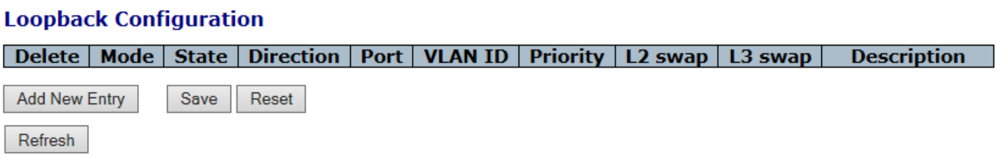


Figure 4-212: Loopback configuration

Table 4-185: Loopback configuration Parameters

Delete	If marked and save button is pressed, the loopback is deleted
Mode	The Loopback mode; Port based or VLAN.based
State	The loopback state; Enable means active, Disable means inactive.
Direction	The Loopback direction; Up means towards network, Down means towards access.
Port	The port on which the loopback operates (uplink ports).
VLAN ID	The VLAN ID on which the loopback operates (in port mode all VLANs are effective)
Priority	The priority on which the loopback operates; currently all PCP codes will be looped back.
L2 swap	The frame type on which the loopback operates: if L2 is marked then all frame with VLAN tag will be looped back, if L3 is marked then only IP packets will be looped back.(L2 OR/AND L3)
L3 swap	The frame type on which the loopback operates : if L3 is marked then only IP packets will be looped back.(
Description	Loopback description; if loopback mode is VLAN the description is the VLAN description, if loopback mode is port the description is the port description..
Buttons	**Add New Entry:** Click to add a new EPS entry **Refresh**: Click to refresh the page immediately. **Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values

4.28 Link Protection

This section allows the user to configure the Link Protection Parameters and check the status

4.28.1 Link Protection Configuration

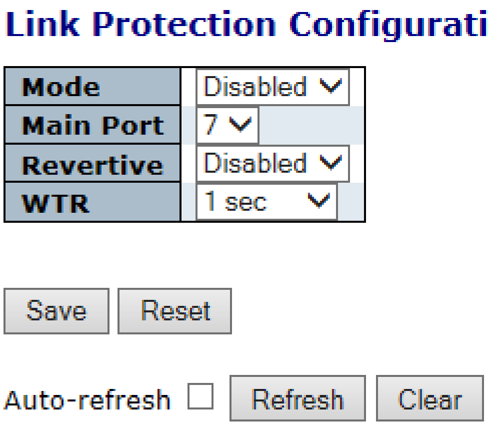


Figure 4-213: Link Protection Configuration

Table 4-186: Link Protection Configuration Parameters

Mode	Enable or Disable the Link Protection function.
Main Port	Select the uplink port that will serve as main (the other will be automatically assigned as backup).
Revertive	Enable or Disable revertive operation. When enabled, main connection will be restored after a previous failure on that link has been fixed. The Wait To Restore (WTR) timer will be triggered when main is back online.
WTR	Set the Wait To Restore timer (in seconds), which will be triggered when main link is restored after failure.
Buttons	**Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values **Refresh:** Click to refresh the list. **Auto-refresh** **:** Check this box to enable an automatic refresh of the page at regular intervals. **Clear**: Click to clear the list

4.28.2 Link Protection Status

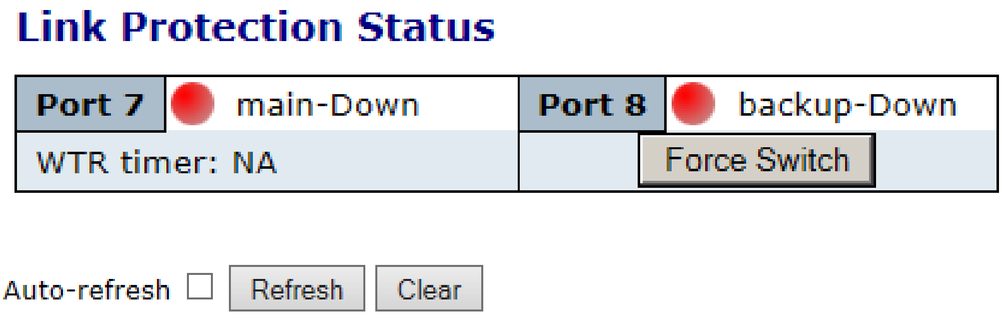


Figure 4-214: Link Protection Status

Table 4-187: Link Protection Status Parameters

Port Status	Indicates the current state of the main and backup ports. States can be: **Active**, **Standby** or **Down**.
WTR	Indicates the current time left on the WTR timer, when counting down
Force Switch	Overrides the WTR timer and forces switch back to main link.
Buttons	**Refresh:** Click to refresh the list. **Auto-refresh** **:** Check this box to enable an automatic refresh of the page at regular intervals. **Clear**: Click to clear the list

4.29 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 dynamicaly 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.

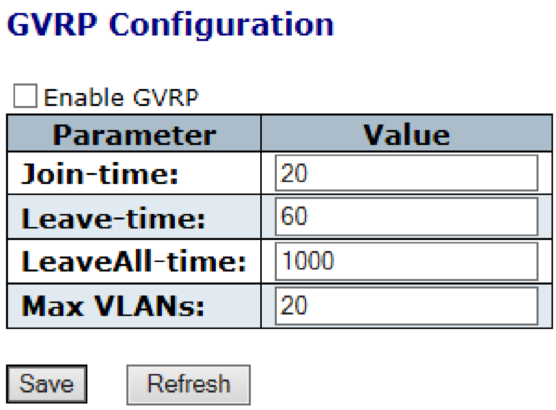


Figure 4-215: GVRP Configuration display

Table 4-188: 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 Save 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. LeaveAll-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.
Button	Save**:** Click to save changes. Refresh: Click to refresh the list.

4.30 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.

4.30.1 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.

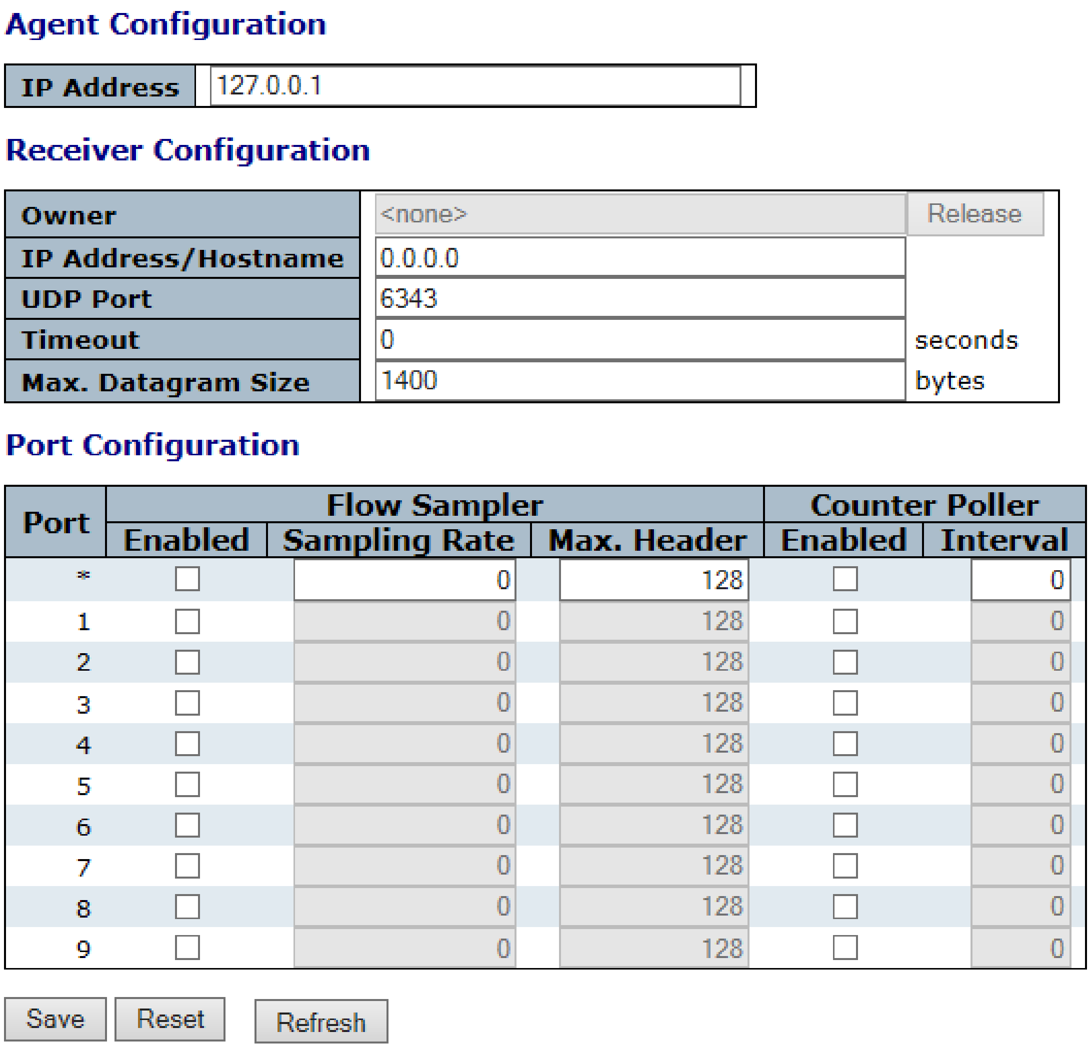


Figure 4-216: sFlow Configuration displays

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 beolow applies
Flow Sampler Enabled	Enable / Disable flow sampling on this port Set to N to sample on average 1/Nth of the packets transmitted/received on the port. This will be reported back in this field. Valid range is 1 to 4294967295.
Flow Sampler Sampling Rate	The statistical sampling rate for packet sampling. Not all sampling rates are achievable If an unsupported sampling rate is requested, the switch will automatically adjust it to the closest achievable.
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. If the maximum datagram size does not take into account the maximum header size, samples may be dropped.
Counter Poller Enabled	Enable/Disable 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.
Buttons	**Refresh:** Click to refresh this sub-section. Note that unsaved changes will be lost. **Save:** Click to save changes. Note that sFlow configuration is not persisted to non-volatile memory. **Reset:** Click to undo any changes made locally and revert to previously saved values.

Table 4-189: sFlow Configuration displays parameters

4.30.2 sFlow Statistics

This sub-section shows receiver and per-port sFlow statistics

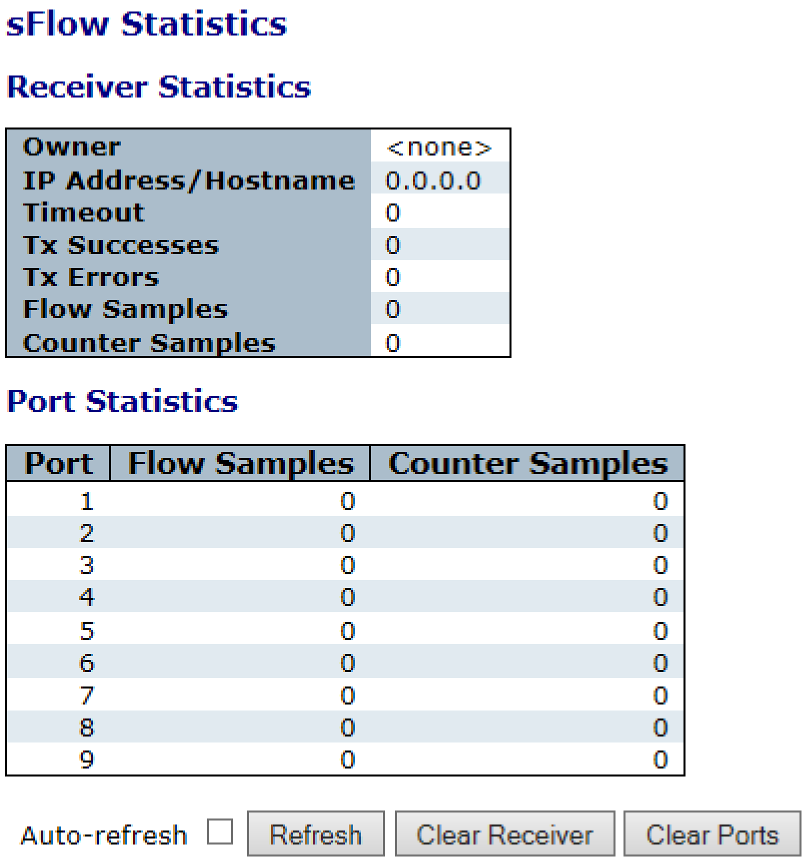


Figure 4-217: sFlow Statistics displays

Table 4-190: sFlow Statistics parameters

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 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 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 Statistics	
Port	The port number for which the statistics applies
Flow Sample	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
Buttons	**Auto-refresh** ☐ **:** Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh this section. **Clear Receiver:** Clears the sFlow receiver counters. **Clear Ports**: Clears the per-port counters.

4.31 UPnP Configuration

UPnP 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

Configure UPnP on this section.

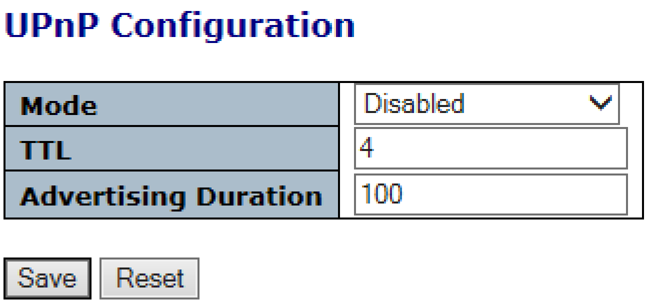


Figure 4-218: UPnP Configuration display

Table 4-191: UPnP Configuration parameters

UPnP Configuration	
Mode	Indicates the UPnP operation mode. Possible modes are: **Enabled**: Enable UPnP mode operation **Disabled**: Disable UPnP mode operation When the mode is enabled, two ACEs are added automatically to trap UPNP related packets to CPU. The ACEs are automatically removed when the mode is disabled.
TTL	The TTL value is used by UPnP to send SSDP advertisement messages Valid values are in the range 1 to 255.
Advertising Duration	The duration, carried in SSDP packets, is used to inform a control point or control points how often it or they should receive an SSDP advertisement message from this switch. If a control point does not receive any message within the duration, it will think that the switch no longer exists. Due to the unreliable nature of UDP, in the standard it is recommended that such refreshing of advertisements to be done at less than one-half of the advertising duration. In In the implementation, the switch sends SSDP messages periodically at the interval one-half of the advertising duration minus 30 seconds. Valid values are in the range 100 to 86400.
Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.32 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.

