D-Link™ DGS-3312SR

12-Port Gigabit Layer 3 Stackable Switch

Release III

Manual

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RECYCLABLE

Information in this document is subject to change without notice.

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Table of Contents

About This Manual

This manual is divided into ten general sections:

Section 1, Introduction - Describes the Switch's hardware and its features.

Section 2, Installation- Helps you get started with the basic installation of the Switch and also describes the front panel, rear panel, side panels, and LED indicators of the Switch.

Section 3, Basic Management - Tells how you can connect the Switch to your Ethernet network.

Section 4, Basic Configuration - A detailed discussion about configuring some of the basic functions of the Switch, including accessing the Switch information, using the Switch's utilities and setting up network configurations, such as Quality of Service, The Access Profile Table, port mirroring and configuring the Spanning Tree.

Section 5, Layer 3 IP Networking - Talks about configuration of the Layer 3 networking functions of the Switch including RIP, OSPF, VRRP, DVMRP and PIM.

Section 6, Management - A discussion of the security features of the Switch, including Security IP, User Accounts, Access Authentication Control, SSH and SSL.

Section 7, Management – A detailed discussion regarding User Accounts and the Simple Network Monitoring Protocol including description of features and a brief introduction to SNMP.

Section 8, Monitoring - Features graphs and screens used in monitoring features and packets on the Switch.

Section 9, Maintenance - Features information on Switch utility functions, including TFTP Services, Switch History, Ping Test Save Changes and Rebooting Services.

Section 10, Single IP Management - Discussion on the Single IP Management function of the Switch, including functions and features of the Java based user interface and the utilities of the SIM function.

Intended Readers

The DGS-3312SR Manual contains information useful for setup and management and of the DGS-3312SR Switch. This manual is intended for network managers familiar with network management concepts and terminology.

Typographical Conventions

Convention	Description
[ ]	In a command line, square brackets indicate an optional entry. For example: [copy filename] means that optionally you can type copy followed by the name of the file. Do not type the brackets.
Bold font	Indicates a button, a toolbar icon, menu, or menu item. For example: Open the **File** menu and choose **Cancel**. Used for emphasis. May also indicate system messages or prompts appearing on your screen. For example: **You have mail**. Bold font is also used to represent filenames, program names and commands. For example: use the **copy** command.
`Boldface Typewriter Font`	Indicates commands and responses to prompts that must be typed exactly as printed in the manual.
Initial capital letter	Indicates a window name. Names of keys on the keyboard have initial capitals. For example: Click Enter.
Italics	Indicates a window name or a field. Also can indicate a variables or parameter that is replaced with an appropriate word or string. For example: type *filename* means that you should type the actual filename instead of the word shown in italic.
Menu Name > Menu Option	**Menu Name > Menu Option** indicates the menu structure. **Device > Port > Port Properties** means the Port Properties menu option under the Port menu option that is located under the Device menu.

Notes, Notices, and Cautions

A **NOTE** indicates important information that helps you make better use of your device.

A **NOTICE** indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

A **CAUTION** indicates a potential for property damage, personal injury, or death.

Safety Instructions

Use the following safety guidelines to ensure your own personal safety and to help protect your system from potential damage. Throughout this safety section, the caution icon is (⚠) used to indicate cautions and precautions that you need to review and follow.

Safety Cautions

To reduce the risk of bodily injury, electrical shock, fire, and damage to the equipment, observe the following precautions.

- Observe and follow service markings.
  - Do not service any product except as explained in your system documentation.
  - Opening or removing covers that are marked with the triangular symbol with a lightning bolt may expose you to electrical shock.
  - Only a trained service technician should service components inside these compartments.
- If any of the following conditions occur, unplug the product from the electrical outlet and replace the part or contact your trained service provider:
  - The power cable, extension cable, or plug is damaged.
  - An object has fallen into the product.
  - The product has been exposed to water.
  - The product has been dropped or damaged.
  - The product does not operate correctly when you follow the operating instructions.
- Keep your system away from radiators and heat sources. Also, do not block cooling vents.
- Do not spill food or liquids on your system components, and never operate the product in a wet environment. If the system gets wet, see the appropriate section in your troubleshooting guide or contact your trained service provider.

- Do not push any objects into the openings of your system. Doing so can cause fire or electric shock by shorting out interior components.
- Use the product only with approved equipment.
- Allow the product to cool before removing covers or touching internal components.
- Operate the product only from the type of external power source indicated on the electrical ratings label. If you are not sure of the type of power source required, consult your service provider or local power company.
- To help avoid damaging your system, be sure the voltage selection switch (if provided) on the power supply is set to match the power available at your location:
    - 115 volts (V)/60 hertz (Hz) in most of North and South America and some Far Eastern countries such as South Korea and Taiwan
    - 100 V/50 Hz in eastern Japan and 100 V/60 Hz in western Japan
    - 230 V/50 Hz in most of Europe, the Middle East, and the Far East
- Also, be sure that attached devices are electrically rated to operate with the power available in your location.
- Use only approved power cable(s). If you have not been provided with a power cable for your system or for any AC-powered option intended for your system, purchase a power cable that is approved for use in your country. The power cable must be rated for the product and for the voltage and current marked on the product's electrical ratings label. The voltage and current rating of the cable should be greater than the ratings marked on the product.
- To help prevent electric shock, plug the system and peripheral power cables into properly grounded electrical outlets. These cables are equipped with three-prong plugs to help ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable. If you must use an extension cable, use a 3-wire cable with properly grounded plugs.
- Observe extension cable and power strip ratings. Make sure that the total ampere rating of all products plugged into the extension cable or power strip does not exceed 80 percent of the ampere ratings limit for the extension cable or power strip.
- To help protect your system from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner, or uninterruptible power supply (UPS).
- Position system cables and power cables carefully; route cables so that they cannot be stepped on or tripped over. Be sure that nothing rests on any cables.
- Do not modify power cables or plugs. Consult a licensed electrician or your power company for site modifications. Always follow your local/national wiring rules.
- When connecting or disconnecting power to hot-pluggable power supplies, if offered with your system, observe the following guidelines:
    - Install the power supply before connecting the power cable to the power supply.
    - Unplug the power cable before removing the power supply.
    - If the system has multiple sources of power, disconnect power from the system by unplugging all power cables from the power supplies.
- Move products with care; ensure that all casters and/or stabilizers are firmly connected to the system. Avoid sudden stops and uneven surfaces.

General Precautions for Rack-Mountable Products

Observe the following precautions for rack stability and safety. Also, refer to the rack installation documentation accompanying the system and the rack for specific caution statements and procedures.

- Systems are considered to be components in a rack. Thus, "component" refers to any system as well as to various peripherals or supporting hardware.

CAUTION: Installing systems in a rack without the front and side stabilizers installed could cause the rack to tip over, potentially resulting in bodily injury under certain circumstances. Therefore, always install the stabilizers before installing components in the rack. After installing system/components in a rack, never pull more than one component out of the rack on its slide assemblies at one time. The weight of more than one extended component could cause the rack to tip over and may result in serious injury.

- Before working on the rack, make sure that the stabilizers are secured to the rack, extended to the floor, and that the full weight of the rack rests on the floor. Install front and side stabilizers on a single rack or front stabilizers for joined multiple racks before working on the rack.
- Always load the rack from the bottom up, and load the heaviest item in the rack first.
- Make sure that the rack is level and stable before extending a component from the rack.
- Use caution when pressing the component rail release latches and sliding a component into or out of a rack; the slide rails can pinch your fingers.
- After a component is inserted into the rack, carefully extend the rail into a locking position, and then slide the component into the rack.
- Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.
- Ensure that proper airflow is provided to components in the rack.
- Do not step on or stand on any component when servicing other components in a rack.

NOTE: A qualified electrician must perform all connections to DC power and to safety grounds. All electrical wiring must comply with applicable local or national codes and practices.

CAUTION: Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

CAUTION: The system chassis must be positively grounded to the rack cabinet frame. Do not attempt to connect power to the system until grounding cables are connected. Completed power and safety ground wiring must be inspected by a qualified electrical inspector. An energy hazard will exist if the safety ground cable is omitted or disconnected.

Protecting Against Electrostatic Discharge

Static electricity can harm delicate components inside your system. To prevent static damage, discharge static electricity from your body before you touch any of the electronic components, such as the microprocessor. You can do so by periodically touching an unpainted metal surface on the chassis.

You can also take the following steps to prevent damage from electrostatic discharge (ESD):

1. When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until you are ready to install the component in your system. Just before unwrapping the antistatic packaging, be sure to discharge static electricity from your body.
2. When transporting a sensitive component, first place it in an antistatic container or packaging.
3. Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads, workbench pads and an antistatic grounding strap.

Section 1

Introduction

Switch Description

The DGS-3312SR is a modular Gigabit Ethernet backbone Switch designed for adaptability and scalability. The Switch provides a management platform and uplink to backbone for a stacked group of up to twelve DES-3226S or DES-3250TG switches in a star topology arrangement. Alternatively, the Switch can utilize up to twelve Gigabit Ethernet ports to function as a central distribution hub for other Switches or Switch groups, or routers. The four built-in combination Gigabit ports have the option of being used as either 1000BASE-T or SFP Gigabit connections.

Features

- Four built-in combination 10/100/1000BASE-T/SFP ports
- Two additional 4-port modules can be added to stack up to eight additional Switches (IEEE 1394) or up to eight additional Gigabit Ethernet ports (1000BASE-T or SFP) or use combination of stacking and Gigabit Ethernet ports.
- Star topology Switch stacking configuration for up to 12 additional DES-3226S/DES-3250TG Switches.
- 24 Gbps Switching fabric capacity
- Supports 802.1D STP, 802.1w Rapid Spanning Tree and 802.1s MSTP for redundant back up bridge paths
- Supports 802.1Q VLAN
- Supports IGMP snooping
- Supports 802.1p Priority Queues
- Supports 802.3ad LACP Link Aggregation
- Supports port mirroring
- Access Control Profile (ACL)
- Multi-layer Access Control (based on MAC address, IP address, VLAN, Protocol, 802.1p, DSCP)
- Quality of Service (QoS) customized control
- Port Security (MAC address table lock)
- 802.1x (port-based and MAC-based) access control and RADIUS Client support
- Administrator-definable port security

- Per-port bandwidth control
- Broadcast, Multicast and DLF storm control
- IEEE 802.3z and IEEE 802.3x compliant Flow Control for all Gigabit ports
- SNMP v.1, v.2, v.3 network management, RMON support
- Supports optional external Redundant Power Supply
- Supports Web-based management.
- Supports CLI management.
- Supports BOOTP/DHCP/DNS Relay
- Supports TFTP upgrade
- Supports System Log
- Fully configurable either in-band or out-of-band control via RS-232 console serial connection.
- Telnet remote control console
- Traffic Segmentation
- Simple Network Time Protocol
- MAC address update notification
- Web GUI Traffic Monitoring
- Supports RIP v1, v2
- Supports OSPF
- Supports PIM-DM
- Supports DVMRP
- Supports IGMP
- Supports VRRP
- Supports floating static route
- Supports SSL
- Supports SSH
- Supports Single IP Management v.1.0
- Supports RADIUS Authentication
- Supports TACACS, TACACS+, and XTACACS

Front-Panel Components

The front panel of the Switch consists of LED indicators, an RS-232 communication port, two slide-in module slots, and four 1000BASE-T/SFP combo ports.

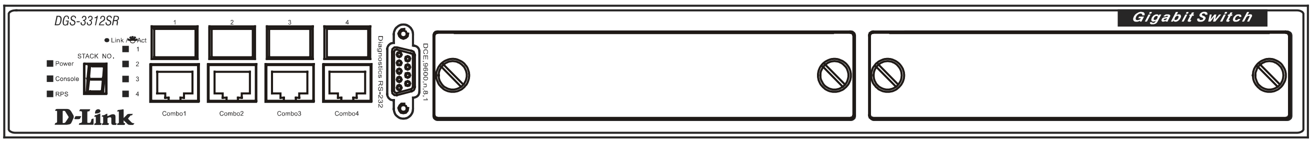


Figure 1- 1. Front Panel View of the Switch as shipped (no modules are installed)

Comprehensive LED indicators display the status of the Switch and the network.

An RS-232 DCE console port for setting up and managing the Switch via a connection to a console terminal or PC using a terminal emulation program.

A front-panel slide-in module slot for Gigabit Ethernet ports can accommodate a 4-port 1000BASE-T Gigabit Ethernet module, a 4-port Gigabit Ethernet SFP module, or a stacking module to connect to four DES-3226S/DES-3250TG Switches.

LED Indicators

The LED indicators of the Switch include Power, Console, and Link/Act. The following shows the LED indicators for the Switch along with an explanation of each indicator.