4.32.1 UDLD Port Configuration

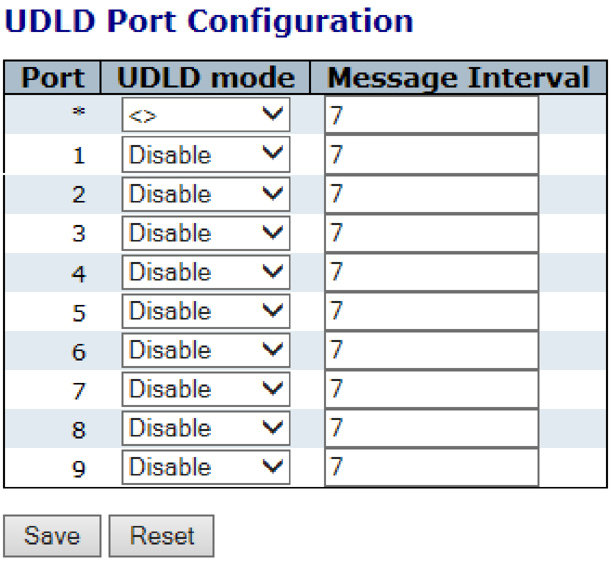


Figure 4-219: UDLD Port Configuration display

Table 4-192: 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).

Buttons	**Save**: Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values.

4.32.2 Detailed UDLD Status forPort 1

This section displays the UDLD status of the selected port

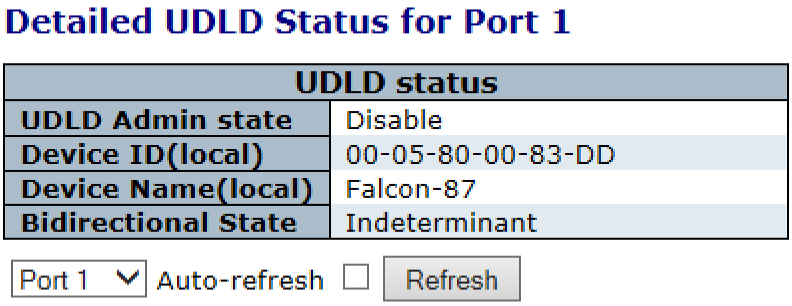


Figure 4-220: UDLD Status for Port 1

Table 4-193: UDLD Status for Port 1 parameters

Detailed UDLD Port Status	
UDLD Admin State	The current port state of the logical port, 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.
Buttons	**Auto-refresh** : Check this box to enable an automatic refresh of the page at regular intervals. **Refresh:** Click to refresh this section immediately

5 Management

5.1 General Introduction

The M-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 (150000Bd) CLI (Cisco like).

3. IEEE802.3ah: When connected to a 3rd party edge switch that supports the standard

5.1.1 System Information

This section provides general information about the system.

System Information

System	
Contact	
Name	Falcon
Location	
Hardware	
HW revision	1.2.0.2.0
Serial number	qa_test
MAC Address	00-05-80-00-83-0b
Time	
System Date	1970-01-01T02:11:51+00:00
System Uptime	0d 02:11:51
Software	
Software Version	6.4.5.11
Software Date	2016-06-28T18:00:28+03:00
Acknowledgments	Details
Firmware	
FW1 Version	5.5.6
FW2 Version	6.6

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

5.1.2 System Status

The switch system status is provided here.

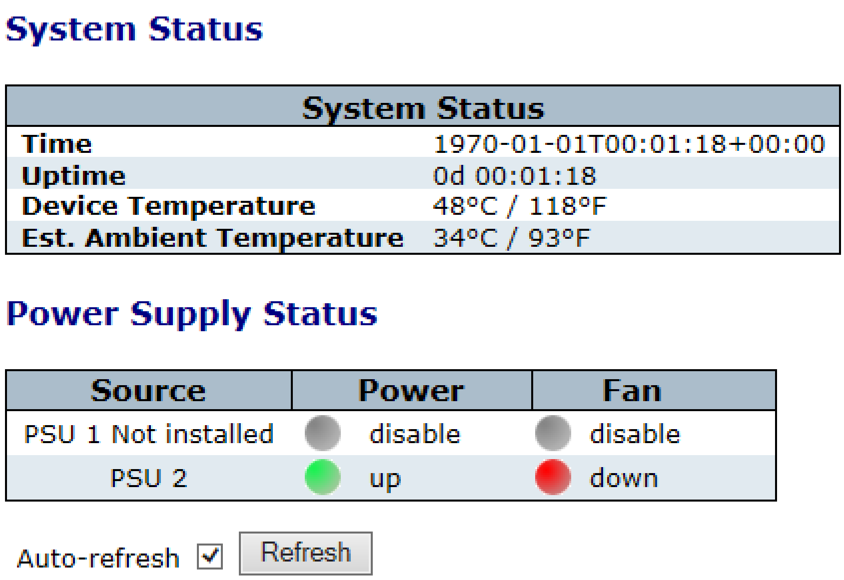


Figure 5-2: System Status

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 of time the device has been operational.
Device Temperature	. The device actual temperature.
Estimated Ambient Temperature	The estimated ambient temperature.
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)
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh**: Click to refresh the page

5.1.3 CPU Load

This section 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.

In order 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

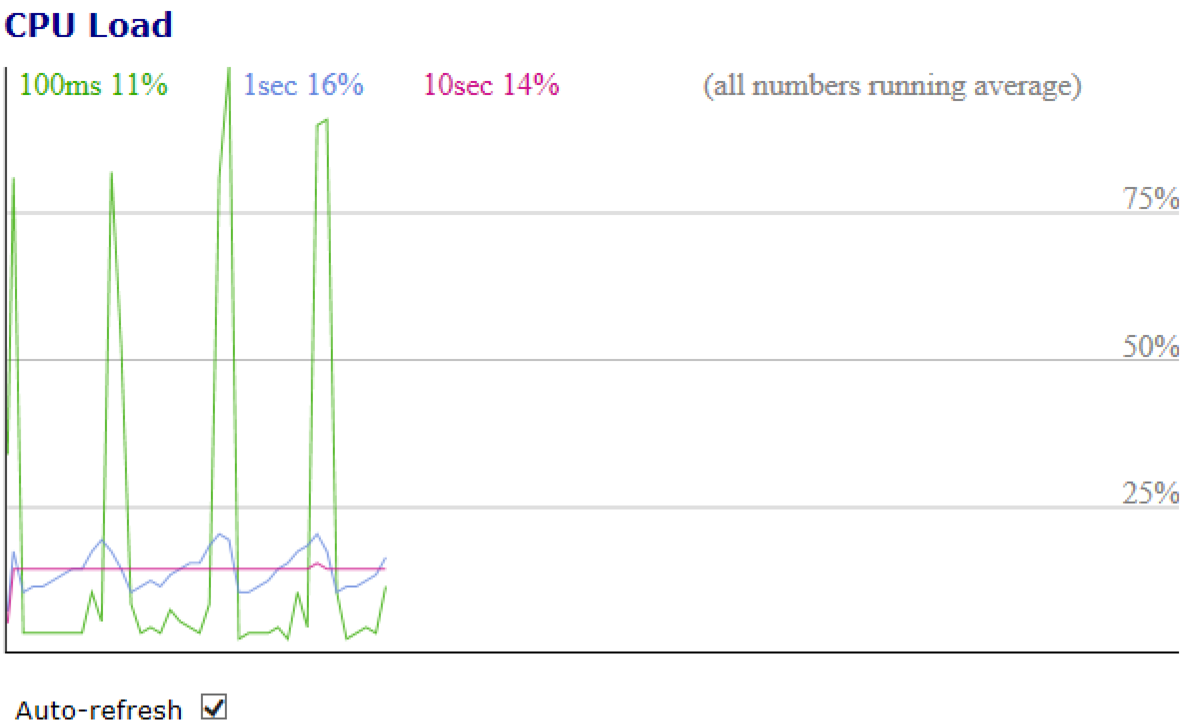
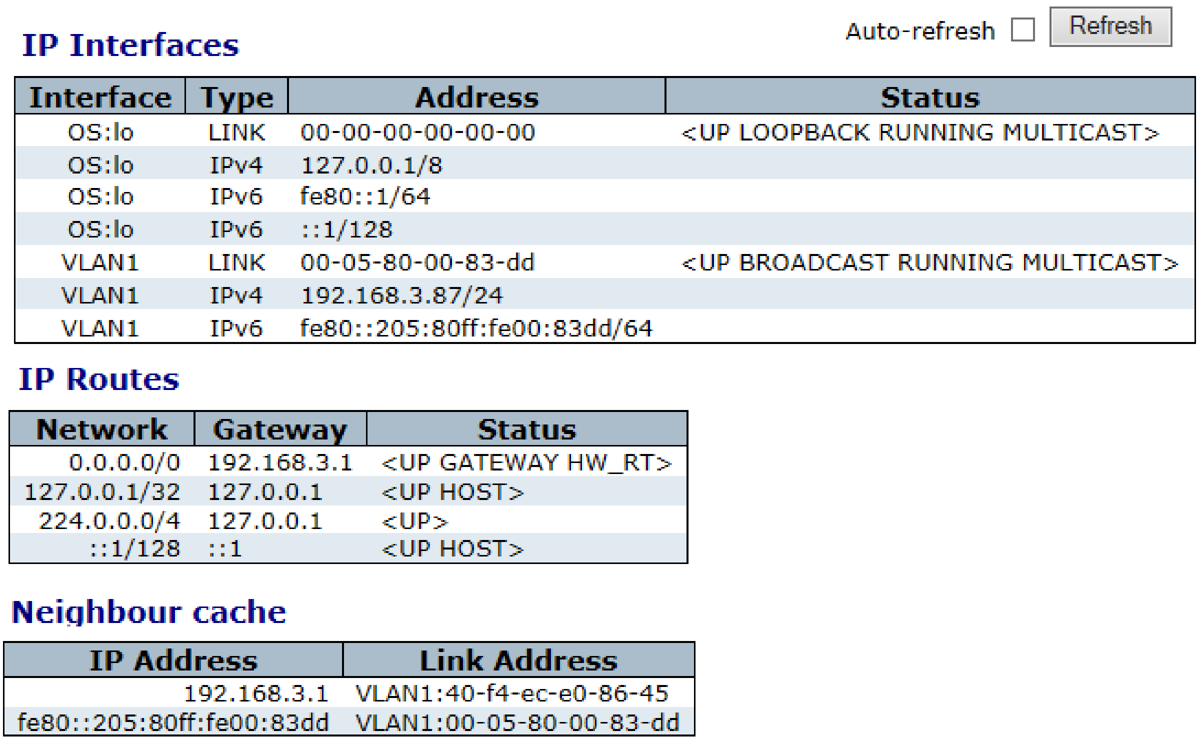


Figure 5-3: CPU Load

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

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 neighbour cache (ARP cache) status.



Auto-refresh Refresh

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

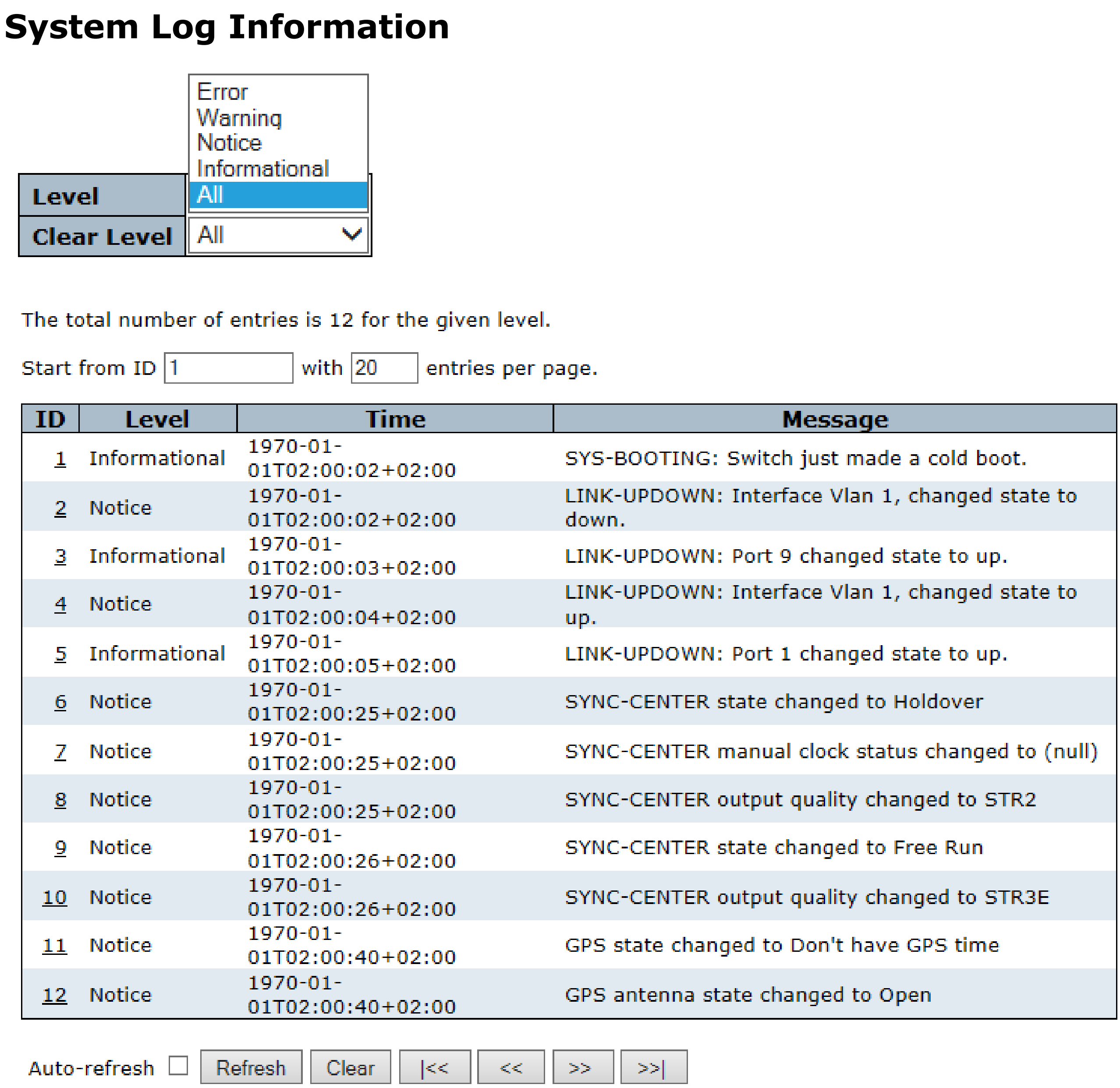
Figure 5-4: IP Status displays

Table 5-3: IP Status displays Parameters

IP Interfaces	
Interface	The name of the interface.
Type	The address type of the entry. This may be LINK or IPv4.
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.
Neighbour cache	
IP Address	The IP address of the entry Link (MAC) address for which a binding to the IP address given exist
Link Address	Link (MAC) address for which a binding to the IP address given exist.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh**: Click to refresh the page

5.1.5 System Log Information

The switch system log information is provided here.