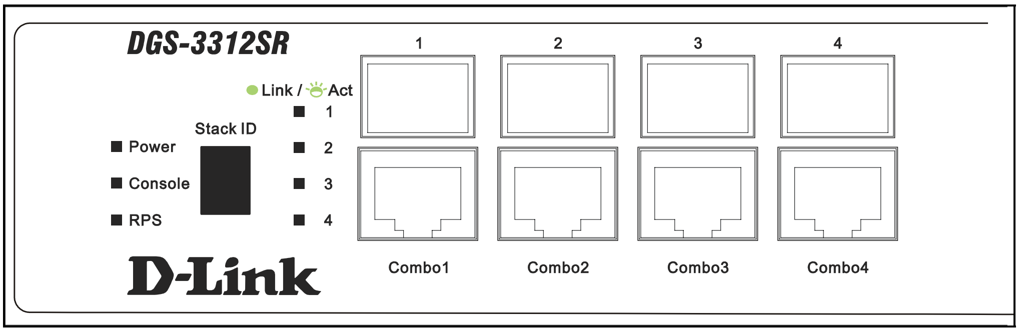


Figure 1- 2. LED Indicators

Power	This indicator on the front panel should be lit during the Power-On Self Test (POST). It will light green approximately two seconds after the Switch is powered on to indicate the ready state of the device.
Console	This indicator is lit green when the Switch is being managed via out-of-band/local console management through the RS-232 console port using a straight-through serial cable.
RPS	This indicator will light steady amber when an external power supply is supplying power. This indicates the internal power supply has failed.
Link/Act	Each on-board Gigabit Ethernet port has a corresponding indicator. This will light steady green for a valid link and blink whenever there is reception or transmission (i.e. Activity--Act) of data occurring at a port.

See below for description of Stack ID LED indicator.

NOTICE: The **Stack ID** LED on the Switch's front panel will display an **F**, regardless of the Switch's stacking mode (Master Switch in a Switch stack, or Standalone mode).

Stacking LED Indicators

Stacking LED indicators include the Stack ID indicator on the front panel and the Link/Act indicators on the front of the DEM-540 stacking module.

NOTICE: The four build-in combination ports on the front panel of the DGS-3312SR can be configured as stacking ports using the CLI.

Each IEEE 1394 stacking module has a single **Link/Act** LED indicator on its front panel for each IEEE 1394 IN/OUT pair.

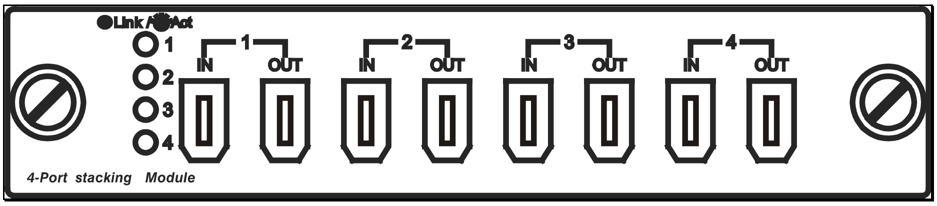


Figure 1- 3. Front panel of DEM-540 IEEE 1394 stacking module

Link/Act	The Link/Act LEDs have the same function as the corresponding LEDs for the Switch's built-in Gigabit Ethernet ports. The Link LED lights to confirm a valid link, while the Act LED blinks to indicate activity on the link.
Stack ID	The Switch includes a digital indicator to indicate the Switch status in a stacked Switch group. An "F" indicates the Switch is acting in the capacity of a master Switch of a stacked group of DGS-3312SR/DES-3226S/DES-3250TG Switches. The remaining slave Switches in the group will display a corresponding stack number (1-C) to indicate the logical position of the slave Switch in the stacked group. See the discussion of Switch Stacking below for more information on stacking DGS-3312SR/DES-3226S/DES-3250TG Switches.

NOTICE: Do not connect the stacked Switch group to the network until you have properly configured all Switches for stacking. An improperly configured Switch stack can cause a broadcast storm.

Rear Panel Description

The rear panel of the Switch contains an AC power connector.

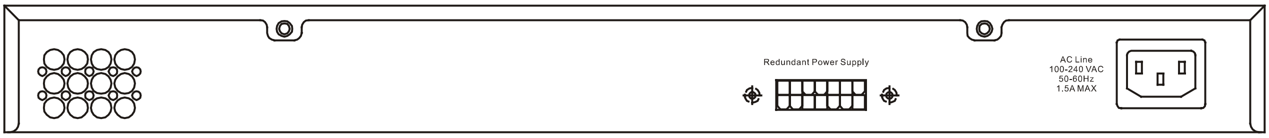


Figure 1- 4. Rear panel view of the Switch

The AC power connector is a standard three-pronged connector that supports the power cord. Plug-in the female connector of the provided power cord into this socket, and the male side of the cord into a power outlet. The Switch automatically adjusts its power setting to any supply voltage in the range from 100 ~ 240 VAC at 50 ~ 60 Hz.

RPS Connector

Connect the optional external redundant power supply to the RPS connector. If the Switch's internal power unit fails, the redundant power system automatically supplies power to the Switch for uninterrupted operation.
The Switch supports the D-Link RPS-200 or RPS-500 redundant power supply units.

Plug-in Modules

The DGS-3312SR Switch is able to accommodate optional plug-in modules in order to increase functionality and performance. Two modules may be installed and used in combination with any of the three available modules. Plug-in modules must be purchased separately.

DEM-340T 1000BASE-T Module

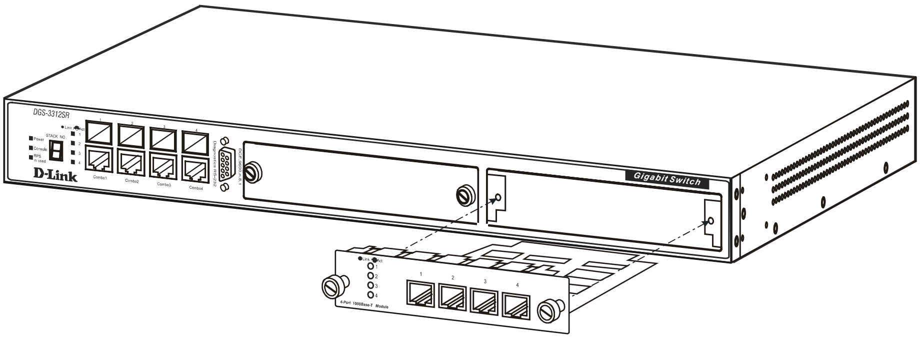


Figure 1- 5. 1000BASE-T Four-port module

- Front-panel module
- Connects to 1000BASE-T devices
- May be used as stacking ports for DES-3250TG slave switches.
- LED indicators for Link/Activity

DEM-340MG SFP (Mini GBIC) Module

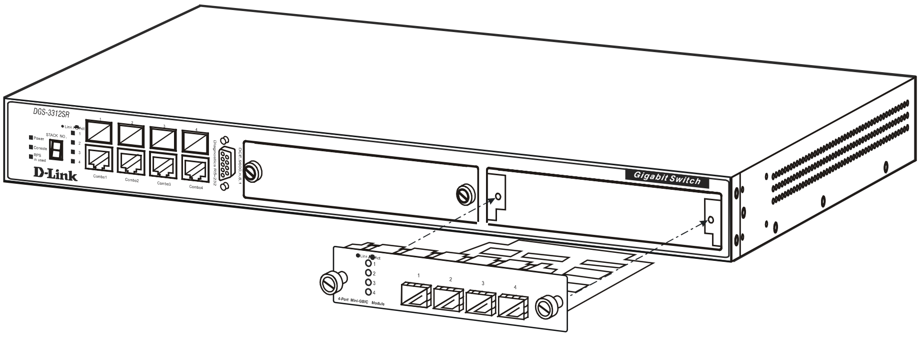


Figure 1- 6. Four-port Gigabit SFP module

- Front-panel module
- Connects to Gigabit Ethernet devices
- May be used as stacking ports for DES-3250TG slave switches.
- LED indicators for Link/Activity and Status

DEM-540 IEEE 1394 Stacking Module

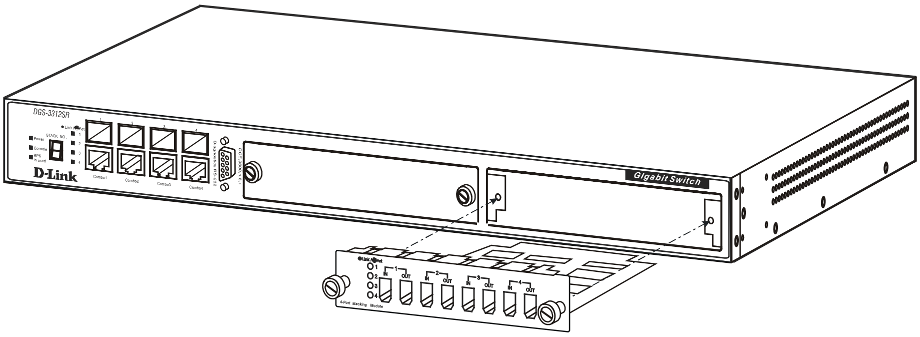


Figure 1- 7. DEM-540 IEEE 1394 Stacking module

- Front-panel module
- Connect to four DES-3226S Switches (up to eight additional slave units may be stacked)
- Four transmitting ports and Four receiving port
- Use the connector of IEEE 1394b
- Data rate up to 1000 Mbps
- 8-segment LED display to indicate Switch ID number within the Switch stack

Switch Stacking

The DGS-3312SR can be stacked with a DES-3226S or DES-3250TG, functioning as the Master of the stack. There are three connection options available to for stacking.

1. Utilizing a gigabit Ethernet port with either the built-in combination mini-GBIC ports or using the DEM-340T 1000BASE-T stacking module.
2. Using a fiber-optic transceiver cabling with either the built-in combination mini-GBIC ports or using the DEM-340MG SFP (Mini GBIC) stacking module.
3. Using IEEE 1394 fire wire cabling with the DEM-540 IEEE 1394 Stacking Module.

Each optional stacking module allows up to four DES-3226S or DES-3250TG Switches to be interconnected in a stack with the DGS-3312SR for up to twelve gigabit ports that may be used to stack up to 12 slave units to provide up to 576 10/100 Mbps ports and 12 Gigabit ports in a star architecture. For stacking, the DGS-3312SR will be the master switch of a stack of DES-3226S switches, DES-3250TG switches or a combination of both. The entire Switch stack is managed and monitored through the network or alternatively, through the serial port on the DGS-3312SR.

The IEEE 1394 fire wire stacking ports are marked **IN** and **OUT**. The IEEE 1394 compliant cable must be connected from an **IN** port on one Switch to an **OUT** port on the next Switch in the stack.

Restrictions and Cautions for Stacking

The DGS-3312SR may serve as the Master of up to twelve additional Switches. The slave switch units must meet the following criteria:

- All additional slave Switches must be DES-3226S or DES-3250TG Switches. The slave unit types can be mixed within a single stacked group.
- DES-3226S or DES-3250TG slave Switches must have firmware Release IV or later loaded to operate properly with the DGS-3312SR Master.
- The DGS-3312SR is automatically started as the Master Switch in a Switch stack.
- It is necessary to enable stacking for each slave Switch in a stacked group before interconnecting them and before connecting the group to the network. Stacking can be enabled by connecting to each slave through the console

port and using the CLI stacking configuration command. Before stacking has been enabled on the slaves, the IEEE 1394 port is treated logically as an individual 1000BASE port in full-duplex mode. Since the Spanning Tree Protocol is disabled by default, a broadcast storm will result if the stacking link is completed between Switches that have not been properly configured.

NOTICE: The CLI stacking command set for the DGS-3312SR is slightly different from the CLI stacking command set for the DES-3226S or DES-3250TG. Please refer to the CLI Reference Manual for each Switch for details or read the instructions starting with the next section.

Management Options

The system may be managed out-of-band through the console port on the front panel or in-band using Telnet, a web browser or SNMP-based management.

Web-based Management Interface

After you have successfully installed the Switch, you can configure the Switch, monitor the LED panel, and display statistics graphically using a web browser, such as Opera, Netscape Navigator (version 6.2 and higher) or Microsoft® Internet Explorer (version 5.0).

NOTE: To access the Switch through a web browser, the computer running the web browser must have IP-based network access to the Switch.

Command Line Console Interface through the Serial Port or Telnet

You can also connect a computer or terminal to the serial console port or use Telnet to access the Switch. The command-line-driven interface provides complete access to all Switch management features. For a full list of commands, see the Command Line Reference Manual, which is included on the documentation CD.

SNMP-Based Management

You can manage the Switch with an SNMP-compatible console program. The Switch is supports SNMP version 1.0, version 2.0 and version 3.0. The SNMP agent decodes the incoming SNMP messages and responds to requests with MIB objects stored in the database. The SNMP agent updates the MIB objects to generate statistics and counters.