System Log Information

Level	Error / Warning / Notice / Informational / All
Clear Level	All

The total number of entries is 12 for the given level.

Start from ID 1 with 20 entries per page.

ID	Level	Time	Message
1	Informational	1970-01-01T02:00:02+02:00	SYS-BOOTING: Switch just made a cold boot.
2	Notice	1970-01-01T02:00:02+02:00	LINK-UPDOWN: Interface Vlan 1, changed state to down.
3	Informational	1970-01-01T02:00:03+02:00	LINK-UPDOWN: Port 9 changed state to up.
4	Notice	1970-01-01T02:00:04+02:00	LINK-UPDOWN: Interface Vlan 1, changed state to up.
5	Informational	1970-01-01T02:00:05+02:00	LINK-UPDOWN: Port 1 changed state to up.
6	Notice	1970-01-01T02:00:25+02:00	SYNC-CENTER state changed to Holdover
7	Notice	1970-01-01T02:00:25+02:00	SYNC-CENTER manual clock status changed to (null)
8	Notice	1970-01-01T02:00:25+02:00	SYNC-CENTER output quality changed to STR2
9	Notice	1970-01-01T02:00:26+02:00	SYNC-CENTER state changed to Free Run
10	Notice	1970-01-01T02:00:26+02:00	SYNC-CENTER output quality changed to STR3E
11	Notice	1970-01-01T02:00:40+02:00	GPS state changed to Don't have GPS time
12	Notice	1970-01-01T02:00:40+02:00	GPS antenna state changed to Open

Auto-refresh ☐ Refresh Clear |<< << >> >>|

Figure 5-5: System log information

Table 5-4: 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. The following level types are supported: **Infol :** **Warning**: Warning level of the system log. **Error**: Error level of the system log. **Notice:**made to help the memory
Time	The occurred time of the system log entry.

<table>
<tr><td>Message</td><td>The detail message of the system log entry.</td></tr>
<tr><td>Buttons</td><td>Auto-refresh ☐ : Check this box to enable an automatic refresh of the page at regular intervals.

Refresh:
Updates the system log entries, starting from the current entry ID.

Clear:
Flushes the selected log entries.

|<<:
Updates the table entries, starting from the first available entry.

<<:
Updates the table entries, ending at the last entry currently displayed.

>>:
Updates the table entries, starting from the last entry currently displayed
.
>>|: Updates the table entries, ending at the last available entry ID.</td></tr>
<tr><td colspan="2">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</td></tr>
</table>

5.1.6 Detailed System Log Information

The switch system detailed log information is provided here

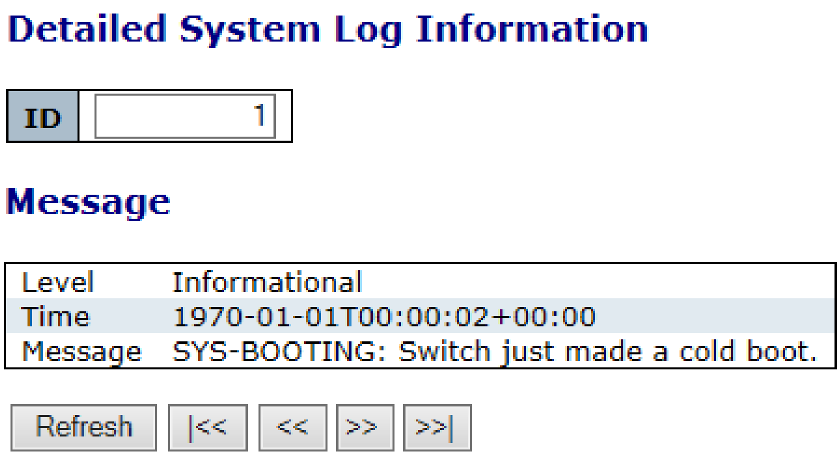


Figure 5-6: Detailed system log information

Table 5-5: 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.
Buttons	**Refresh:** Updates the system log entry to the current entry ID **|<<:** Updates the system log entry to the first available entry ID. **<<:** Updates the system log entry to the previous available entry ID **>>:** Updates the system log entry to the next available entry ID.. **>>|:** Updates the system log entry to the last available entry ID.

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

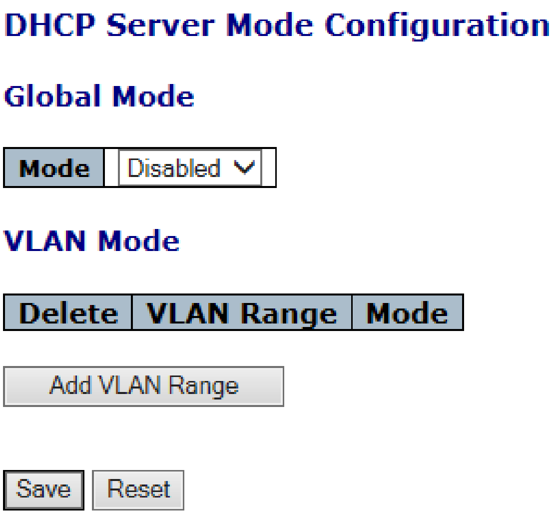


Figure 5-7: DHCP Server Mode Configuration

Table 5-6: 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.	
Delete VLAN Mode	
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.	
Indicate the operation mode per VLAN. Possible modes are: **Enabled**: Enable DHCP server per VLAN **Disabled**: Disable DHCP server pre VLAN.	
Buttons	**Save:**Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Add VLAN Range:** Click to add a new VLAN range..

5.2.2 DHCP ServerExcluded IP Configuration

This section configures excluded IP addresses. DHCP server will not allocate these excluded IP addresses to DHCP client.

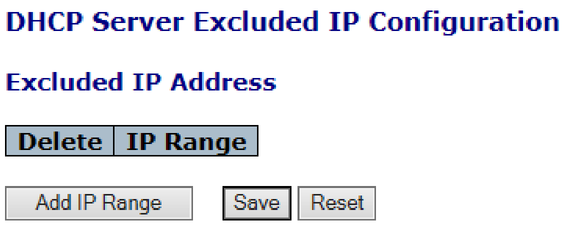


Figure 5-8: DHCP Server Excluded IP Configuration

Table 5-7: DHCP Server Excluded IP Configuration Parameters

Excluded IP Address Configure excluded IP addresses.	
Delete	Delete Excluded Ip Address opperation
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	**Save:** Click to save changes. Reset: Click to undo any changes made locally and revert to previously saved values. **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.

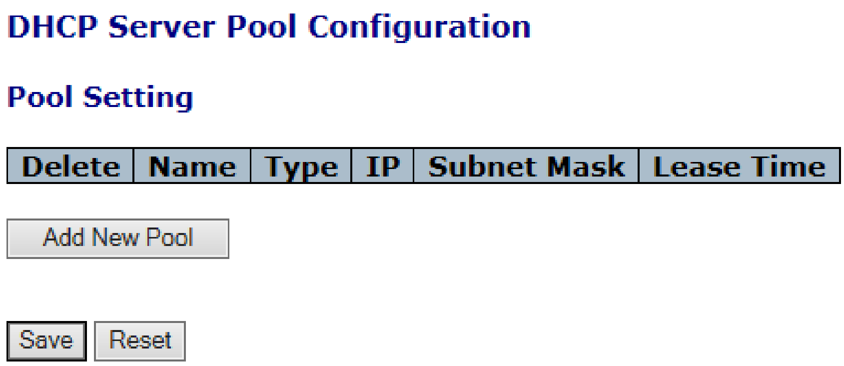


Figure 5-9: DHCP Server Pool Configuration

Table 5-8: 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.
Delete Pool Setting
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.
Display which type of the 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.
Display network number of the DHCP address pool. If "-" is displayed, it means not defined.
Display subnet mask of the DHCP address pool. If "-" is displayed, it means not defined.
Display lease time of the pool
Save: Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Add New Pool**: Click to add anew DHCP POOL

5.2.4 DHCP Snooping Configuration

Configure DHCP Snooping on this section

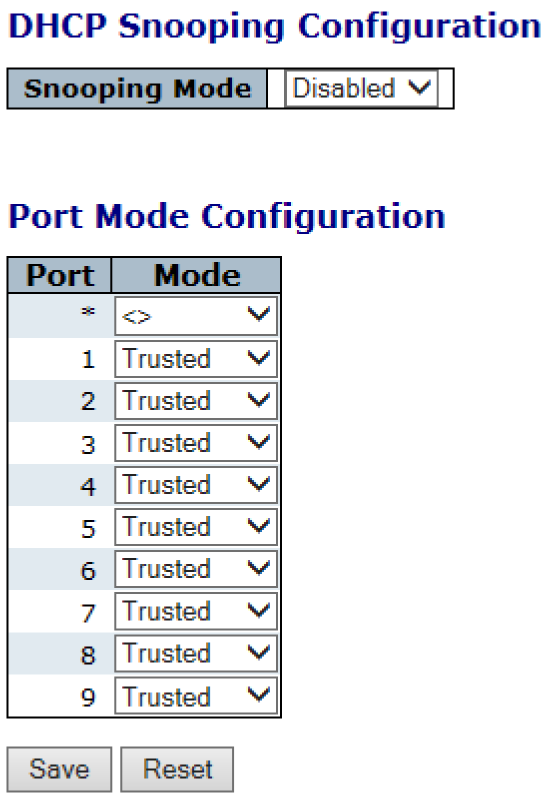


Figure 5-10: DHCP Server Pool Configuration

Table 5-9: DHCP Server Pool 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
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.2.5 Dynamic DHCP Snooping Table

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

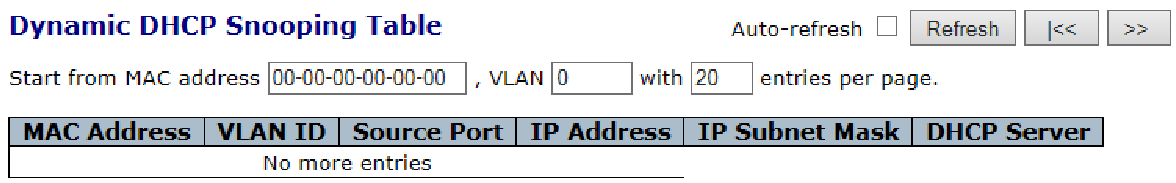


Figure 5-11: Dynamic DHCP Snooping Table

Table 5-10: 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
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Refreshes the displayed table starting from the input fields. **Clear:** Flushes all dynamic entries **|<<**: Updates the table starting from the first entry in the Dynamic DHCP snooping Table **>>:** Updates the table, starting with the entry after the last entry currently displayed.

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

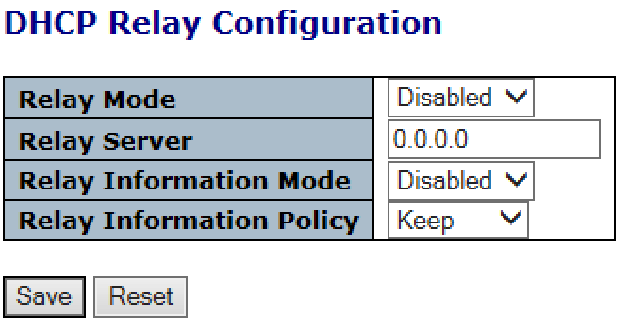


Figure 5-12: DHCP Relay Configuration

Table 5-11: 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 always equal 0, in stackable device it means switch ID).), and the last two characters are the port number. For example, "00030108" means the DHCP 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.
Buttons	**Save**: Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.2.7 DHCP Relay Statistics Configuration

M-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

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

Auto-refresh ☐ Refresh Clear

Figure 5-13: DHCP Relay Statistics

Table 5-12: 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 numberof 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	Thenumber 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.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately **Clear:** Clear all statistics.

5.2.8 DHCP Server Statistics

This section displays the database counters and the number of DHCP messages sent and received by DHCP server.

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

Auto-refresh ☐ Refresh Clear

Figure 5-14: DHCP Server Statistics

Table 5-13: DHCP Server Statistics Parameters

1. Data base Counters	
Pool	Number of pools
Excluded IP Address	Number of excluded IP address ranges
Declined IP Address	Number of declined IP addresses.
2. Binding Counters	
Automatic NumberBinding	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. of DHCP NAK messages sent.
NAK	Number of DHCP NAK messages sent.
Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Refreshes the displayed table starting from the input fields. **Clear:** Flushes all dynamic entries

5.2.9 DCHP Server Binding IP

This section displays bindings generated for DHCP clients.

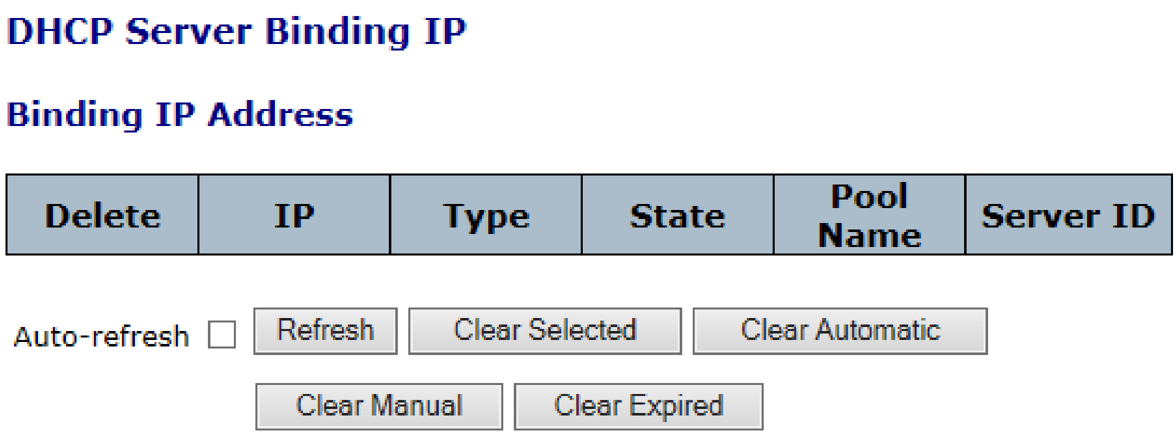


Figure 5-15: DHCP Server Binding IP

Table 5-14: 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 ID	Server IP address to service the binding.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds . **Refresh:** Refreshes the displayed table starting from the input fields. **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.

DHCP Server Declined IP

Declined IP Address

Declined IP

Auto-refresh ☐ Refresh

Figure 5-16: DHCP Server Declined IP

Table 5-15: DHCP Server Declined IP Parameters

Declined IP IP Address Display IP addresses declined by DHCP clients.	
Declined IP	List of IP addresses declined
Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every ? seconds **Refresh:** Click to refresh the page immediately

5.2.11 DHCP Detailed Statistics Port 1

This page provides statistics for DHCP snooping.

Notice that the normal forward per-port TX statistics isn't 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.