The Switch supports a comprehensive set of MIB extensions:

- RFC 1643 Ether-like MIB
- RFC 1724 RIPv2 MIB
- RFC 1757 RMON
- RFC 1850 OSPF MIB
- RFC 1907 SNMPv2 MIB
- RFC 2021 RMON II MIB
- RFC 2096 IP-FORWARD MIB
- RFC 2233 IF-MIB
- RFC 2358 Ethernet-Link MIB
- RFC 2573 SNMP Notification and Target MIB
- RFC 2574 SNMP User-based SM MIB
- RFC 2575 SNMP View-based ACM MIB
- RFC 2674 802.1p and 802.1q Bridge MIB
- RFC 2737 Entity MIB
- RFC 2932 IPMROUTE STD MIB
- RFC 2933 IGMP MIB
- RFC 2934 PIM MIB
- IEEE8021-PAE 802.1x PAE MIB
- D-Link Enterprise MIB

SECTION 2

Installation

Package Contents

Before You Connect to the Network

Installing the Switch without a Rack

Installing the Switch in a Rack

Connecting Stacked Switch Groups

Configuring a Switch Group for Stacking

External Redundant Power System

Connecting the Console Port

Password Protection

SNMP Settings

IP Address Assignment

Connecting Devices to the Switch

Package Contents

Before you begin installing the Switch, confirm that your package contains the following items:

- One DGS-3312SR Layer 3 Switch
- Mounting kit: 2 mounting brackets and screws
- Four rubber feet with adhesive backing
- One AC power cord
- This Manual
- CLI Reference Manual

Before You Connect to the Network

Before you connect to the network, you must install the Switch on a flat surface or in a rack, set up a terminal emulation program, plug in the power cord, and then set up a password and IP address.

NOTICE: Do not connect the Switch to the network until you have established the correct IP settings, user accounts and proper stacking configuration (if the Switch is stacked).

Installing the Switch without the Rack

The Switch is supplied with rubber feet for stationing it on a flat surface and mounting brackets and screws for mounting the Switch in a rack.

1. Install the Switch on a level surface that can safely support the weight of the Switch and its attached cables. The Switch must have adequate space for ventilation and for accessing cable connectors.
2. Set the Switch on a flat surface and check for proper ventilation. Allow at least 5 cm (2 inches) on each side of the Switch and 15 cm (6 inches) at the back for the power cable.
3. Attach the rubber feet on the marked locations on the bottom of the chassis.

The rubber feet, although optional, are recommended to keep the unit from slipping.

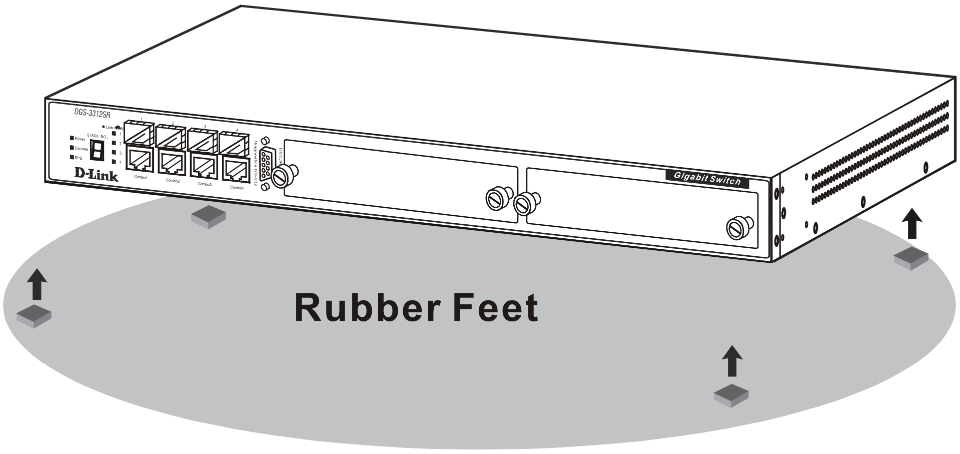


Figure 2- 1. Install rubber feet for installations with or without a rack

Installing the Switch in a Rack

You can install the Switch in most standard 19-inch (48.3-cm) racks. Refer to the illustrations below.

1. Use the supplied screws to attach a mounting bracket to each side of the Switch.
2. Align the holes in the mounting bracket with the holes in the rack.
3. Insert and tighten two screws through each of the mounting brackets.

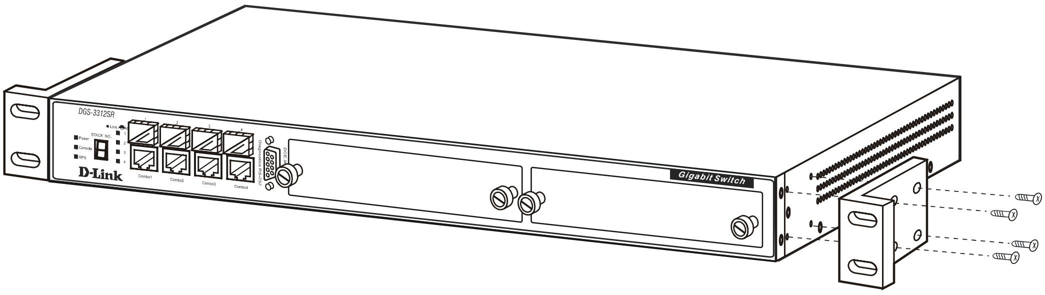


Figure 2- 2. Attach mounting brackets to Switch

Fasten the mounting brackets to the Switch using the screws provided. With the brackets attached securely, you can mount the Switch in a standard rack as shown in Figure 2-3 on the following page.

Mounting the Switch in a Standard 19" Rack

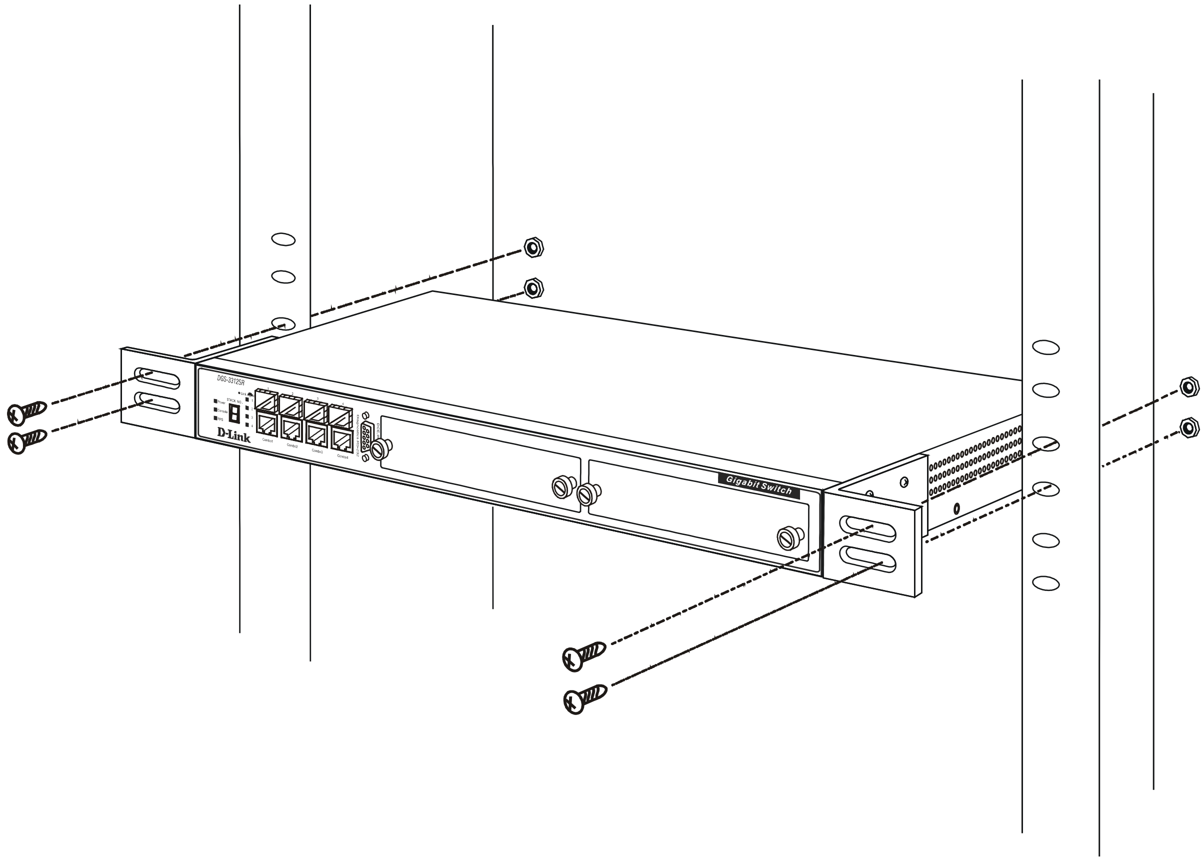


Figure 2-3. Install Switch in equipment rack

Connecting Stacked Switch Groups

The DGS-3312SR has the capability to hold twelve gigabit ports that may be used in standalone mode or can be used in a stacking configuration to provide up to 576 10/100 Mbps ports and 12 Gigabit ports in a star architecture. For stacking, the DGS-3312SR will be the master switch of a stack of DES-3226S switches, DES-3250TG switches or a combination of both. The instructions below, Configuring a Switch Group for Stacking, tell you how to configure the DGS-3312SR to function as a Master, as well as how to configure the DES-3226S and the DES-3250TG to function as slave Switch units using the CLI interface.

Stacking Connections with IEEE 1394, Ethernet Cabling and Fiber-Optic Transceiver Cabling

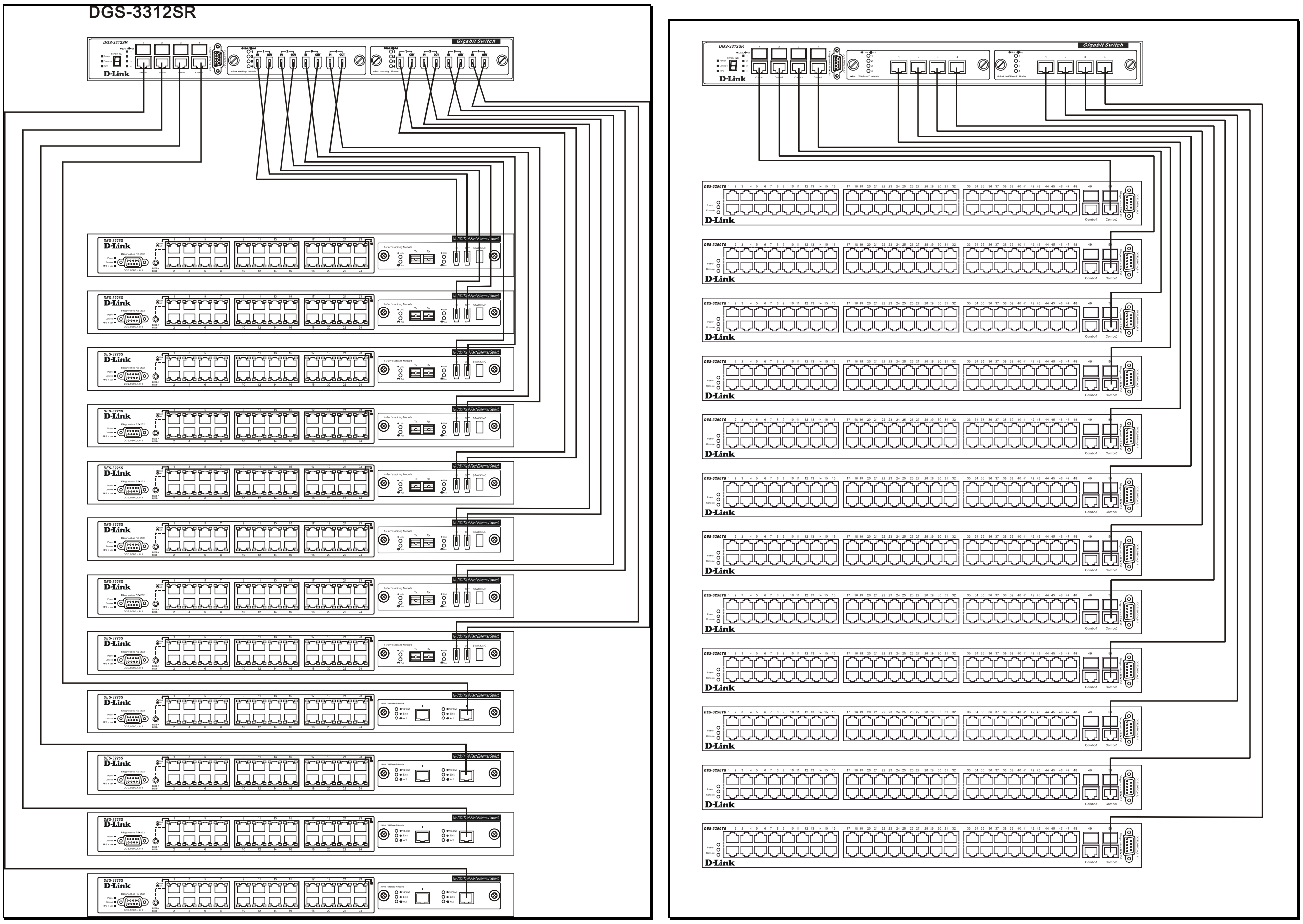


Figure 2-4. Star Topology Stacked Switch Group

The IEEE 1394 fire wire stacking ports are marked **IN** and **OUT**. The IEEE 1394 compliant cable must be connected from an **IN** port on one Switch to an **OUT** port on the next Switch in the stack.