DHCP Detailed Statistics Port 1

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		

Combined | Port 1 | Auto-refresh ☐ | Refresh | Clear

Figure 5-17: DHCP Detailed Statistics Port 1

Table 5-16: 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.
Rx Discarded checksum error	The number of of discard packet that IP/UDP checksum is error.
Rx Discarded from Untrusted	The number of discarded packet that are coming from untrusted port.
Buttons	The DHCP user box determines which user is affected by clicking the buttons. The port select box determines which port is affected by clicking the buttons. **Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page immediately. **Clear:** Clears the counters for the selected port.

5.3 Green Ethernet and Thermal Protection

5.3.1 Port Power Savings Configuration

This section allows the user to configure the port power savings capability

For more info, refer to Green Ethernet Configuration

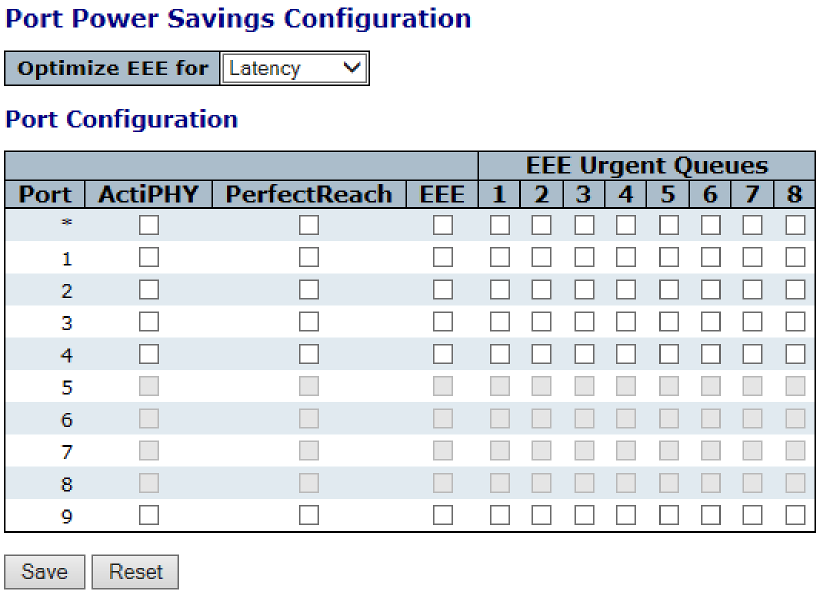


Figure 5-18: Port Power Savings Configuration display

Optimize EEE for Power or latency

The switch device can be set to optimize EEE for either best power saving or least traffic latency.

Table 5-17: Port Power Savings Configuration Parameters

Port Power Savings Configuration	
Port	The device logical port number
ActiPHY	Link down power savings mode is enabled. ActiPHY works by lowering the power for a port when there is no link. The port is power up for short moment in order to determine if cable is inserted.
PerfectReach	Cable length power savings is enabled. PerfectReach works by determining the cable length and lowering the power for ports with short cables
EEE	Controls whether EEE is enabled for this switch port. For maximizing power savings, the circuit isn't started at once when transmit data is ready for a port, but is instead queued until a burst of data is ready to be transmitted. This will give some traffic latency. If desired it is possible to minimize the latency for specific frames, by mapping the frames to a specific queue (done with QOS), and then mark the queue as an urgent queue. When an urgent queue gets data to be transmitted, the circuits will be powered up at once and the latency will be reduced to the wakeup time.
EEE Urgent Queues	Queues set will activate transmission of frames as soon as data is available. Otherwise the queue will postpone transmission until a burst of frames can be transmitted.
Buttons	**Save:** Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.3.1.1 Green Ethernet Status

This section provides the status of EEE

Shows if EEE is enabled for the port (reflects the settings at the Port Power Savings configuration page)

Port Power Savings Status

Port	Link	EEE Cap	EEE Ena	LP EEE Cap	EEE In power save	ActiPhy Savings	PerfectReach Savings
1	🔴	✓	✗	✗	✗	✗	✗
2	🔴	✓	✗	✗	✗	✗	✗
3	🟢	✓	✗	✗	✗	✗	✗
4	🔴	✓	✗	✗	✗	✗	✗
5	🔴	✗	✗	✗	✗	✗	✗
6	🔴	✗	✗	✗	✗	✗	✗
7	🔴	✓	✗	✗	✗	✗	✗
8	🔴	✓	✗	✗	✗	✗	✗
9	🔴	✗	✗	✗	✗	✗	✗
10	🔴	✗	✗	✗	✗	✗	✗

Auto-refresh ☐ Refresh

Figure 5-19: Port Power Savings Status display

Table 5-18: Port Power Savings Status Parameters

Port Power Savings Status	
Local Port	Logical port number for this row
Link	It shows if the link is enable for the poert (**green**=link, red = link down
EEE cap	It shows if the port is EEE capable
EEE Ena	Shows if EEE is enabled for the port (reflects the settings at the Port Power Savings configuration page).
LP EEE cap	Shows if the link partner has EEE capability.
EEE In power save	Shows if the system is currently saving power due to EEE. When EEE is enabled, the system is powered down if no frame has been received or transmitted in 5 uSec.
Actiphy Savings	Shows if the system is currently saving power due to ActiPhy.
PerfectReach Savings	Shows if the system is currently saving power due to PerfectReach.
Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page.

5.3.2 Thermal Protection Configuration

Each group can be given a temperature at which the corresponding ports shall be turned off. This page allows the user to inspect and configure the current setting for controlling thermal protection. Thermal protection is used to protect the chip from getting overheated.
When the temperature exceeds the configured thermal protection temperature, ports will be turned off in order to decrease the power consumption. It is possible to arrange the ports with different

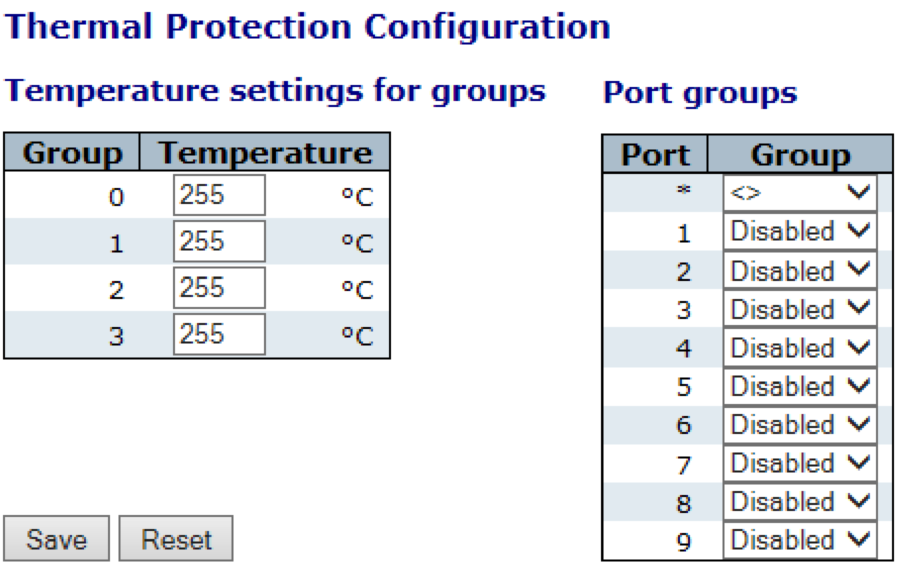


Figure 5-20: Thermal Protection Configuration display

Table 5-19: Thermal Protection Configuration Parameters

Temperature setting for groups	
The temperature at which the ports with the corresponding group will be turned off. Temperatures between 0 and 255 C are supported.	
Port groups	
The group the port belongs to. 4 groups are supported.-	
Buttons	**Save:** Click to save changes **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.3.2.1 Thermal Protection Status

This section allows the user to inspect status information related to thermal protection

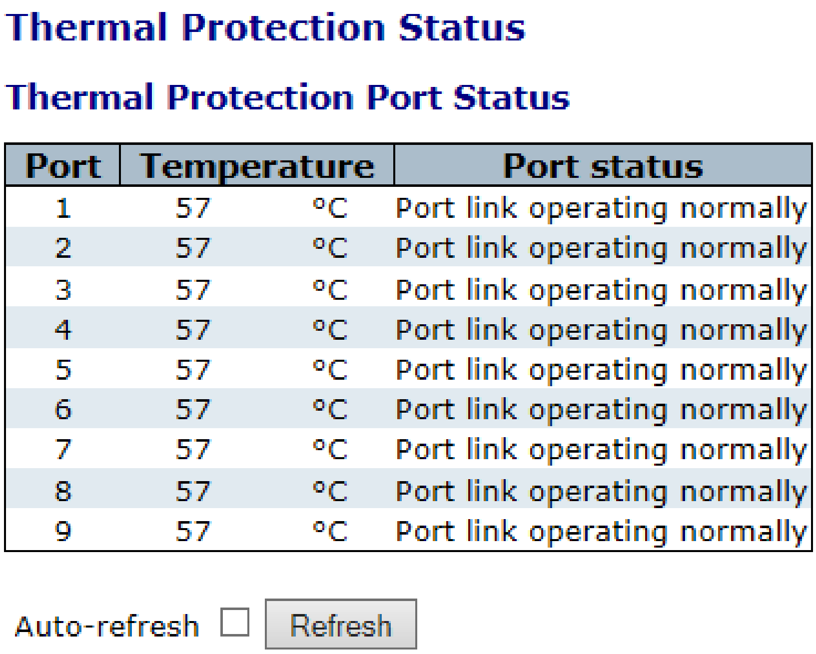


Figure 5-21: Thermal Protection Port Status display

Table 5-20: Thermal Protection Port Status Parameters

Thermal Protection Port Status	
Port	The switch port number.
Temperature	Shows the current chip temperature in degrees Celsius.
Port Status	Shows if the port is thermally protected (link is down) or if the port is operating normally.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds. **Refresh:** Click to refresh the page.

5.4 Dying Gasp Configuration

The M-Class series is capable of transmitting a dying gasp event notification when it senses loss of power. The notification can be an SNMP trap to a selected destination.
This feature is available on the device's Power Link ports:

The dying gasp feature can be configured on a per-port basis.
The Dying Gasp feature may be configured under Web management and CLI

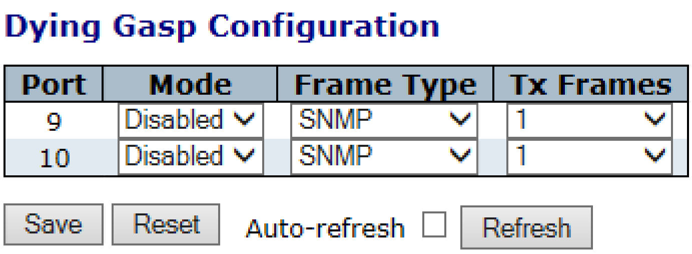


Figure 5-22: Dying Gasp Configuration

Table 5-21: Dying Gasp configuration parameters Parameters

Dying Gasp Configuration	
mode	Enable or disable dying gasp functionality for a port
Frame type	select the sending frame format during dying gasp. SNMP or Link OAM
TX frame	Indicates the number of frames to transmit during dying gasp. Tx Frames can be set between 1 to 5 frames.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds Refresh: Click to refresh the page immediately Save **:** Click to save changes Reset: Click to undo any changes made locally and revert to previously saved values.

5.5 Simple Network Management Protocol (SNMP)

M-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 Configuratio
- SNMPv3 Community Configuration
- SNMPv3 Users Configuration
- SNMPv3 Group Configuration
- SNMPv3 View Configuration
- SNMPv3 Access Configuration

5.5.1 SNMP System Configuration

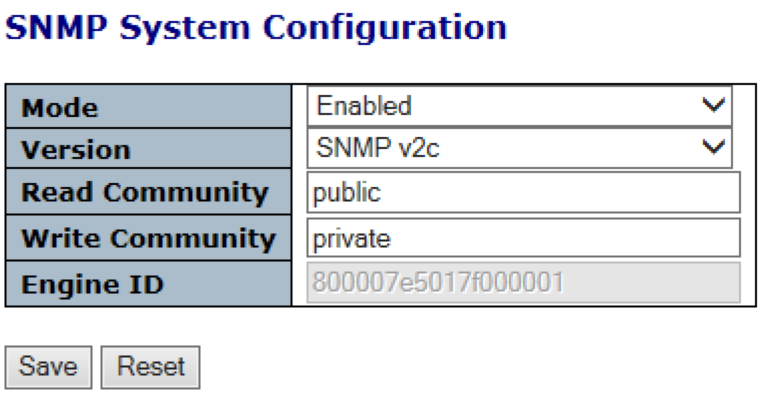


Figure 5-23: SNMP System Configuration display

Table 5-22: 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.
Version	Indicate the SNMP supported version. Possible versions are: **SNMP v1**: Set SNMP supported version 1. **SNMP v2c**: Set SNMP supported version 2c. **SNMP v3**: Set SNMP supported version 3.
Read Community	Indicates the community read access string to permit access to SNMP agent.The allowed string length is 0 to 255, and the allowed content is the ASCII characters from 33 to 126. The field is applicable only when SNMP version is SNMPv1 or SNMPv2c. If If SNMP version is SNMPv3, the community string will be associated with SNMPv3 communities table. It It provides more flexibility to configure security name than a SNMPv1 or SNMPv2c community string. In In addition to community string, a particular range of source addresses can be used to restrict source subne

Write Community	Indicates the community write access string to permit access to SNMP agent.The allowed string length is 0 to 255, and the allowed content is the ASCII characters from 33 to 126. The field is applicable only when SNMP version is SNMPv1 or SNMPv2c. If If SNMP version is SNMPv3, the community string will be associated with SNMPv3 communities table. It It provides more flexibility to configure security name than a SNMPv1 or SNMPv2c community string. In In addition to community string, a particular range of source addresses can be used to restrict source subne
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.
Buttons	**Save**: Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.2 Trap Configuration

Configure the SNMP trap on this section.