NOTICE: Do not connect the stacked Switch group to the network until you have properly configured all Switches for stacking. An improperly configured Switch stack can cause a broadcast storm.

Configuring a Switch Group for Stacking

Follow the instructions below to first configure the slave units, and then to configure the DGS-3312SR as the designated Master.

NOTICE: The DGS-3312SR can be used to manage a Switch stack consisting of only DES-3226S and/or DES-3250TG Switches.

For the DES-3226S and DES-3250TG, the stacking configuration as a Master or Slave Switch is no longer necessary. The DGS-3312SR can communicate with these slave switches regardless of its stacking configuration. It is recommended that you configure all slave Switches in a Switch stack in the auto stacking mode to reduce the potential for problems. The default stacking mode configuration for the DES-3226S and DES-3250TG is *auto*.

To configure the DES-3226S or DES-3250TG to function in a stacked group as a slave, do the following:

1. At the CLI login prompt, enter `config stacking mode enable auto` and press the **Enter** key.
2. You will be prompted to save the stacking mode configuration. Press the Y key (yes) to save the stacking mode configuration.
3. Successful configuration will be verified by a **Success** message. It takes a few seconds for the change to take effect and be saved. See the example below for the DES-3226S.

```
DES-3226S:4#config stacking mode enable auto
Command: config stacking mode enable auto

Do you want to save the new system configuration to NV-RAM now?(y/n)
Saving all configurations to NV-RAM... Done.
Success.

DES-3226S:4#...........
```

The default settings for the DGS-3312SR has the stacking mode enabled. However if the stacking mode has been disabled it will be necessary to enable it. Follow the instructions below to change the stacking mode to enable. If you do not know what the stacking mode setting currently is, use the command `show stacking mode`.

To enable stacking in the DGS-3312SR, do the following:

1. At the CLI login prompt, enter `config stacking mode enable` and press the **Enter** key.
2. You will be prompted to save the stacking mode configuration. If you save the new stacking mode by pressing the Y key, the settings will be saved and the Switch will restart.
3. Press the Y key (yes) to save the stacking mode configuration and restart the Switch.

```
DGS-3312SR:4#config stacking mode enable
Command: config stacking mode enable

The new stacking mode configuration must be saved and the system restarted
to put the new settings into effect.
If you do not save the changes now, they will be lost.
Saving all configurations to NV-RAM... 15%
```

Changing the stacking mode in the DGS-3312SR will automatically save the settings and restart the system. It will take a few minutes to complete the process.

Unit ID Display for Switches in a Switch Stack

The Stack ID 7-segment LED (as shown below) on the front panel of the DGS-3312SR will always display **F** (15 in hex). An **F** will also be displayed in the Stack ID LED even if the DGS-3312SR is in standalone mode.

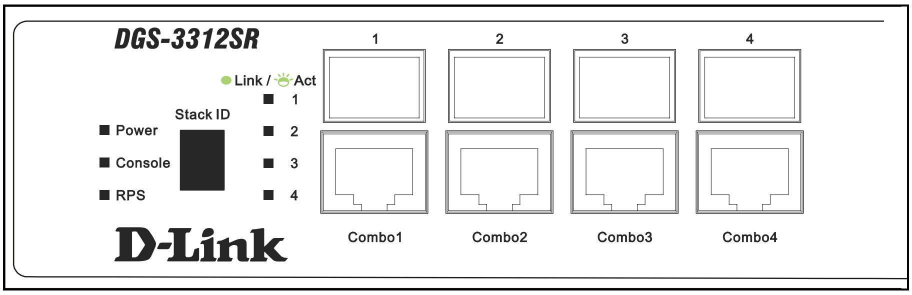


Figure 2-5. DGS-3312SR Front Panel

The Unit ID of individual DES-3226S or DES-3250TG Switches in a Switch stack is determined by the port number of the port on the DGS-3312SR to which the Switch is connected. The ports on the DGS-3312SR are numbered starting with port 1 from left to right along the front panel of the Switch. For example, the four combination ports next to the Stack NO. LED are numbered 1 through 4, so if a four port stacking module is installed in the first module slot, the stacking ports will be numbered 5 through 8. If two stacking modules are installed in the DGS-3312SR, then the stacking ports on the second module will be numbered 9 through 12.

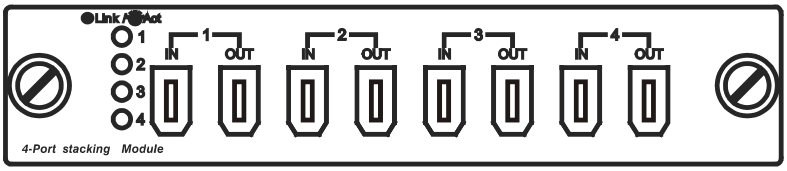


Figure 2-6. DEM-540 Stacking Module Front Panel

If the a stacking module is installed in the DGS-3312SR's first module slot, then the first IN/OUT pair in the figure above will be port 5. If a DES-3226S in a Switch stack is connected to the first stacking port (port number 5 on the DGS-3312SR), then the Unit ID of the DES-3226S will be 5.

The Unit ID of the DES-3226S or DES-3250TG will be displayed in the STACK NO. LED on the front panel of the DES-3226S's or DES-3250TG's stacking module, as shown below.

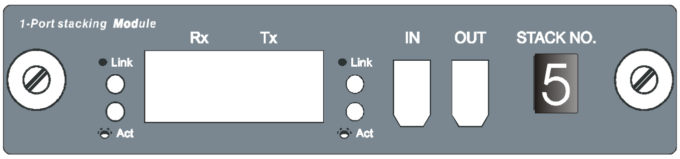


Figure 2-7. DES-3226S Stacking Module Front Panel

External Redundant Power System

The Switch supports an external redundant power system.

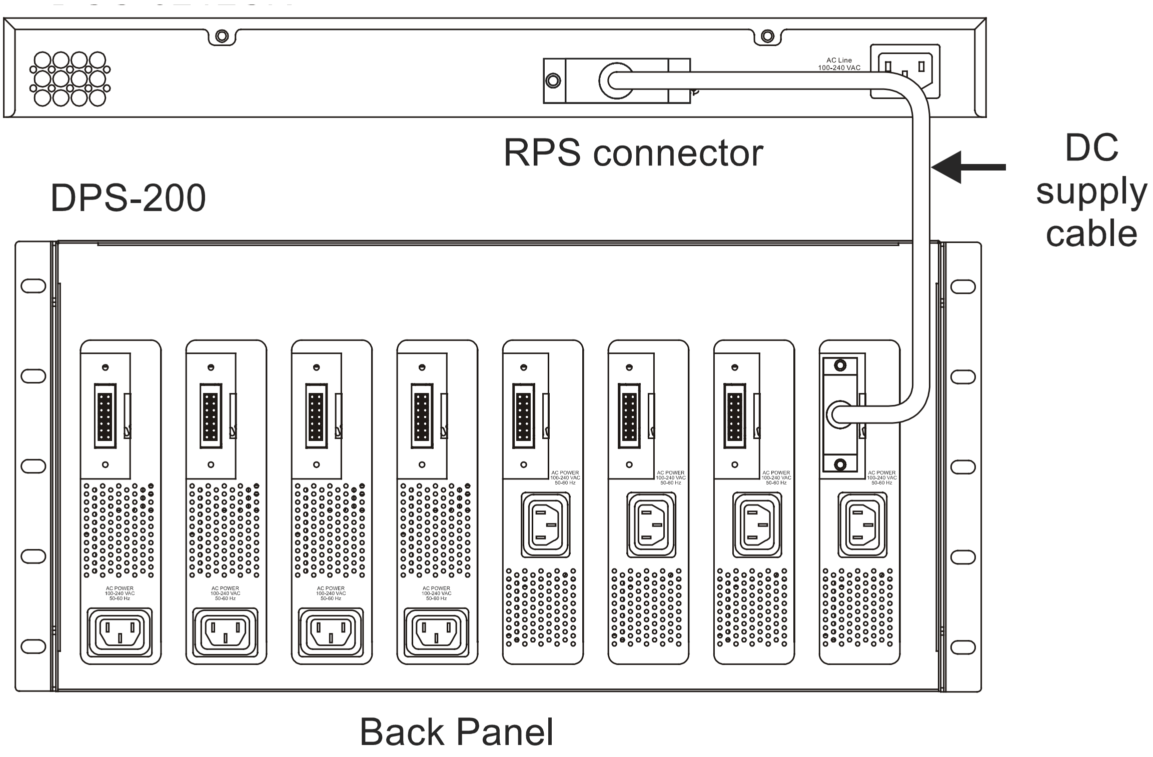


Figure 2-8. DPS-200 with DGS-3312SR

NOTE: See the DPS-200 documentation for more information.

CAUTION: Do not use the Switch with any redundant power system other than the DPS-200 or DPS-500.

Connecting the Console Port

The Switch provides an RS-232 serial port that enables a connection to a computer or terminal for monitoring and configuring the Switch. This port is a male DB-9 connector, implemented as a data terminal equipment (DTE) connection.

To use the console port, you need the following equipment:

- A terminal or a computer with both a serial port and the ability to emulate a terminal
- A null modem or crossover RS-232 cable with a female DB-9 connector for the console port on the Switch

To connect a terminal to the console port:

1. Connect the female connector of the RS-232 cable directly to the console port on the Switch, and tighten the captive retaining screws.
2. Connect the other end of the cable to a terminal or to the serial connector of a computer running terminal emulation software. Set the terminal emulation software as follows:

a. Select the appropriate serial port (COM port 1 or COM port 2).

b. Set the data rate to 9600 baud.

c. Set the data format to 8 data bits, 1 stop bit, and no parity.

d. Set flow control to `none`.

e. Under **Properties**, select **VT100** for **Emulation** mode.

f. Select **Terminal keys** for **Function, Arrow, and Ctrl keys**. Ensure that you select **Terminal keys** (*not* **Windows keys**).

NOTICE: When you use HyperTerminal with the Microsoft® Windows® 2000 operating system, ensure that you have Windows 2000 Service Pack 2 or later installed. Windows 2000 Service Pack 2 allows you to use arrow keys in HyperTerminal's VT100 emulation. See **www.microsoft.com** for information on Windows 2000 service packs.

g. After you have correctly set up the terminal, plug the power cable into the power receptacle on the back of the Switch. The boot sequence appears in the terminal.

h. After the boot sequence completes, the console login screen displays.

i. If you have not logged into the command line interface (CLI) program, press the Enter key at the User name and password prompts. There is no default user name and password for the Switch, user names and passwords must first be created by the administrator. If you have previously set up user accounts, log in and continue to configure the Switch.

j. Enter the commands to complete your desired tasks. Many commands require administrator-level access privileges. Read the next section for more information on setting up user accounts. See the *Command Line Reference Manual* on the documentation CD for a list of all commands and additional information on using the CLI.

k. When you have completed your tasks, exit the session with the **`logout`** command or close the emulator program.

Password Protection

The DGS-3312SR does not have a default user name and password. One of the first tasks when settings up the Switch is to create user accounts. If you log in using a predefined administrator-level user name, you have privileged access to the Switch's management software.

After your initial login, define new passwords for both default user names to prevent unauthorized access to the Switch, and record the passwords for future reference.

To create an administrator-level account for the Switch, do the following:

1. At the CLI login prompt, enter **create account admin** followed by the <user name> and press the **Enter** key.
2. You will be asked to provide a password. Type the <password> used for the administrator account being created and press the **Enter** key.
3. You will be prompted to enter the same password again to verify it. Type the same password and press the **Enter** key.
4. Successful creation of the new administrator account will be verified by a **Success** message.

User names and passwords can be up to 15 characters in length.

The sample below illustrates a successful creation of a new administrator-level account with the user name “newmanager”.