Figure 5-24: SNMP Trap Configuration display

Table 5-23: SNMP Trap Configuration Parameters

Global Settings	
Mode	Indicate the SNMP trap mode operation. Possible modes are: "**Enabled"**: Enable SNMP trap mode operation. "**Disabled**": Disable SNMP trap mode operation.
Trap Destination Configuration	
Delete	Check to delete the entry. It will be deleted during the next save.
Name	Indicates the trap Configuration's name Indicates the trap destination's name.
Enable	Indicates the trap destination 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.
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.
Buttons	**Add New Entry:** Click to add a new user. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.3 SNMPv3 Community Configuration

Configure SNMPv3 community table. The entry index key is “**Community”.**

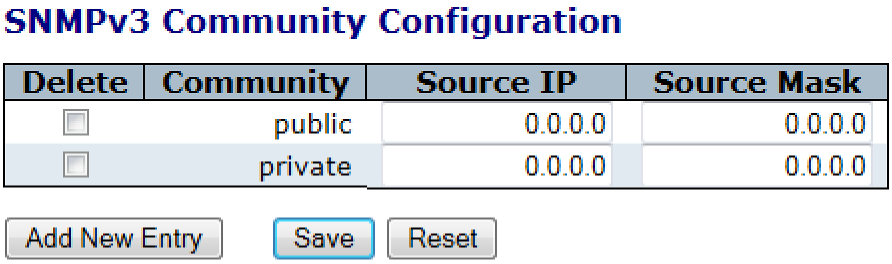


Figure 5-25: SNMPv3 Community Configuration

Table 5-24: SNMPv3 Community Configuration Parameters

Delete	Check to delete the entry. It will be deleted during the next save.
Community	Indicates the community access string to permit access to SNMPv3 agent. The allowed string length is 1 to 32, and the allowed content is the ASCII characters from 33 to 126. The community string will treat as security name and map a SNMPv1 or SNMPv2c community string.
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 mask.
Source Mask	Indicates the SNMP access source address mask.
Buttons	**Add new Entry:** Click to add a new community entry. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.4 SNMPv3 User Configuration

Configure **SNMP**v3 users table. The entry index keys are **“Engine ID”** and **“User Name”.**

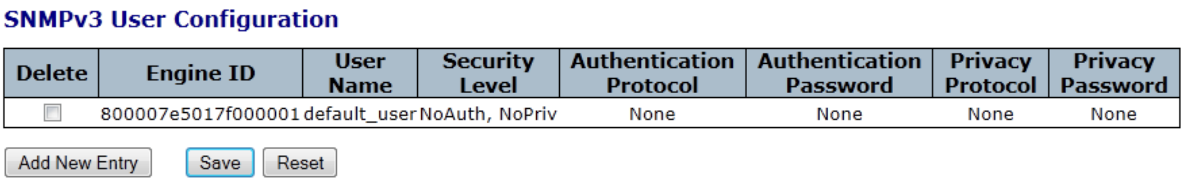


Figure 5-26: SNMPv3 User Configuration

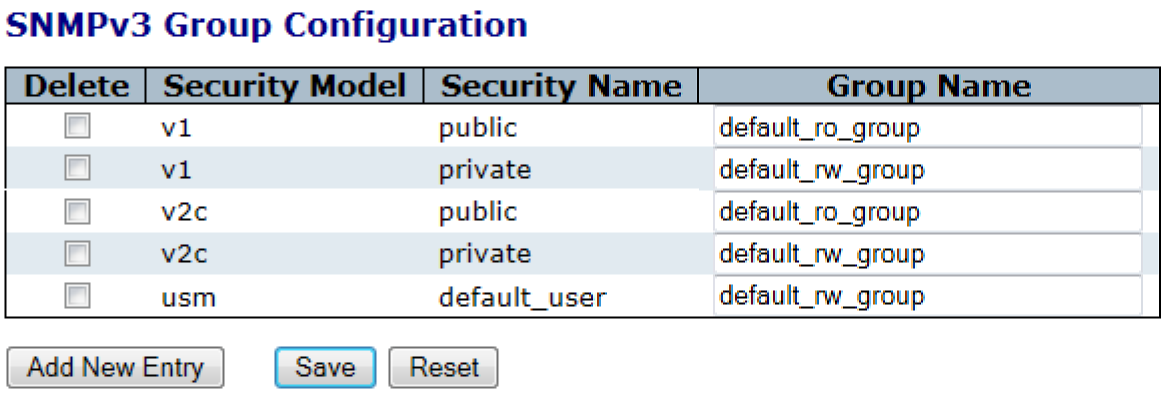
Table 5-25: SNMPv3 User Configuration Parameters

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.
User Name	A string identifying the user 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 Level	Indicates the security model that this entry should belong to. Possible security models are: **NoAuth, NoPriv:** None authentication and none privacy. **Auth, NoPriv:** Authentication and none 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 protocol 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. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.5 SNMPv3 Group Configuration

Configure **SNMPv3** groups table. The entry index keys are **"Security Model"** and **"Security Name".**


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
☐	usm	default_user	default_rw_group

Add New Entry Save Reset

Figure 5-27: SNMPv3 Group Configuration

Table 5-26: 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.
Buttons	**Add New Entry:** Click to add a new group entry. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.6 SNMPv3 View Configuration

Configure **SNMP**v3 views table. The entry index keys are **"View Name"** and "**OID Subtree"**.

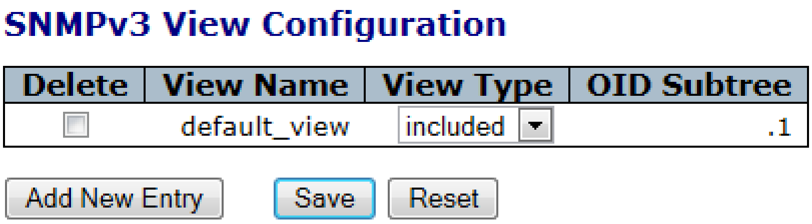


Figure 5-28: SNMPv3 View Configuration

Table 5-27: 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 are: **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 (*).
Buttons	**Add New Entry** Click to add a new view entry. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.5.7 SNMPv3 Access Configuration

Configure **SNMP**v3 accesses table. The entry index keys are "Group Name", "Security Model" and "Security Level".

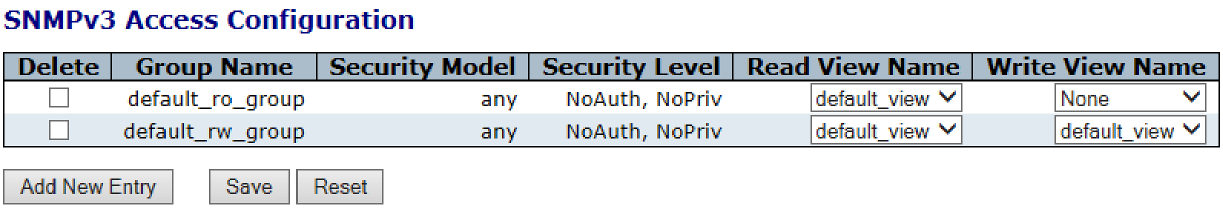


Figure 5-29: SNMPv3 Access Configuration

Table 5-28: 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:** None authentication and none privacy. **Auth, NoPriv:** Authentication and none 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.
Buttons	**Add New Entry:** Click to add a new access entry. **Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values.

5.6 Supported SNMP MIBs

The M-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 have to access Fibrolan Web site/Support section

BRIDGE-MIB.txt	FIBROLAN-SFP-MIB.mib
ENTITY-MIB.txt	FIBROLAN-SYNC-CENTER-MIB.mib
EtherLike-MIB.txt	IF-MIB.txt
FIBROLAN-ATOMIC-CLOCK-MIB.mib	LLDP-MIB.txt
FIBROLAN-COMMON-MIB.mib	Q-BRIDGE-MIB.txt
FIBROLAN-DEVICE-MIB.mib	RFC1213-MIB.txt
FIBROLAN-GPS-MIB.mib	RMON-MIB.txt

5.7 Command Line Interface (CLI)

CLI commands are used to manage the M-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 M-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 M-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 M-Class series)

The Telnet screen prompts for a username and password.

Username:moose

Password: 1234

5.7.1 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.

Link to SSH Configuration

5.7.2 HTTP Secure (HTTPS)

The M-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.

Link to HTTPS Configuration

5.8 Events Configuration

In this section, the user may change (enable/disable) the current events configuration

5.8.1 Events Configuration table

Events Configuration

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

Save | Clear All | Reset

Figure 5-30: Events Configuration

Table 5-29 Events Configuration Parameters

Events Configuration	
#	Event Index.
Event	Unique Name of the Event.
Severity	The severity level of the listed events The following lseveritytypes are supported: **Informational :** Information level of the system log. **Warning**: Warning level of the system log. **Error**: Error 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 give interface : snmp, syslog, cli.
Status	Indication whether an event occured or not .
Clear	Clear event occurred indication.
Buttons	**Save:** Click to save changes. **Reset:** Click to undo any changes made locally and revert to previously saved values. **Clear All** : Click to clear ALL event occurred indications.

5.9 Web Interface

To Access the M-Class series through the Web Browser:

- Enter the IP address of the relevant µFalcon/Falcon URL and press enter.
  The Log in prompt window displays.
- Type the user name and the password in the dialog box.
  Default Username :`moose`
  Password: `1 2 3 4`
- Click Ok

When accessing the M-Class series via the Web interface, the M-Class series Port State Overview window is displayed.Same event with the M-Class series.

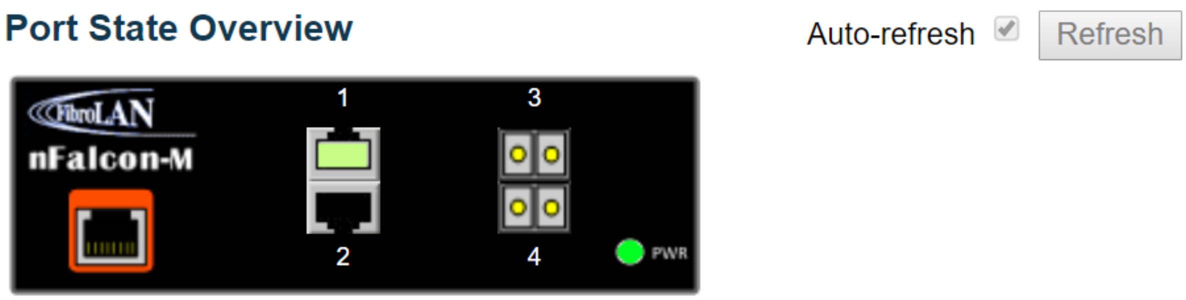
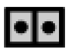
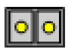
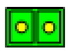


Figure 5-31: Port State Overview

Table 5-30: Port State Overview

State	Disabled	Down	Link
RJ45 ports			
SFP ports			
Buttons	**Auto-refresh** : Check this box to refresh the screen automatically. Automatic refresh occurs at regular intervals. **Refresh:** Click to refresh the screen; any changes made locally will be undone.		

The left pane of the screen shows the expandable menu tree and the right pane shows the M-Class series front panel with its port state.

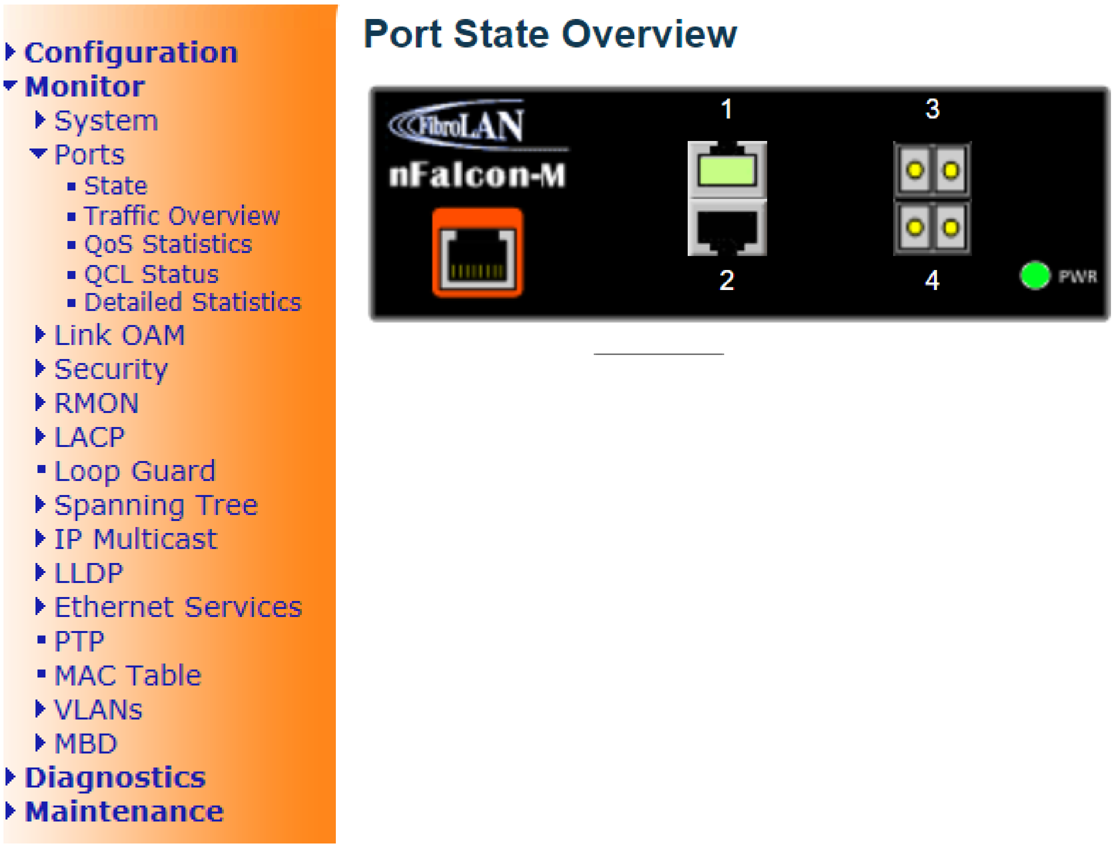


Figure 5-32: M-Class series Web management front panel overview

- Click on the top right corner  Help button to get M-Class series help screens.
- Place the cursor over a port to get information about that particular port.
- Click on a port to get detailed information about the selected port.

<u>The expandable menu tree contains four menus:</u>

1. **Configuration**
2. **Monitor**
3. **Diagnostics**
4. **Maintenance**

5.9.1 Port Configuration

The various M-Class devices ports can be configured using the procedure described in the [Port Configuration and Monitoring]

5.9.2 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

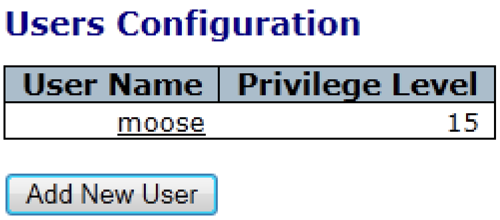


Figure 5-33: Users Configuration

Table 5-31: Users Configuration Parameters

User Name	The name identifying the user.- This is also a link to 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 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 and 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

By clicking on the “moose” word in the above Users Configuration display, you access the following display, which allows you to edit a user

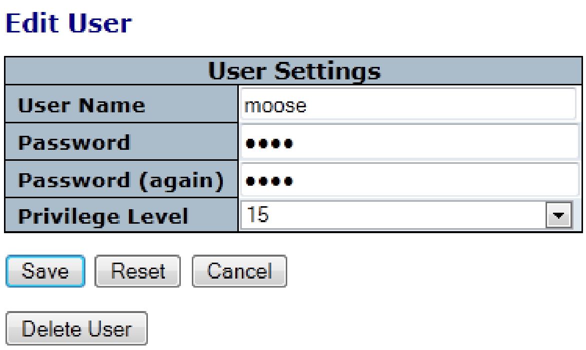


Figure 5-34: Edit User Configuration

Table 5-32: Edit Users Configuration Parameters

User Name	A string identifying the user name that this entry should belong to. The allowed string length is **1** to **31**. The valid user name 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 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 and 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	**Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **Cancel:** Click to undo any changes made locally and return to the User Configuration display **Delete User:** Delete the current user. This button is not available for new configurations (Add new user)

By clicking “Add New User” you get the: Add User” display to add a new user.