NOTE: Passwords are case sensitive.

```
DGS-3312SR:4#create account admin newmanager
Command: create account admin newmanager


Enter a case-sensitive new password:********
Enter the new password again for confirmation:********
Success.


DGS-3312SR:4#
```

NOTICE: CLI configuration commands only modify the running configuration file and are not saved when the Switch is rebooted. To save all your configuration changes in nonvolatile storage, you must use the **save** command to copy the running configuration file to the startup configuration.

SNMP Settings

Simple Network Management Protocol (SNMP) is an OSI Layer 7 (Application Layer) designed specifically for managing and monitoring network devices. SNMP enables network management stations to read and modify the settings of gateways, routers, Switches, and other network devices. Use SNMP to configure system features for proper operation, monitor performance and detect potential problems in the Switch, Switch group or network.

Managed devices that support SNMP include software (referred to as an agent), which runs locally on the device. A defined set of variables (managed objects) is maintained by the SNMP agent and used to manage the device. These objects are defined in a Management Information Base (MIB), which provides a standard presentation of the information controlled by the on-board SNMP agent. SNMP defines both the format of the MIB specifications and the protocol used to access this information over the network.

The DGS-3312SR supports the SNMP versions 1, 2c, and 3. You can specify which version of the SNMP you want to use to monitor and control the Switch. The three versions of SNMP vary in the level of security provided between the management station and the network device.

In SNMP v.1 and v.2, user authentication is accomplished using ‘community strings’, which function like passwords. The remote user SNMP application and the Switch SNMP must use the same community string. SNMP packets from any station that has not been authenticated are ignored (dropped).

The default community strings for the Switch used for SNMP v.1 and v.2 management access are:

public - Allows authorized management stations to retrieve MIB objects.

private - Allows authorized management stations to retrieve and modify MIB objects.

SNMP v.3 uses a more sophisticated authentication process that is separated into two parts. The first part is to maintain a list of users and their attributes that are allowed to act as SNMP managers. The second part describes what each user on that list can do as an SNMP manager.

The Switch allows groups of users to be listed and configured with a shared set of privileges. The SNMP version may also be set for a listed group of SNMP managers. Thus, you may create a group of SNMP managers that are allowed to view read-only information or receive traps using SNMP v.1 while assigning a higher level of security to another group, granting read/write privileges using SNMP v.3.

Using SNMP v.3 individual users or groups of SNMP managers can be allowed to perform or be restricted from performing specific SNMP management functions. The functions allowed or restricted are defined using the Object Identifier (OID) associated with a specific MIB. An additional layer of security is available for SNMP v.3 in that SNMP messages may be encrypted. To read more about how to configure SNMP v.3 settings for the Switch read the next section, Management.

Traps

Traps are messages that alert network personnel of events that occur on the Switch. The events can be as serious as a reboot (someone accidentally turned OFF the Switch), or less serious like a port status change. The Switch generates traps and sends them to the trap recipient (or network manager). Typical traps include trap messages for Authentication Failure, Topology Change and Broadcast\Multicast Storm.

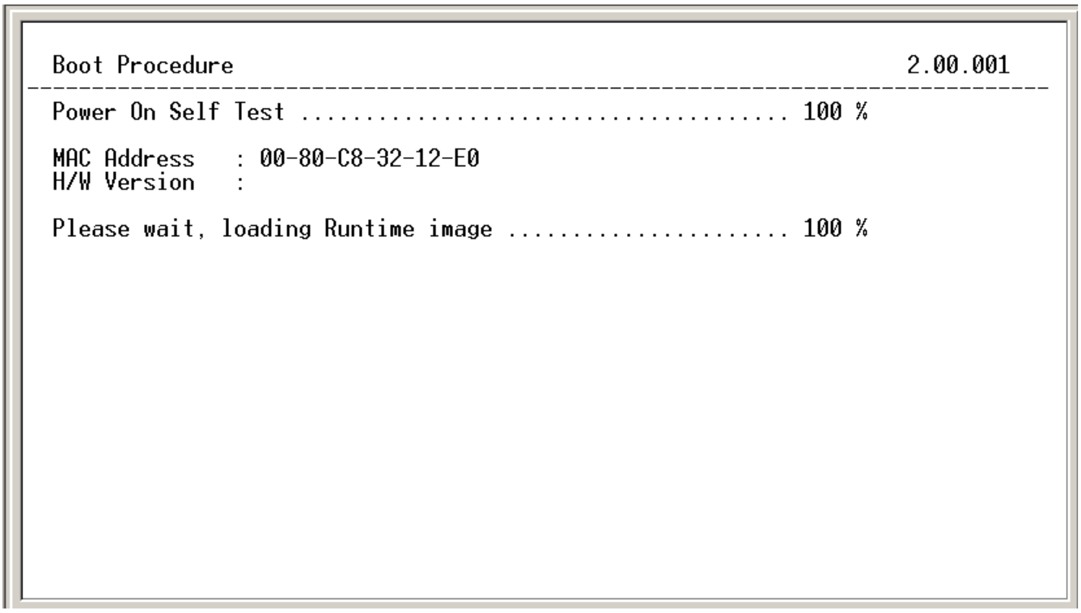
MIBs

Management and counter information are stored by the Switch in the Management Information Base (MIB). The Switch uses the standard MIB-II Management Information Base module. Consequently, values for MIB objects can be retrieved from any SNMP-based network management software. In addition to the standard MIB-II, the Switch also supports its own proprietary enterprise MIB as an extended Management Information Base. The proprietary MIB may also be retrieved by specifying the MIB Object Identifier. MIB values can be either read-only or read-write.

IP Address Assignment

Each Switch must be assigned its own IP Address, which is used for communication with an SNMP network manager or other TCP/IP application (for example BOOTP, TFTP). The Switch's default IP address is 10.90.90.90. You can change the default Switch IP address to meet the specification of your networking address scheme.

The Switch is also assigned a unique MAC address by the factory. This MAC address cannot be changed, and can be found from the initial boot console screen – shown below.



```
  Boot Procedure                                                  2.00.001
--------------------------------------------------------------------------------
  Power On Self Test ..................................... 100 %

  MAC Address    : 00-80-C8-32-12-E0
  H/W Version    :

  Please wait, loading Runtime image ...................... 100 %
```

Figure 2-9. Boot screen

The Switch's MAC address can also be found from the Web management program on the Switch Information (Basic Settings) window on the Configuration menu.

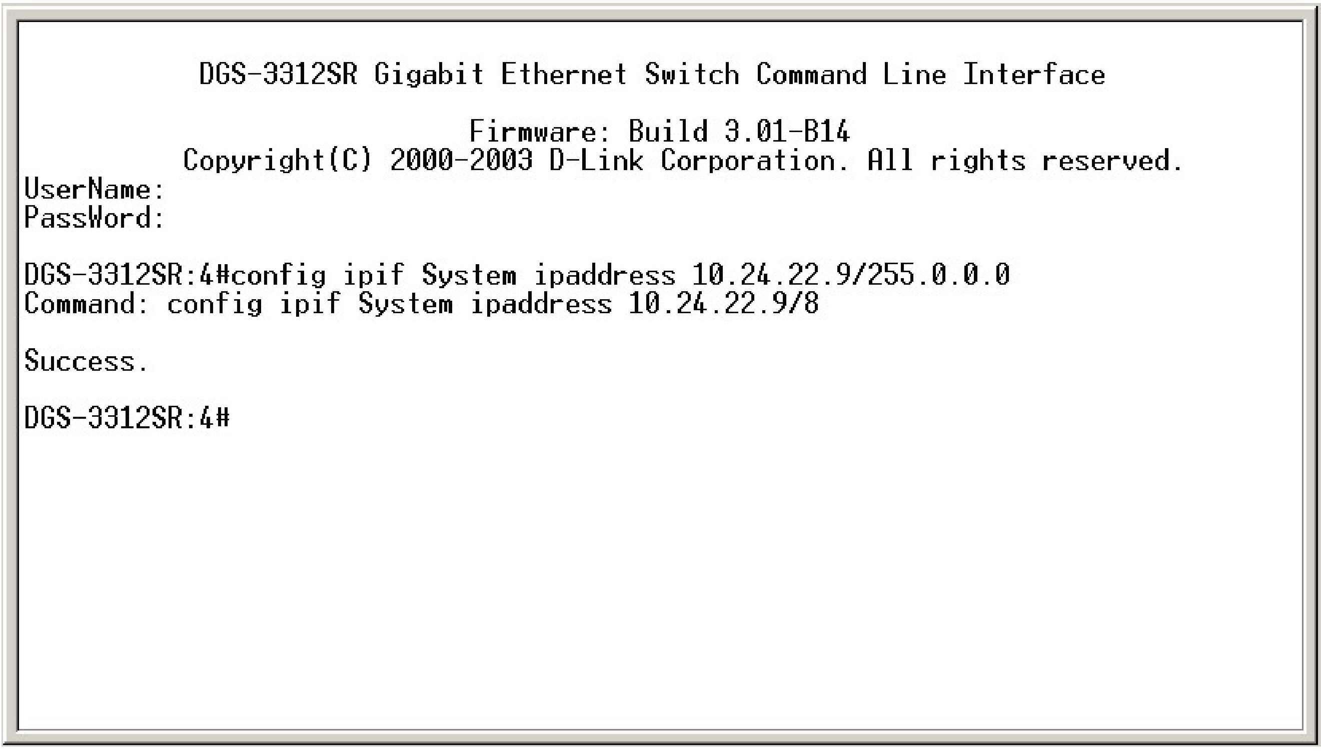
The IP address for the Switch must be set before it can be managed with the Web-based manager. The Switch IP address can be automatically set using BOOTP or DHCP protocols, in which case the actual address assigned to the Switch must be known.

The IP address may be set using the Command Line Interface (CLI) over the console serial port as follows:

1. Starting at the command line prompt, enter the commands **config ipif System ipaddress xxx.xxx.xxx.xxx/yyy.yyy.yyy.yyy**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **y**'s represent the corresponding subnet mask.

2. Alternatively, you can enter **config ipif System ipaddress xxx.xxx.xxx.xxx/z**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **z** represents the corresponding number of subnets in CIDR notation.

The IP interface named System on the Switch can be assigned an IP address and subnet mask that can then be used to connect a management station to the Switch's Telnet or Web-based management agent.



```
            DGS-3312SR Gigabit Ethernet Switch Command Line Interface

                                Firmware: Build 3.01-B14
           Copyright(C) 2000-2003 D-Link Corporation. All rights reserved.
UserName:
PassWord:

DGS-3312SR:4#config ipif System ipaddress 10.24.22.9/255.0.0.0
Command: config ipif System ipaddress 10.24.22.9/8

Success.

DGS-3312SR:4#
```

Figure 2-10. Assigning the Switch an IP Address

In the above example, the Switch was assigned an IP address of 10.22.24.9 with a subnet mask of 255.0.0.0. The system message **Success** indicates that the command was executed successfully. The Switch can now be configured and managed via Telnet and the CLI or via the Web-based management.

Connecting Devices to the Switch

After you assign IP addresses to the Switch, you can connect devices to the Switch.

To connect a device to an SFP transceiver port:

1. Use your cabling requirements to select an appropriate SFP transceiver type.
2. Insert the SFP transceiver (sold separately) into the SFP transceiver slot.
3. Use the appropriate network cabling to connect a device to the connectors on the SFP transceiver.

NOTICE: When the SFP transceiver acquires a link, the associated integrated 10/100/1000BASE-T port is disabled.

Section 3

Basic Switch Management

Before You Start

General Deployment Strategy

Web-based User Interface

Basic Setup

Switch Information

Switch IP Settings

Security IP Management Stations

User Accounts Management

Saving Changes

Factory Reset

Restart System

Advanced Settings

Switch Stack Management

All software function of the DGS-3312SR can managed, configured and monitored via the embedded web-based (HTML) interface. The Switch can be managed from remote stations anywhere on the network through a standard browser such as Opera, Netscape Navigator/Communicator or Microsoft Internet Explorer. The browser acts as a universal access tool and can communicate directly with the Switch using the HTTP protocol.

The web-based management module and the Console program (and Telnet) are different ways to access the same internal Switching software and configure it. Thus, all settings encountered in web-based management are the same as those found in the console program.

Before You Start

The DGS-3312SR Layer 3 Switch supports a wide array of functions and gives great flexibility and increased network performance by eliminating the routing bottleneck between the WAN or Internet and the Intranet. Its function in a network can be thought of as a new generation of router that performs routing functions in hardware, rather than software. It is in effect, a router that also has numerous independent Ethernet collision domains – each of which can be assigned an IP subnet.

This flexibility and rich feature set requires a bit of thought to arrive at a deployment strategy that will maximize the potential of the DGS-3312SR Layer 3 Switch. Please read the portions of this manual pertaining to the functions you wish to perform with the Switch. It is especially important to map out VLANs and configuration of IP interfaces, and OSPF configuration in advance of actual configuration. For this reason, these subjects are presented in greater detail in the final two parts of this manual.

General Deployment Strategy

1. Determine how the network would be best segmented. This is probably done using VLANs in an existing layer 2 Switched network.
2. Develop an IP addressing scheme. This involves allocating a block of IP addresses to each network segment. Each network subnet is then assigned a network address and a subnet mask. Background information regarding IP addresses is presented in Part IV of this guide.

3. Determine which network resources must be shared by the subnets. Shared resources may be connected directly to Layer 3 Switches. Static routes to each of the shared resources should be determined.
4. Determine how each subnet will communicate with the WAN or Internet. Again, static routes should be determined and default gateways identified.
5. Develop a security scheme. Some subnets on the network need more security or should be isolated from the other subnets. IP or MAC filtering can be used. Also, one or more VLANs on the Layer 3 Switch can be configured without an IP subnet – in which case, these VLANs will function as a layer 2 VLAN and would require an external router to connect to the rest of the network.
6. Develop a policy scheme. Some subnets will have a greater need for multicasting bandwidth, for example. A policy is a mechanism to alter the normal packet forwarding in a network device, and can be used to intelligently allocate bandwidth to time-critical applications such as the integration of voice, video, and data on the network.
7. Develop a redundancy scheme. Planning redundant links and routes to network critical resources can save valuable time in case of a link or device failure. The DGS-3312SR Spanning Tree function can be used to block the redundant link until it is needed.

VLAN Setup

VLANs setup in Layer 3 Switching is more complicated than in conventional Layer 2 Switching environments. Be sure to carefully plan the VLAN/IP interface arrangement for the network before configuring the VLANs and IP interface associations.

VLANs configuration and concepts are provided in Part III.

Defining Static Routes

Routes between the IP interfaces and a default gateway or other router with a WAN connection should be determined beforehand and entered into the static/default routing table on the DGS-3312SR.

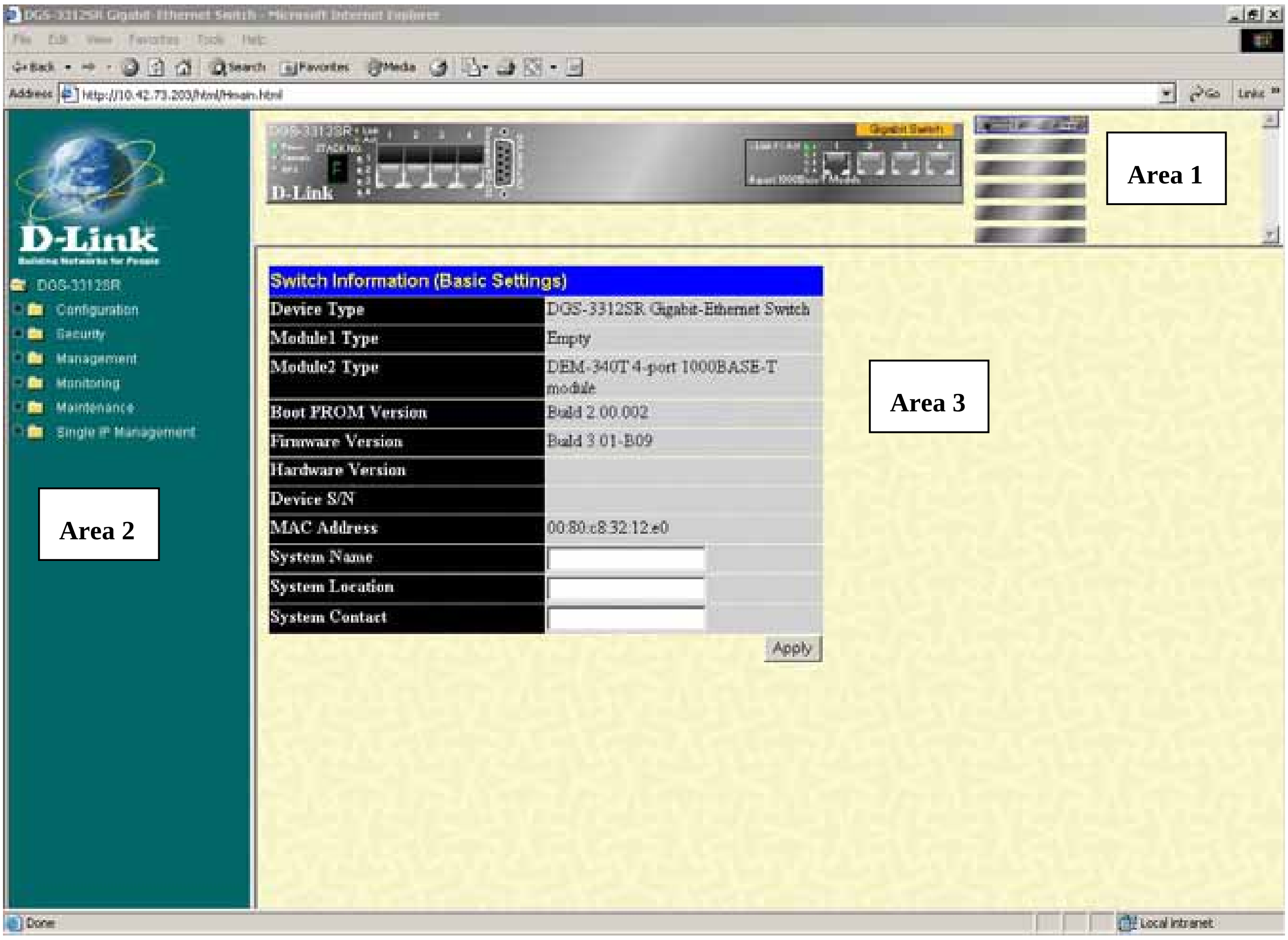
Configuration of static routes and other uses of routing protocols are presented in Section IV.

Web-based User Interface

The user interface provides access to various Switch configuration and management screens, allows you to view performance statistics, and permits you to graphically monitor the system status.

Areas of the User Interface

The figure below shows the user interface. The user interface is divided into three distinct areas as described in the table below.



Switch Information (Basic Settings)

Device Type	DGS-3312SR Gigabit-Ethernet Switch
Module1 Type	Empty
Module2 Type	DEM-340T 4-port 1000BASE-T module
Boot PROM Version	Build 2.00.002
Firmware Version	Build 3.01-B09
Hardware Version	
Device S/N	
MAC Address	00:80:c8:32:12:e0
System Name	
System Location	
System Contact	

Figure 3-1. Main Web-Manager window

Area	Function
1	Presents a graphical near real-time image of the front panel of the Switch. This area displays the Switch's ports and expansion modules. When the Switch is stacked a virtual representation of the Switch stack appears in the right hand portion. Click on the ports in the front panel to manage the port's configuration or view data for the port.
2	Select the window to be displayed. The folder icons can be opened to display the hyperlinked window buttons and sub-folders contained within them.
3	Presents the information selected for configuration or display.

Login to Web Manager

To begin managing the Switch simply run the browser you have installed on your computer and point it to the IP address you have defined for the device. The URL in the address bar should read something like: http://123.123.123.123, where the numbers 123 represent the IP address of the Switch.

NOTE: The Factory default IP address for the Switch is 10.90.90.90.

In the Welcome page, click on the Login hyperlink; this opens a login dialog box. Enter a user name and password to access the Switch’s management main page (pictured above). There is no user name or password configured for the Switch in the default settings, so if this is the first time logging in it is not necessary to enter these.

NOTICE: Any changes made to the Switch configuration during the current session must be saved in the **Save Configuration** window (explained below) or use the command line interface (CLI) command **save**.

Web Pages and Folders

Below is a list and description of the main folders and windows available in the web interface:

Configuration: This folder includes all the sub-folders and windows used to configure various performance functions of the Switch including Layer 3 functions.

Security: This folder contains SSL, SSH, and Access Authentication Control sub-folders are also located here. The Trusted Host window link is located here as well.

Management: The windows used to configure SNMP settings, management IP stations, and user accounts are located here.

Monitoring: This folder includes stack information and data tables for performance statistics, application, and protocol status, including Layer 3 functions.

Maintenance: Contains windows for upgrading firmware and saving configuration files (TFTP Services), saving configuration changes, resetting and rebooting the Switch, PING test, and logging out of the web manager.

Single IP Management: SIM settings, Topology, Firmware Update, and Configuration Backup/Restore windows are located here.

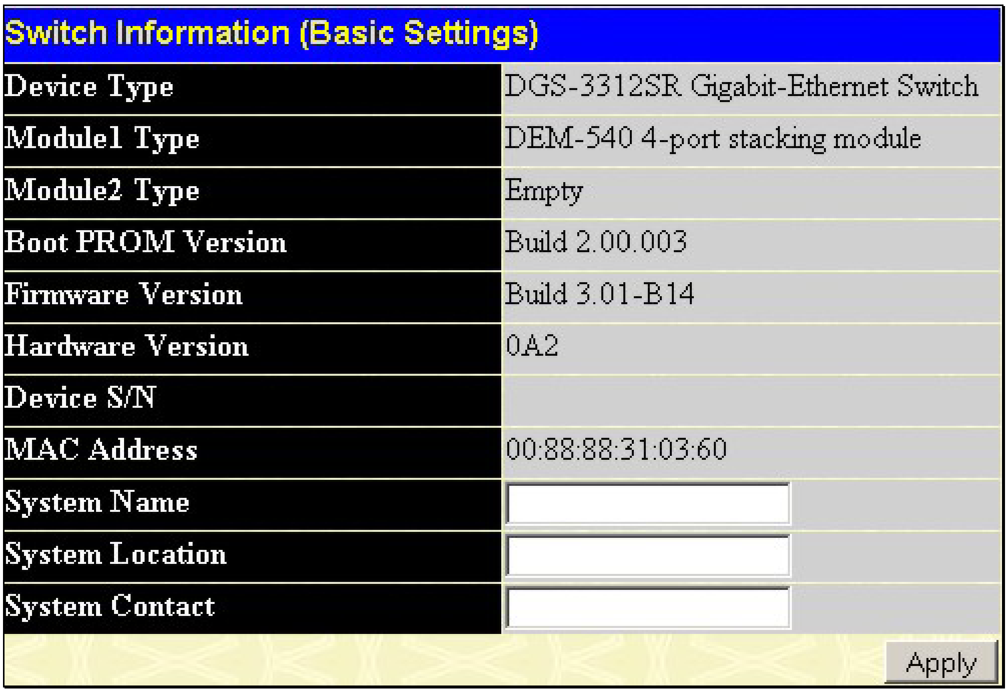
NOTE: Be sure to configure the user name and password in the User Accounts window before connecting the Switch to the greater network.

Basic Setup

The subsections below describe how to change some of the basic settings for the Switch such as changing IP settings and assigning user names and passwords for management access privileges, as well as how to save the changes and restart the Switch.

Switch Information

The first page displayed upon logging in is the **System Information (Basic Settings)** window. This window can be accessed at any time by clicking the **Switch Information** button in the **Configuration** folder.



Switch Information (Basic Settings)

Device Type	DGS-3312SR Gigabit-Ethernet Switch
Module1 Type	DEM-540 4-port stacking module
Module2 Type	Empty
Boot PROM Version	Build 2.00.003
Firmware Version	Build 3.01-B14
Hardware Version	0A2
Device S/N	
MAC Address	00:88:88:31:03:60
System Name	
System Location	
System Contact	

Figure 3-2. Switch Information (Basic Settings) window

This window displays general information about the Switch including its MAC Address, Hardware Boot PROM and Firmware versions, and installed module information.

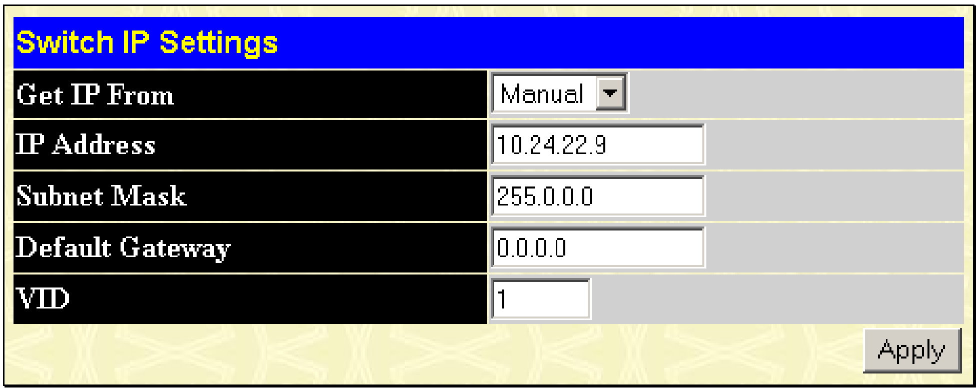
Switch IP Settings

Switch IP settings may initially be set using the console interface prior to connecting to it through the Ethernet. If the Switch IP address has not yet been changed, read the Introduction of the CLI Reference or skip ahead to the end of this section for a quick description of how to use the console port and CLI IP settings commands to establish IP settings for the Switch.