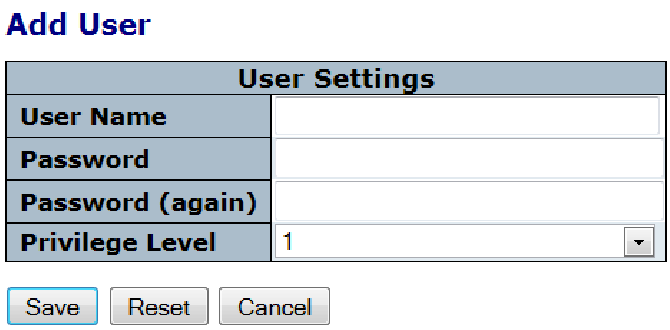


Figure 5-35: Add User Configuration

The Parameters are the same as reported in the above table

5.9.3 Authentication Method Configuration

The M-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:

Authentication Method Configuration

Client	Authentication Method	Fallback	Maximum Login Attempts
telnet	local		3
ssh	local		3
web	local		N/A
console	local		3

Save Reset

Figure 5-36: Authentication Method Configuration

To access the related setup go to: [Authentication Method Configuration]

5.9.4 Authentication Servers Configuration

This section allow the user to configure the different RADIUS Authentication Servers

To access this section, go to Authentication Server Configuration (AAA)

5.9.5 Access Management Configuration

In this section, you may configure the access management configuration

The maximum number of entries is **16**. If the application's 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

5.10 RMON Overview

The RMON Overview includes the following displays:

- RMON Alarm Overview
- RMON Event Overview
- RMON History Overview
- RMON Statistics Status Overview

5.10.1 RMON Alarm Overview

This section provides an overview of RMON Alarm entries

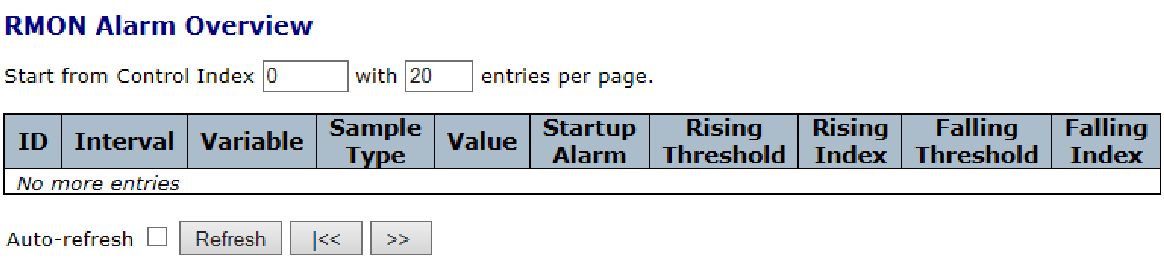


Figure 5-37: Rmon Alarm Overview

Table 5-33: 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
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately. **|<<**: Updates the the table starting from the first entry in the Alarm Table, i.e. the entry with the lowest ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

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.

5.10.2 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.

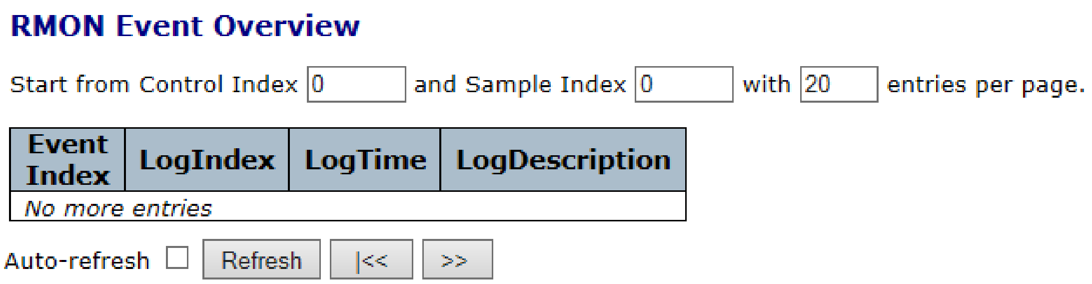


Figure 5-38: Rmon Event Overview

Table 5-34: 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

Buttons	**Auto-refresh** ☐ : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately. **<<**: Updates the the table starting from the first entry in the Alarm Table, i.e. the entry with the lowest ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

5.10.3 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.

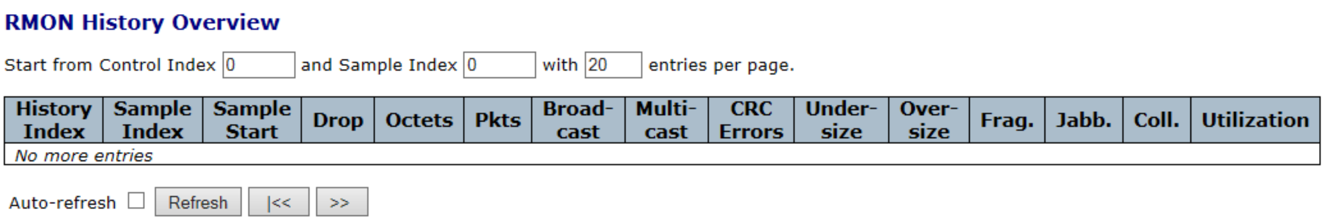


Figure 5-39: Rmon History Overview

Table 5-35: 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.
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately. **|<<**: Updates the the table starting from the first entry in the Alarm Table, i.e. the entry with the lowest ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

5.10.4 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.

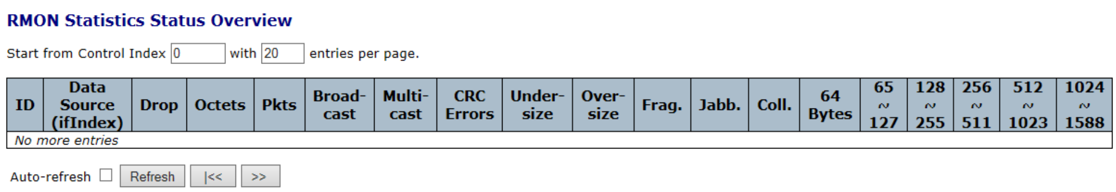


Figure 4-40: Rmon Statistics Status Overview

Table 5-36: Rmon Statistics Status Overview Parameters

RMON Statistics Status Overview	
ID	Indicates the index of History control entry.
Data Source if (Index)	The port ID which has to 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 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 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
Buttons	**Auto-refresh** : Check this box to refresh the page automatically. Automatic refresh occurs every 3 seconds **Refresh:** Click to refresh the page immediately. **|<<**: Updates the the table starting from the first entry in the Alarm Table, i.e. the entry with the lowest ID. **>>:** Updates the table, starting with the entry after the last entry currently displayed.

6 Maintenance

6.1 Diagnostics

Diagnostics include the following procedures:

- Ping
- Ping6
- Link OAM MIB Retrieval
- Copper Link Test
- RFC2544
- Falcon Report Configuration

6.1.1 ICMP Ping

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.