To change IP settings using the web manager you must access the **Switch IP Settings** window located in the **Configuration** folder.

To configure the Switch's IP address:

Open the **Configuration** folder and click the IP Address button. The web manager will display the **Switch IP Settings** window below.



Switch IP Settings

Get IP From	Manual
IP Address	10.24.22.9
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0
VID	1

Figure 3-3. Switch IP Settings window

NOTE: The Switch's factory default IP address is 10.90.90.90 with a subnet mask of 255.0.0.0 and a default gateway of 0.0.0.0.

To manually assign the Switch's IP address, subnet mask, and default gateway address:

- Select *Manual* from the Get IP From drop-down menu.
- Enter the appropriate IP address and subnet mask.

If you want to access the Switch from a different subnet from the one it is installed on, enter the IP address of the gateway. If you will manage the Switch from the subnet on which it is installed, you can leave the default address (0.0.0.0) in this field.

If no VLANs have been previously configured on the Switch, you can use the default VLAN ID (VID) 1. The default VLAN contains all of the Switch ports as members. If VLANs have been previously configured on the Switch, you will need to enter the VLAN ID of the VLAN that contains the port connected to the management station that will access the Switch. The Switch will allow management access from stations with the same VID listed here.

To use the BOOTP or DHCP protocols to assign the Switch an IP address, subnet mask, and default gateway address:

Use the Get IP From pull-down menu to choose from *BOOTP* or *DHCP*. This selects how the Switch will be assigned an IP address on the next reboot.

The **Switch IP Settings** options are:

Parameter	Description
BOOTP	The Switch will send out a BOOTP broadcast request when it is powered up. The BOOTP protocol allows IP addresses, network masks, and default gateways to be assigned by a central BOOTP server. If this option is set, the Switch will first look for a BOOTP server to provide it with this information before using the default or previously entered settings.
DHCP	The Switch will send out a DHCP broadcast request when it is powered up. The DHCP protocol allows IP addresses, network masks, and default gateways to be assigned by a DHCP server. If this option is set, the Switch will first look for a DHCP server to provide it with this information before using the default or previously entered settings.
Manual	Allows the entry of an IP address, Subnet Mask, and a Default Gateway for the Switch. These fields should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal form) between *0* and *255*. This address should be a unique address on the network assigned for use by the network administrator. The fields which require entries under this option are as follows:

Subnet Mask	A Bitmask that determines the extent of the subnet that the Switch is on. Should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal) between *0* and *255*. The value should be 255.0.0.0 for a Class A network, 255.255.0.0 for a Class B network, and 255.255.255.0 for a Class C network, but custom subnet masks are allowed.
Default Gateway	IP address that determines where packets with a destination address outside the current subnet should be sent. This is usually the address of a router or a host acting as an IP gateway. If your network is not part of an intranet, or you do not want the Switch to be accessible outside your local network, you can leave this field unchanged.
VID	This allows the entry of a VLAN ID from which a management station will be allowed to manage the Switch using TCP/IP (in-band via web manager or Telnet). Management stations that are on VLANs other than the one entered in the VID field will not be able to manage the Switch in-band unless their IP addresses are entered in the Security IP Management menu. If VLANs have not yet been configured for the Switch, the default VID (1) contains all of the Switch's ports. There are no entries in the Security IP Management table, by default – so any management station that can connect to the Switch can access the Switch until either Management Station IP Addresses (see page 29) are assigned or SNMP settings are configured to control management.

Setting the Switch's IP Address using the Console Interface

Each Switch must be assigned its own IP Address, which is used for communication with an SNMP network manager or other TCP/IP application (for example BOOTP, TFTP). The Switch's default IP address is 10.90.90.90. You can change the default Switch IP address to meet the specification of your networking address scheme.

The IP address for the Switch must be set before it can be managed with the Web-based manager. The Switch IP address can be automatically set using BOOTP or DHCP protocols, in which case the actual address assigned to the Switch must be known.

The IP address may be set using the Command Line Interface (CLI) over the console serial port as follows:

Starting at the command line prompt, enter the commands **config ipif System ipaddress xxx.xxx.xxx.xxx/yyy.yyy.yyy.yyy**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **y**'s represent the corresponding subnet mask.

Alternatively, you can enter **config ipif System ipaddress xxx.xxx.xxx.xxx/z**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **z** represents the corresponding number of subnets in CIDR notation.

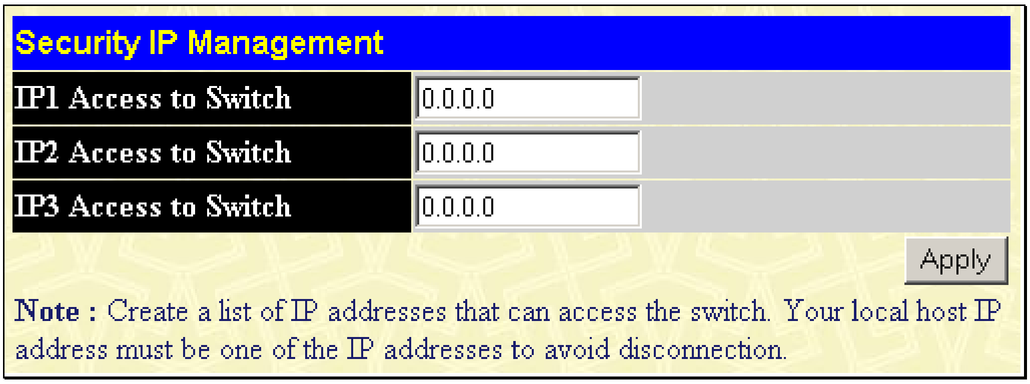
The IP interface named **System** on the Switch can be assigned an IP address and subnet mask that can then be used to connect a management station to the Switch's Telnet or Web-based management agent.

The system message **Success** indicates that the command was executed successfully. The Switch can now be configured and managed via Telnet and the CLI or via the Web-based management agent using the above IP address to connect to the Switch.

Security IP Management Stations Configuration

Use the **Security IP Management** window to define up to four community strings. Community strings are used to verify who can receive SNMP information from the Switch.

To access the **Security IP Management** window, click **Trusted Host** in the **Security** folder.



Security IP Management

IP1 Access to Switch	0.0.0.0
IP2 Access to Switch	0.0.0.0
IP3 Access to Switch	0.0.0.0

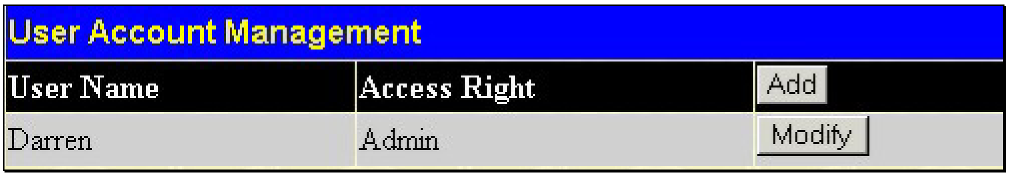
Note : Create a list of IP addresses that can access the switch. Your local host IP address must be one of the IP addresses to avoid disconnection.

Figure 3-4. Security IP Management window

Use the **Security IP Management** window to select up to three management stations used to manage the Switch. If you choose to define one or more designated management stations, only the chosen stations, as defined by IP address, will be allowed management privilege through the web manager or Telnet session. To define a management station IP setting, type in the IP address in the area provided and then click the **Apply** button.

User Account Management

Use the **User Account Management** to control user privileges. To view existing User Accounts, open the **Management** folder and click on the **User Accounts** link. This will open the **User Account Management** window, as shown below.

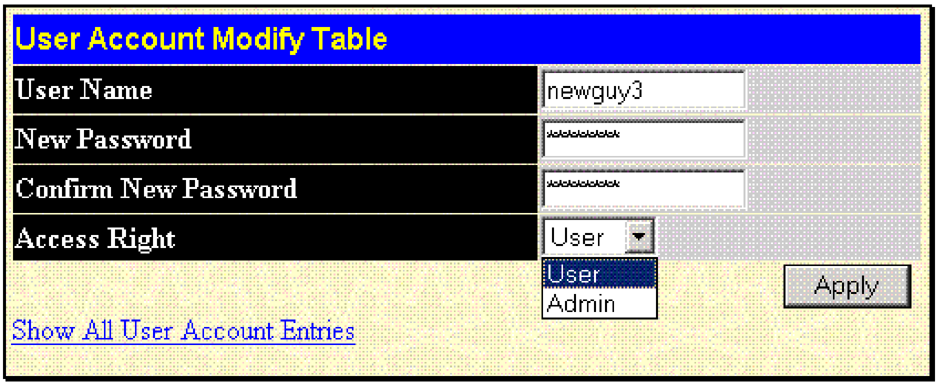


User Account Management

User Name	Access Right	Add
Darren	Admin	Modify

Figure 3- 5. User Account Management window

To add a user account, click the **Add** button revealing the following window to configure.



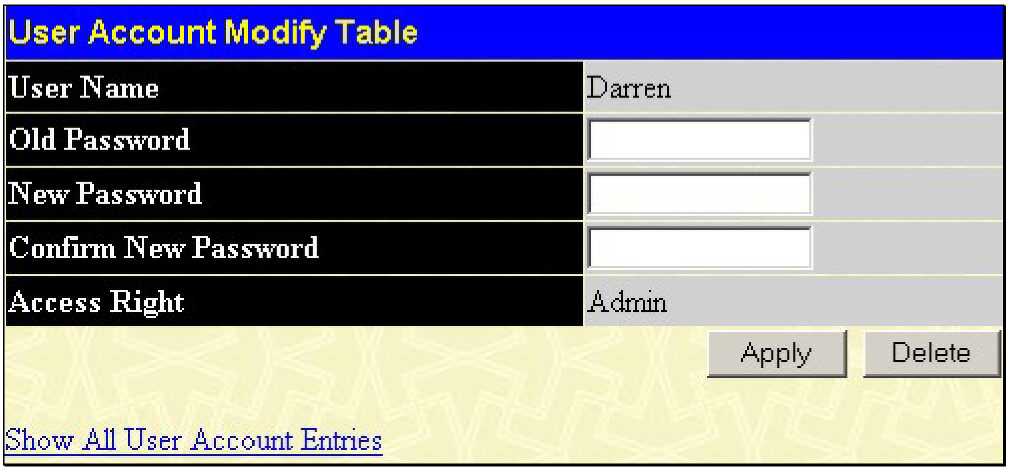
User Account Modify Table

User Name	newguy3
New Password	********
Confirm New Password	********
Access Right	User

Figure 3-6. User Account Management window

Add a new user by typing in a **User Name**, **New Password** and retype the same password in the **Confirm New Password**. Choose the level of privilege (*Admin* or *User*) from the **Access Right** drop-down menu.

To modify or delete an existing user, click on the **Modify** button for that user.



User Account Modify Table

User Name	Darren
Old Password	
New Password	
Confirm New Password	
Access Right	Admin

Figure 3- 7. User Account Modify Table window

Modify or delete an existing user account in the **User Account Modify Table** window. To delete the user account, click on the **Delete** button. To change the password, type in the **Old Password**, then enter the **New Password** and retype it in the **Confirm New Password** entry field. Click **Apply** to implement changes made. To delete the selected user account, click the **Delete** button.

Admin and User Privileges

There are two levels of user privileges: *Admin* and *User*. Some menu selections available to users with *Admin* privileges may not be available to those with *User* privileges.

The following table summarizes the *Admin* and *User* privileges:

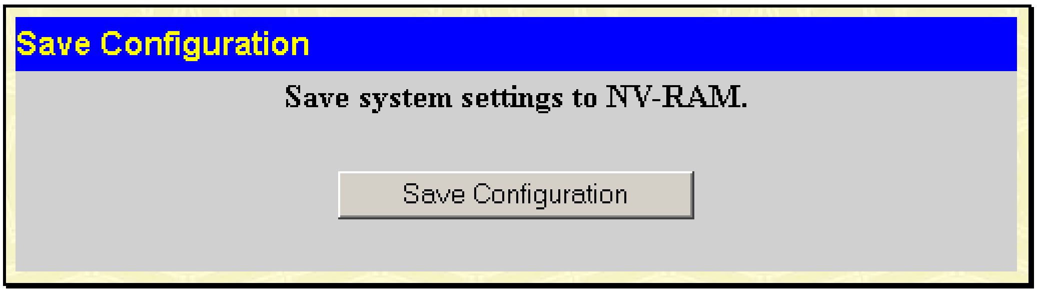
Management	Admin	User
Configuration	Yes	Read Only
Network Monitoring	Yes	Read Only
Community Strings and Trap Stations	Yes	Read Only
Update Firmware and Configuration Files	Yes	No
System Utilities	Yes	No
Factory Reset	Yes	No
User Account Management		
Add/Update/Delete User Accounts	Yes	No
View User Accounts	Yes	No

Table 3- 1. Admin and User Privileges

After establishing a User Account with *Admin*-level privileges, be sure to save the changes (see below).