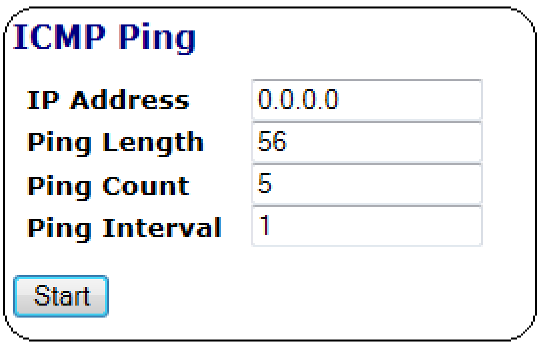


Figure 6-1: ICMP PING Configuration

6.1.2 Ping 6

M-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

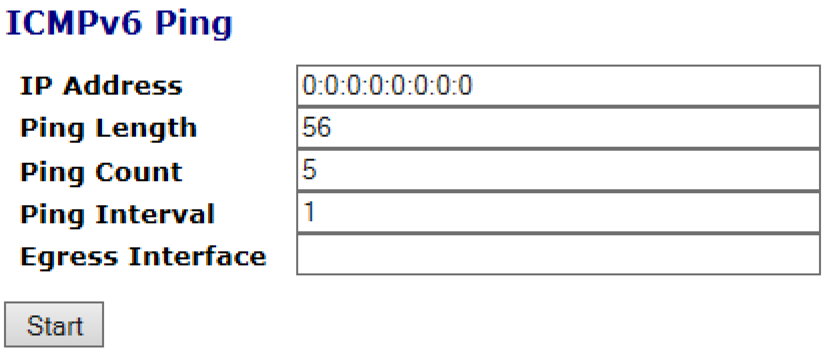


Figure 6-2: ICMPv6 PING Configuration

```
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 6-1: 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 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.
Select the appropriate radio button and enter the port number of the switch to retrieve the content of interest.

Click on **Start** to retrieve the content.
Click on **New Retrieval** to retrieve another content of interest.

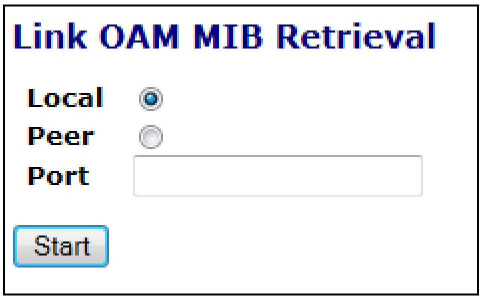
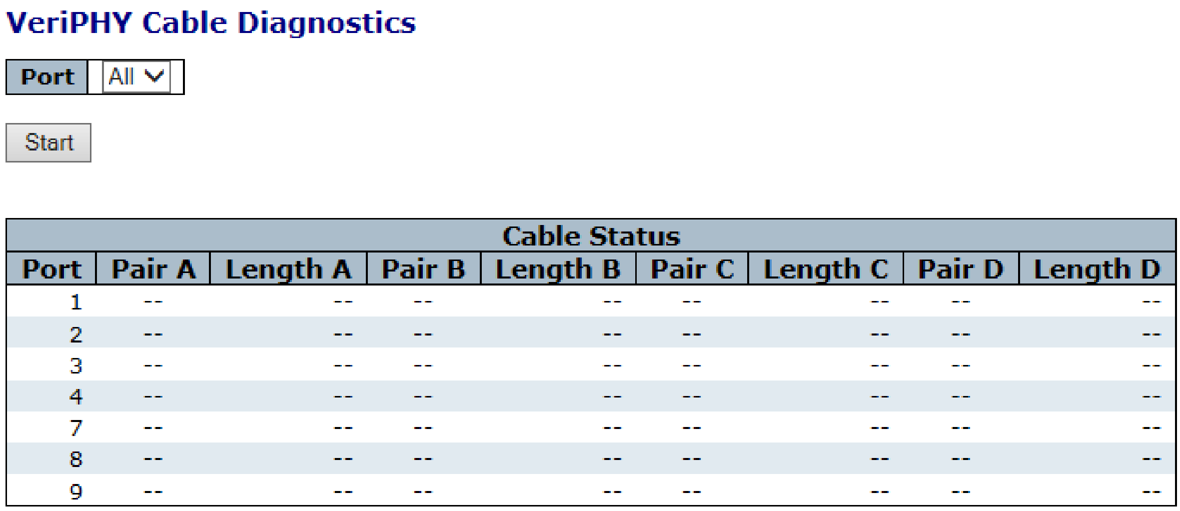


Figure 6-3 :Link OAM MIB Retrieval display

6.1.4 VeriPHY Cable Diagnostics

This section is used for running the VeriPHY Cable Diagnostics for 10/100 and 1G copper ports.



Cable Status								
Port	**Pair A**	**Length A**	**Pair B**	**Length B**	**Pair C**	**Length C**	**Pair D**	**Length D**
1	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--

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 6-2: 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

6.2 RFC2544

The Internet Engineering Task Force RFC 2544 is a benchmarking methodology for network interconnects devices
RFC 2544 provides engineers and network technicians with a common language and results format. The RFC 2544 for the current release implements the following subtests:

Throughput: measures the maximum rate at which none of the offered frames are dropped by the device/system under test

.
Frame loss: defines the percentage of frames that should have been forwarded by a network device under steady state (constant) loads that were not forwarded due to lack of resources.

Latency: measures the round-trip time taken by a test frame to travel through a network device or across the network and back to the test port. Latency is the time interval that begins when the last bit of the input frame reaches the input port and ends when the first bit of the output frame is seen on the output port. It is the time taken by a bit to go through the network and back.

CLI Commands List

Available Commands:

rfc2544 frame-loss rate

rfc2544 cycle-number

rfc2544 mac-

rfc2544 max-rate

rfc2544 min-rate

rfc2544 frame mode

rfc2544 mtu

rfc2544 pattern

rfc2544 rate-

rfc2544 resolution

rfc2544 vid

rfc2544 vlan-priority

rfc2544 trial-time

6.2.1 Test Configuration

This section allows the user to configure RFC2544 Test Parameters

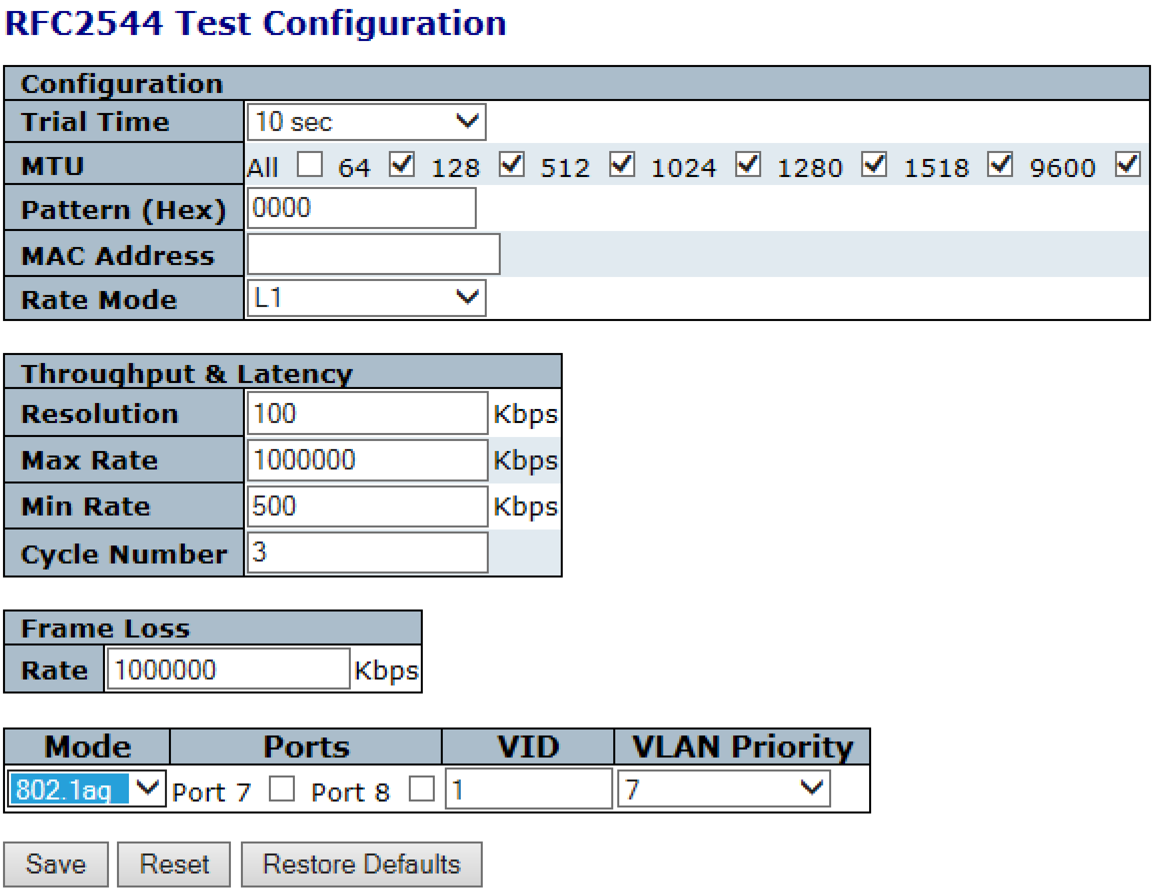


Figure 6-5: RFC2544 Test Configuration

Table 6-3: RFC2544 Test Configuration Parameters

Test Configuration	
Trial Time	Set test trial duration. Trial duration in msec/sec (100 mSec,300 mSec,500 mSec,1 sec,5 sec,10 sec,60 sec). Default: 10 sec.
MTU	Check which MTU (frame sizes) the test to run for (64, 128, 256, 512, 1024, 1280, 1518, 9600, all). Default: all
MAC Address	Set destination MAC address. Destination MAC addresses to be used in frame.
Rate Mode	You may select L1 or L2
Throughput & Latency	
Resolution	The interval of the ICMP packet. Values range from 0 second to 30 seconds.
Max Rate	Set test Max Rate to start test with. Rate in 1000 bits per second (500-1000000 kbps). Default: 1000000 Kbps.
Min Rate	Set test Min Rate to start test with. Rate in 1000 bits per second (500-1000000 Kbps). Default: 500 Kbps.
Cycle Number	The number of cycle
Frame Loss	
Rate	The rate of the frame loss
Mode	You can choose 802.1aq or Layer 2
Ports	List of output ports: port 7 or port 8.
VID	VLAN ID to run test with.
VLAN Priority	Default: 7.
Buttons	**Save:** Click to save changes. **Reset**: Click to undo any changes made locally and revert to previously saved values. **Restore Defaults**: Click to Restore Test Defaults

6.2.2 RFC2544 Test.

This section is used for running the RFC2544 Test

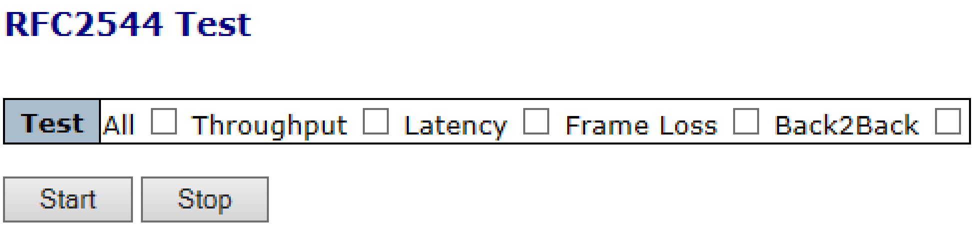


Figure 6-6: RFC2544 Test

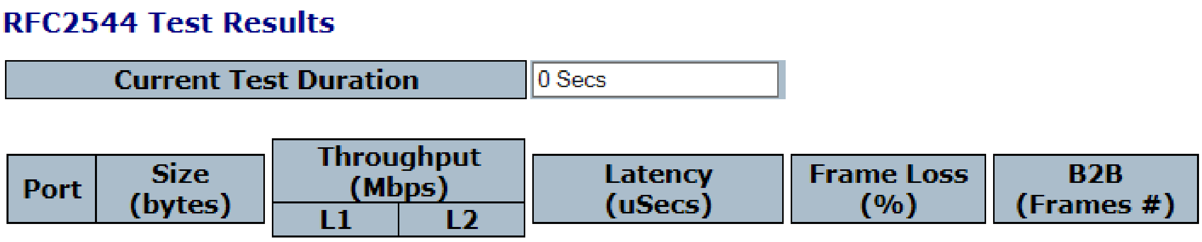


Figure 6-7: RFC2544 Test Result

Table 6-4: RFC2544 Test Parameters

RFC2544 Test	
Test	Test Type (Throughput/Latency/frame-loss/Back to Back). Default: Throughput.
RFC2544 Test Results	
Throughput Test	**Port**: Port number. **Size**: Frame Size in bytes. **Throughput**: Throughput in bps units.
Latency	**Latency result (in usec)**
Frame Loss %	**Frame Loss in percentage**
B2B (Frames #)	**B2B (Frames # result**
Buttons	**Start**: Click to Start the Test **Stop**: Click to Stop the Test.

6.3 Falcon Report Configuration

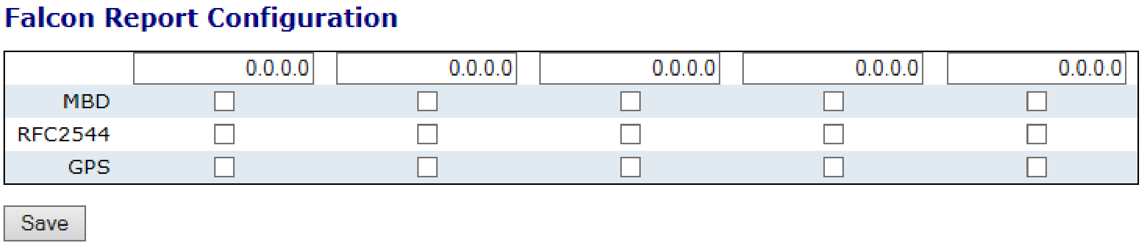


Figure 6-8: Falcon Report Configuration

Table 6-5: Falcon Report Configuration Parameters

Falcon Report Configuration	
0.0.0.0	Insert the IP of your computer in which you will receive Falcon reports (status, Test results, etc) for MDB,RFC2544 and GPS)
MBD	**Click on MBD box,you enable to receive the Micro Burst Detection Statistics in your computer**
RFC2544	**Click on RFC2544 box, you enable to receive the RFC255 Test Result** **in your computer**
GPS	**Click on GPS box,you enable to receive the GPS Status**
Buttons	**Save:** Click to save changes

6.4 Mirroring

Mirroring is a feature for switched port analyzer.The The administrator can use the Mirroring to debug network problems.
The selected traffic can be mirrored or copied on a destination port where
a network analyzer can be attached to analyze the network traffic.

Remote Mirroring is an extend function of Mirroring. It can extend the destination port in other switch.
So the administrator can analyze the network traffic on the other switches.
If you want to get the tagged mirrored traffic, you have to set VLAN egress tagging as "Tag All" on the reflector port. On the other hand, if you want to get untagged mirrored traffic, you have to set VLAN egress tagging as "Untag ALL" on the reflector port.

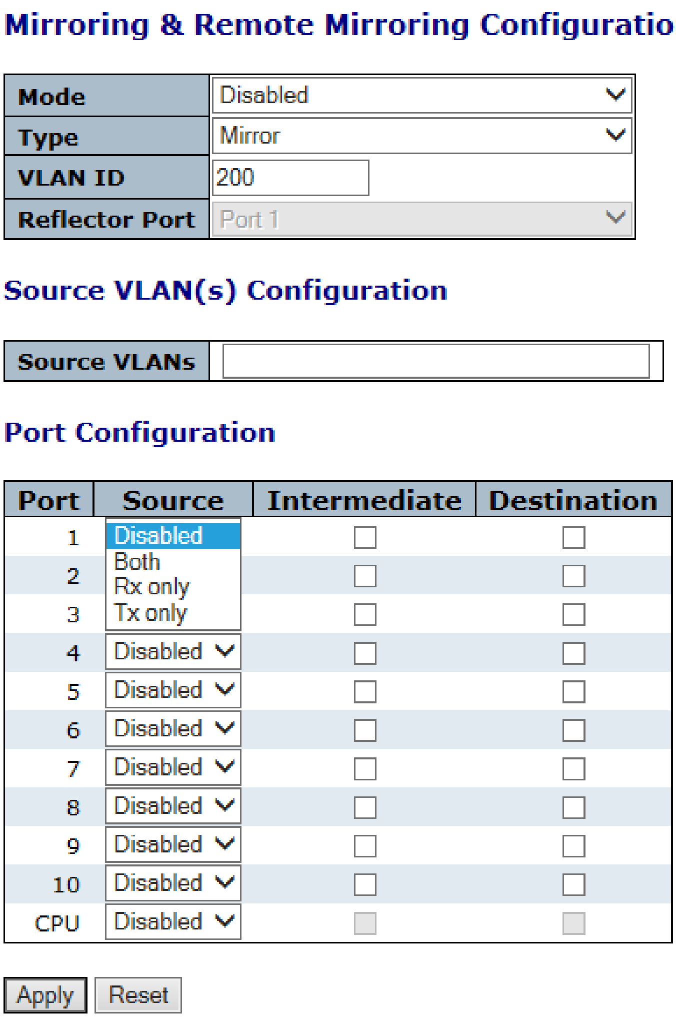


Figure 6-9: Mirroring displays

Table 6-6: Mirroring displays parameters

Mirroring & Remote Mirroring Configuration	
Mode	To **Enabled/Disabled** the mirror or Remote Mirroring function.
Type	**Mirror:** The switch is running on mirror mode. The source port(s) and destination port are located on this switch. **Source:(RMirror)** The switch is a source node for monitor flow. The source port(s), reflector port and intermediate port(s) are located on this switch **Intermediate: :(RMirror)** The switch is a forwarding node for monitor flow and the switch is an option node. The object is to forward traffic from source switch to destination switch. The intermediate ports are located on this switch. **Destination: :(RMirror)** The switch is an end node for monitor flow. The destination port(s) and intermediate port(s) are located on this switch
VLAN ID	The VLAN ID points out where the monitor packet will copy to. The default VLAN ID is 200.
Reflector port	The The **reflector port** is a method to redirect the traffic to Remote Mirroring VLAN. Any device connected to a port set as a reflector port loses connectivity until the Remote Mirroring is disabled. In the stacking mode, you need to select switch ID to select the correct device. If you shut down a port, it cannot be a candidate for **reflector port**. If you shut down the port which is a **reflector port**, the remote mirror function cannot work. **Note 1: The reflector port needs to select only on Source switch type.** **Note 2: The reflector port needs to disable MAC Table learning and STP.** **Note 3: The reflector port only supports on pure copper ports**
Source VLAN(s) Configuration	
Source VLANs	The switch can support VLAN-based Mirroring. If you want to monitor some VLANs on the switch, you can set the selected VLANs on this field. **Note 1**: **The Mirroring session shall have either ports or VLANs as sources, but not both.**
Port Configuration	
Port	The following table is used for port role selecting.

Source	Select mirror mode: **Disabled:** Neither frames transmitted nor frames received are mirrored **Both:** Frames received and frames transmitted are mirrored on the **Intermediate/Destination port** **Rx only:** Frames received on this port are mirrored on the **Intermediate/Destination port**. Frames transmitted are not mirrored **Tx only:** Frames transmitted on this port are mirrored on the **Intermediate/Destination port**. Frames received are not mirrored
Intermediate	Select Intermediate port. This checkbox is designed for Remote Mirroring The **intermediate port** is a switched port to connect to other switch. **Note: The intermediate port needs to disable MAC Table learning.**
Destination	Select destination port. This checkbox is designed for mirror or Remote Mirroring. The **destination port** is a switched port that you receive a copy of traffic from the source port. **Note 1: On mirror mode, the device only supports one destination port.** **Note 2: The destination port needs to disable MAC Table learning**
Buttons	**Reset:** Click to undo any changes made locally and revert to previously saved values. **Apply:** Click to save changes.

Configuration Guideline for All Features

When the switch is running on Remote Mirroring mode, the administrator also needs to check whether or not other features are enabled or disabled.
For example, the administrator is not disabled the MSTP on reflector port.
All monitor traffic will be blocked on reflector port
All recommended settings are described in the Home page.

6.5 Maintenance

The Maintenance includes the following procedure:

- Restart Device
- Factory Default
- System Update
- Configuration (Save/Upload)

6.5.1 Restart Device

You can restart the switch here. After restart, the switch will boot normally.

Figure 6-10: Restart Device Screen

Table 6-7: Restart Device Parameters

Yes:	Click to restart device.
No:	Click to return to the Port State page without restarting

6.5.2 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.

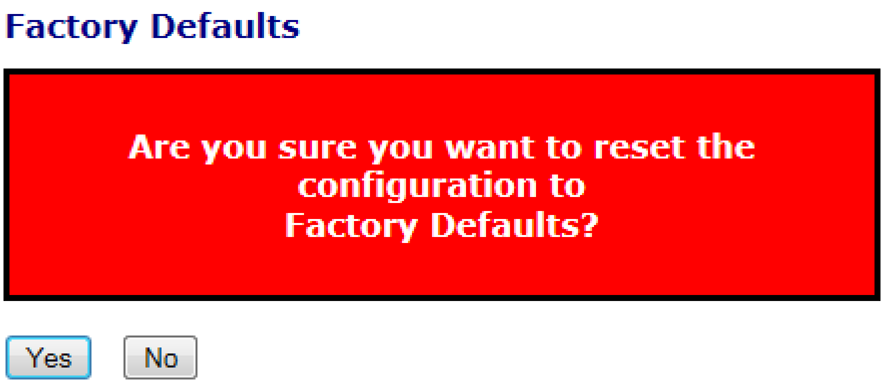


Figure 6-11: Restore to Factory Defaults Screen

Table 6-8: 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*

6.5.3 Software

This section facilitates an update of the firmware controlling the switch.

Figure 6-12: Software Upload

Table 6-9: Software Upload Parameters

Browse:	to the location of a software image and click **Upload**
After the software image is uploaded, a page announces that the firmware update is initiated. After about a minute, the 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.*

6.5.3.1 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.

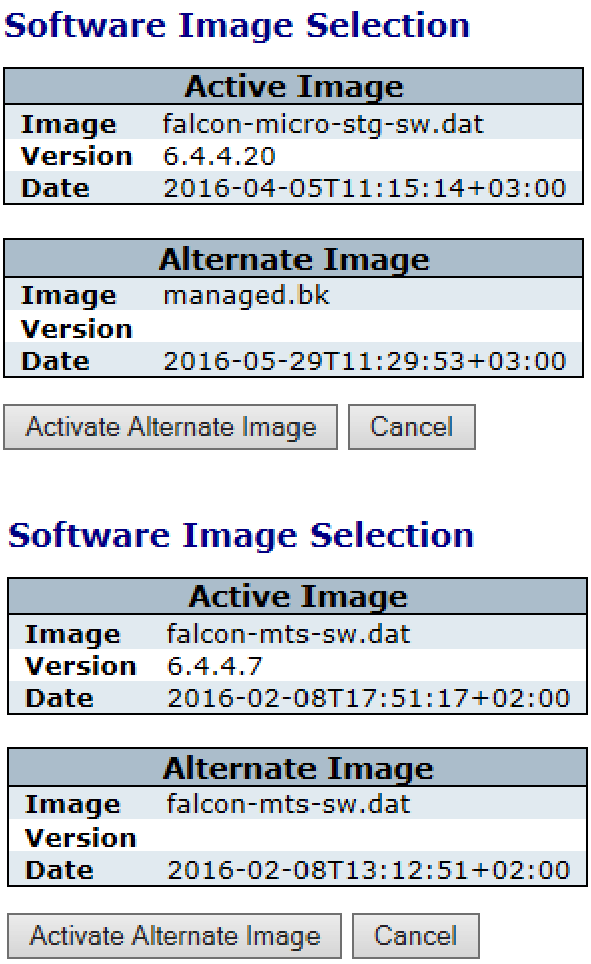


Figure 6-13: Software Image Selection

Table 6-10: 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.

6.5.4 Configuration

The switch stores its configuration in a number of 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.

6.5.4.1 Save startup configuration

This copies *running-config* to *startup-config*, thereby ensuring that the currently active configuration will be used at the next reboot.

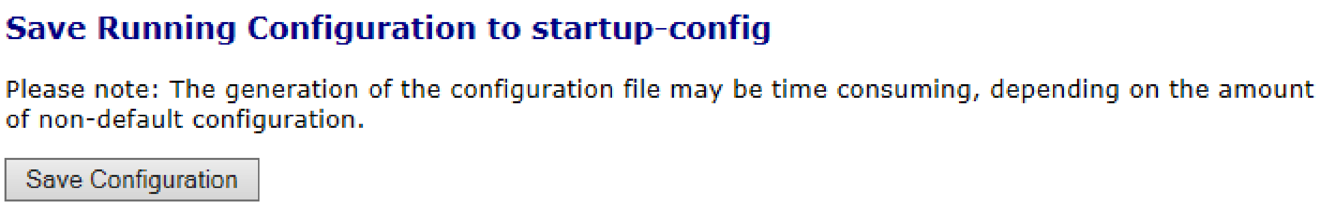


Figure 6-14: Save Configuration display

6.5.4.2 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.

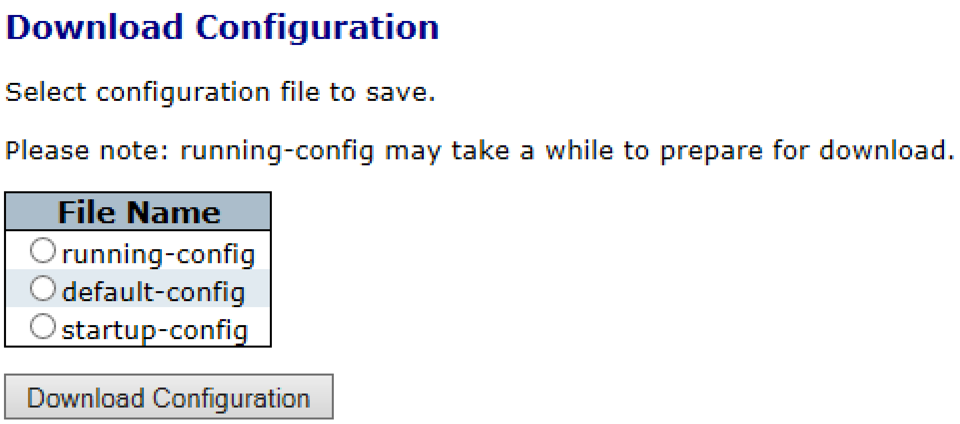


Figure 6-15: Download Configuration

6.5.4.3 Upload Configuration

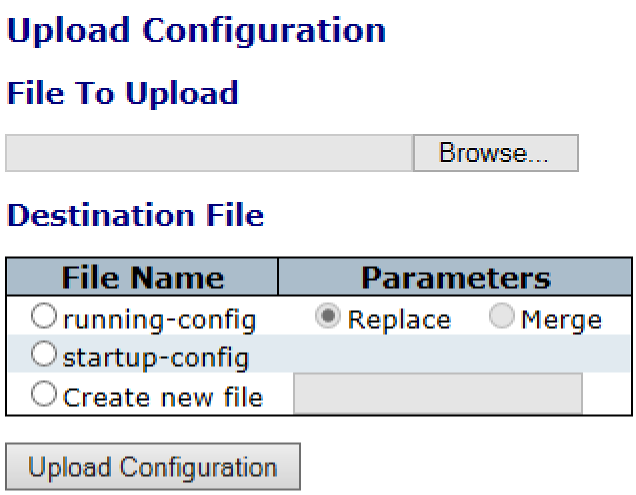


Figure 6-16: Upload Configuration

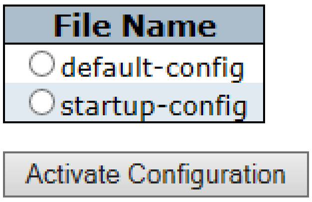
It is possible to upload a file from the web browser to all the files on the switch, except *default-config* which is read-only.
Select the file to upload, select the destination file on the target, then click **Upload.Configuration**
If the destination is *running-config*, the file will be applied to 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.

6.5.4.4 Activate

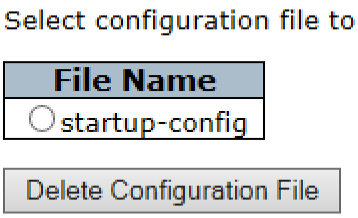
It is possible to activate any of the configuration files present on the switch, except for *running-config* which represents the currently active configuration.

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.



6.5.4.5 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.



6.6 Power Supply Overview

Warning

ONLY the Fibrolan Power Supply (AC or DC) is suitable to be used with the M-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 should it 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.

6.6.1 AC Power Supply

Connect AC line voltage using the power supply cords provided (alternatively you may use other 18AWG three wire cord). M-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.

Figure 6-17: µFalcon-MX front panel

Power LED

Figure 6-18: µFalcon-MX AC rear panel connector

6.6.2 DC Power Supplies

Connect DC line voltage using the power supply cords provided (alternatively you may use other 18AWG three wire cord). M-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.

Figure 6-19: µFalcon-MX rear panel 125VDC connector

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 6-20: µFalcon-MX 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):

µFalcon-MX
- Maximum <12W
- Typical: <10W

nFalcon-M:
- Maximum <20W
- Typical: <15W

Falcon-MX:
- Maximum <60W
- Typical: <50W

Falcon-MX device include Dual redundant, hot swappable power supplies

6.7 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:** **1. 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.** **2. 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
	PRUDENCE La radiation emise par un connecteur de fibre optique peut etre hadardeuse pour la vision humaine. En consequence, les regles suivantes doivent etre strictement observee: 1. Tout les modeles de Mode Simple (Single Mode-SM) sont PRODUIT LASER CLASS1qui peut mettre vos yeux en danger et droit etre manipule avec soin special Quand non utilise, gardez le connecteur de fibre optique ferme en utilisant sa couverture protectrice 2. Ne jamais regardez fixement et directement sur le connecteur de fibre optique d'un instrument allume au sur la terminaison d'une fibre optique raccordee a l'instrument. Ne regardez pas directement dans les cables de fibre optique au sur un transmitteur
Securite Laser	Les emissions produites par les produits decrits dans ce guide sont sous niveau d'emisiion Class 1 selon les norms IEC 60825-1 2007.Ces produits ne doivent pas installes dans un reseau optique qui opera au-dessus du niveau Class 1.

7 Warranty Information

7.1 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 month (**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.

Revision 6.4.5. Software Version 6.4.5.

8 Glossary of Terms

8.1 General Glossary of Terms

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

General Glossary of Terms

Acronym	Description
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
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

General Glossary of Terms	
Acronym	**Description**
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 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)

General Glossary of Terms

Acronym	Description
	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

General Glossary of Terms	
Acronym	**Description**
LCK	Locked Signal
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

General Glossary of Terms	
Acronym	**Description**
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
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

General Glossary of Terms

Acronym	Description
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
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

General Glossary of Terms

Acronym	Description
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	Is 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.
SSM	Synchronization Status Messages

General Glossary of Terms

Acronym	Description
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
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 Trivial File Transfer Protocol. It is transfer protocol that uses the User Datagram Protocol (UDP) and provides file writing and reading,
TLV	It 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
ToS	It 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.
TrTCM	Two rate Three Color Marker
TTL	Time To Live
TST	Test PDU
Tx	Transmit

General Glossary of Terms	
Acronym	**Description**
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

8.2 Alphabetical Glossary of Terms

ACE

ACE is an acronym for **A**ccess **C**ontrol **E**ntry. 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 **A**dvanced **E**ncryption **S**tandard. 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 **A**uto **M**edia **S**elect. 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 **A**utomatic **P**rotection **S**witching. 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 **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.

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.

C

CC

CC is an acronym for **C**ontinuity **C**heck. 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 **C**ontinuity **C**heck **M**essage. 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 **C**isco **D**iscovery **P**rotocol.

D

DEI

DEI is an acronym for **D**rop **E**ligible **I**ndicator. It is a 1-bit field in the VLAN tag.

DES

DES is an acronym for **D**ata **E**ncryption **S**tandard. 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 **D**ynamic **H**ost **C**onfiguration **P**rotocol. 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 **D**omain **N**ame **S**ystem. 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 **D**enial of **S**ervice. 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 corresponds to 'Discard Eligible' (Yellow) frames.

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.

E

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.

F

FTP

FTP is an acronym for **F**ile **T**ransfer **P**rotocol. 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.

H

HTTP

HTTP 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 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 **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.

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.

I

ICMP

ICMP is an acronym for **I**nternet **C**ontrol **M**essage **P**rotocol. 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 **I**nternet **G**roup **M**anagement **P**rotocol. 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 **I**nternet **M**essage **A**ccess **P**rotocol. 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 **I**nternet **P**rotocol. 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** **M**ulti**C**ast.

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.

L

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 **L**oss **O**f **C**onnectivity and is detected by a MEP and is indicating lost connectivity in the network. Can be used as a switch criteria byEPS

M

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 **M**aintenance **E**ntity **E**ndpoint and is an endpoint in a Maintenance Entity Group (ITU-T Y.1731).

MD5

MD5 is an acronym for **M**essage-**D**igest 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).

N

NAS

NAS is an acronym for **N**etwork **A**ccess **S**erver. 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 **Net**work **B**asic **I**nput/**O**utput **S**ystem. 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 **N**etwork **F**ile **S**ystem. 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 **N**etwork **T**ime**P**rotocol, a network protocol for synchronizing the clocks of computer systems. NTP uses UDP (datagrams) as transport layer.

O

OAM

OAM is an acronym for **O**peration **A**dministration and **M**aintenance.

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.

P

PCP

PCP is an acronym for **P**riority **C**ode **P**oint. 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 **P**owered **D**evice. 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 **P**ower **O**ver **E**thernet.

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 **P**ost **O**ffice **P**rotocol 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 **P**oint-to-**P**oint **P**rotocol **o**ver **E**thernet.

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 **P**recision **T**ime**P**rotocol, a network protocol for synchronizing the clocks of computer systems.

Q

QCE

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.

QCL

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.

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 **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.

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.

R

RARP

RARP is an acronym for **R**everse **A**ddress **R**esolution **P**rotocol. 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 **R**emote **A**uthentication **D**ial**I**n **U**ser **S**ervice. 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 **R**emote **D**efect **I**ndication. 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 ofSTP: the **R**apid **S**panning **T**ree **P**rotocol, 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.

S

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 **S**ecure **H**ash **A**lgorithm. 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 **S**imple **M**ail **T**ransfer **P**rotocol. 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 **S**imple **N**etwork **M**anagement **P**rotocol. 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 **S**imple **N**etwork **T**ime**P**rotocol, a network protocol for synchronizing the clocks of computer systems. SNTP uses UDP (datagrams) as transport layer.

SPROUT

Stack **P**rotocol using **ROU**ting **T**echnology. 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 **S**et **I**dentifier 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 **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 (Wikipedia).

SSM

SSM In SyncE this is an abbreviation for Synchronization Status Message and is containing a QL indication.

STP

Spanning **T**ree **P**rotocol 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 **F**low. 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.

T

TACACS+

TACACS+ is an acronym for **T**erminal **A**cess **C**ontroller **A**ccess**C**ontrol **S**ystem **P**lus. 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 **T**ransmission **C**ontrol **P**rotocol. 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 **TEL**etype **NET**work. 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 **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, but it does not provide directory service and security features.

ToS

ToS 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. 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 **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.

TKIP

TKIP is an acronym for **T**emporal **K**ey **I**ntegrity **P**rotocol. 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 **U**ser **D**atagram **P**rotocol. 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 doesn't 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 **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

User Priority

User Priority is a 3-bit field storing the priority level for the 802.1Q frame. It is also known as PCP.

V

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.

W

WEP

WEP is an acronym for **W**ired **E**quivalent **P**rivacy. 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 **Wi**reless **Fi**delity. 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 **W**i-Fi **P**rotected **A**ccess. 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 **W**i-Fi **P**rotected **A**ccess - **P**re **S**hared **K**ey. 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 **W**i-Fi **P**rotected **A**ccess - 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 **W**i-Fi **P**rotected **S**etup. 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 **W**eighted **R**andom **E**arly **D**etection. 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 **W**ait **T**o **R**estore. This is the time

Intl. Headquarters

Fibrolan Ltd.
Tel: +972-4-959-1717
Fax: +972-4-959-1718
info@fibrolan.com
www.fibrolan.com

North America

Fibrolan Inc.
Tel: +1-201-843-1626
Fax: +1-201-843-1628
us.info@fibrolan.com
www.fibrolan.com

Central-Eastern Europe

Fibrolan CEE GmbH.
Tel: +43-2622-90-990-0
Fax: +43-2622-90-990-99
office@fibrolan.at
www.fibrolan.at