Save Changes

Changes made to the Switch's configuration must be saved in order to retain them. Access the **Save Configuration** window by clicking the **Save Changes** button located in the **Maintenance** folder.



Save Configuration

Save system settings to NV-RAM.

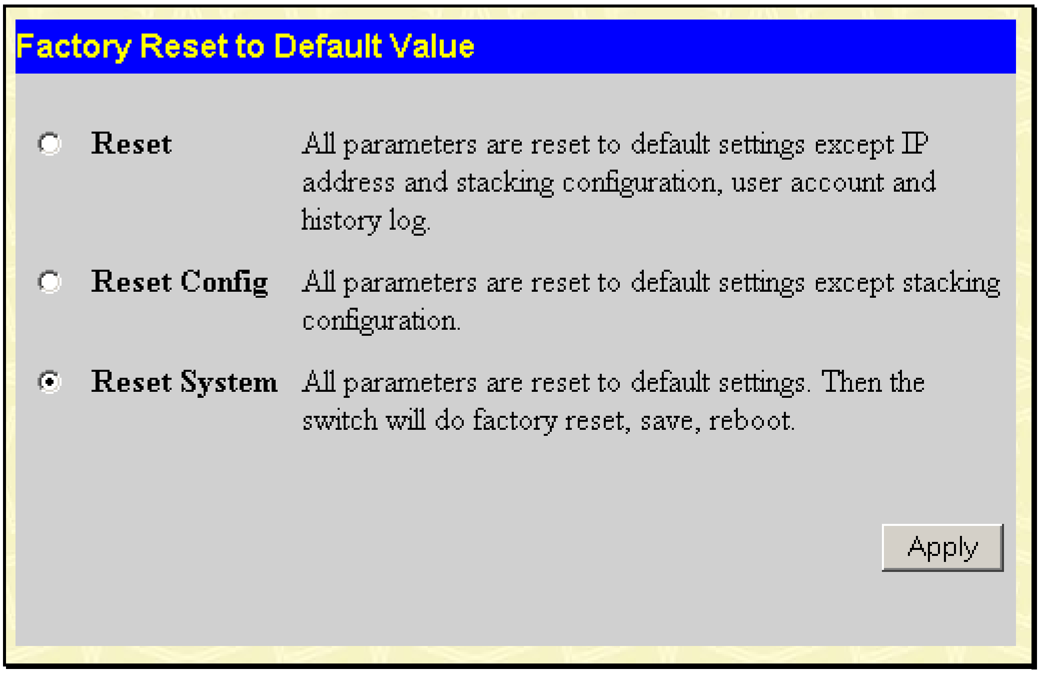
Figure 3- 8. Save Configuration window

The Switch has two levels of memory, normal RAM and non-volatile or NV-RAM. To save all the changes made in the current session to the Switch's flash memory, click the **Save Configuration** button. Click the **OK** button in the new dialog box that appears to continue. When this is done, the settings will be immediately applied to the Switching software in RAM, and will immediately take effect. Once the Switch configuration settings have been saved to NV-RAM, they become the default settings for the Switch. These settings will be used every time the Switch is rebooted.

Some settings, though, require you to restart the Switch before they will take effect. Restarting the Switch erases all settings in RAM and reloads the stored settings from the NV-RAM. Thus, it is necessary to save all setting changes to NV-RAM before rebooting the Switch.

Factory Reset

Click the **Factory Reset** link in the **Maintenance** folder to bring up the following window.



Factory Reset to Default Value

○ Reset — All parameters are reset to default settings except IP address and stacking configuration, user account and history log.

○ Reset Config — All parameters are reset to default settings except stacking configuration.

● Reset System — All parameters are reset to default settings. Then the switch will do factory reset, save, reboot.

Figure 3- 9. Factory Reset to Default Value window

The following options are available to perform a factory reset:

- **Reset** – Returns all configuration settings to the factory default settings except the Switch's stacking mode, user account, IP address, subnet mask, and default gateway settings.

- **Reset Config** – Returns all configuration settings to the factory default settings except the stacking mode configuration, but does not save the settings or reboot the Switch. If you select this option the Switch configuration will be returned to the factory default settings for the current session only. When the Switch is rebooted, it will return to the last configuration saved to the Switch's NV-RAM using the Save Changes option.
- **Reset System** – Returns all configuration settings to the factory default settings. If you select this option the Switch configuration will be returned to the factory default settings and then saves the factory default configuration to the Switch's NV-RAM. The Switch will then reboot. When the Switch has rebooted, it will have the same configuration as when it was delivered from the factory.

Select the reset option you want to perform and click on the **Apply** button.

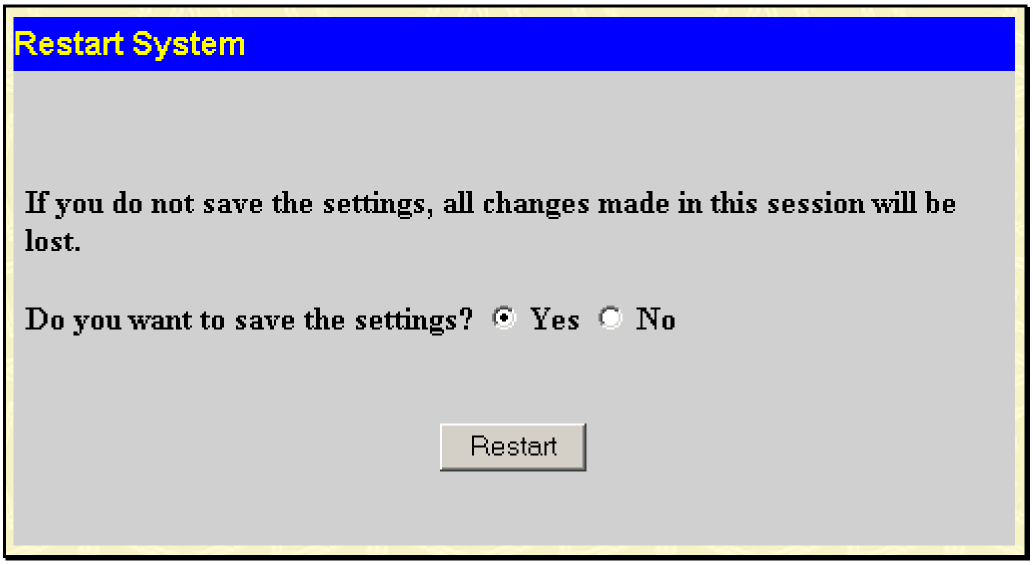
Restart System

The following window is used to restart the Switch. Access this window by clicking on the **Restart System** link in the **Maintenance** folder.

Click **Yes** after "Do you want to save the settings?" to instruct the Switch to save the current configuration to non-volatile RAM before restarting the Switch.

Clicking the No option instructs the Switch not to save the current configuration before restarting the Switch. All of the configuration information entered from the last time **Save Changes** was executed will be lost.

Click the **Restart** button to restart the Switch.



Restart System

If you do not save the settings, all changes made in this session will be lost.

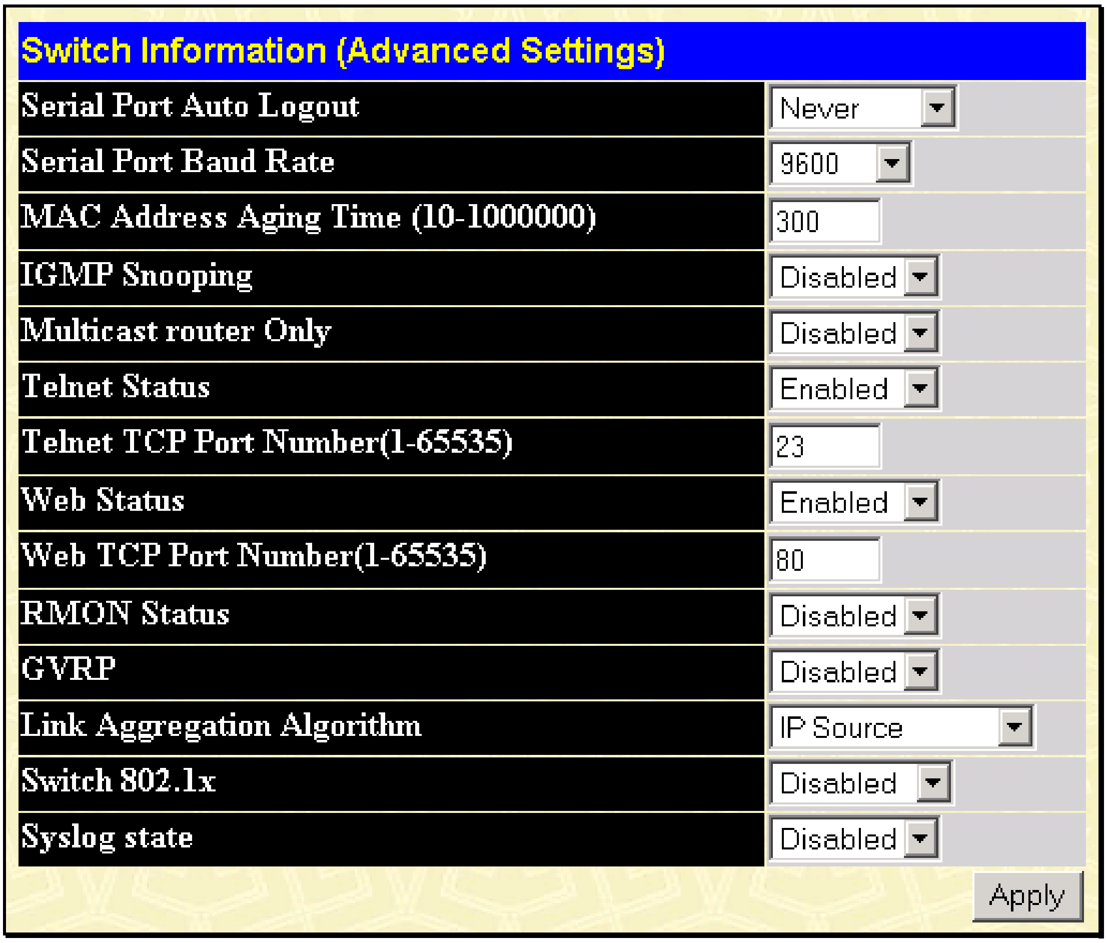
Do you want to save the settings? ● Yes ○ No

Figure 3- 10. Restart System window

NOTE: Clicking **Yes** is equivalent to executing Save Changes and then restarting the Switch.

Advanced Settings

To view the following window, click **Configuration** > **Advanced Settings**:



Switch Information (Advanced Settings)

Serial Port Auto Logout	Never
Serial Port Baud Rate	9600
MAC Address Aging Time (10-1000000)	300
IGMP Snooping	Disabled
Multicast router Only	Disabled
Telnet Status	Enabled
Telnet TCP Port Number(1-65535)	23
Web Status	Enabled
Web TCP Port Number(1-65535)	80
RMON Status	Disabled
GVRP	Disabled
Link Aggregation Algorithm	IP Source
Switch 802.1x	Disabled
Syslog state	Disabled

Figure 3- 11. Switch Information (Advanced Settings) window

The **Advanced Settings** options are summarized in the table below:

Parameter	Description
Serial Port Auto Logout	Select the logout time used for the console interface. This automatically logs the user out after an idle period of time as defined. Choose from the following options: *2 Minutes, 5 Minutes, 10 Minutes, 15 Minutes* or *Never.*
Serial Port Baud Rate	Select the baud rate used for the console interface. This automatically logs the user out after an idle period of time as defined. Choose from the following options: *9600, 19200, 38400* or *115200*.
MAC Address Aging Time (10-1000000)	This field specifies the length of time a learned MAC Address will remain in the forwarding table without being accessed (that is, how long a learned MAC Address is allowed to remain idle). The default age-out time for the Switch is 300 seconds. To change this, type in a different value representing the MAC address age-out time in seconds. The Aging Time can be set to any value between *10* and *1,000,000* seconds.
IGMP Snooping	To enable system-wide IGMP Snooping capability select *Enabled*. IGMP snooping is *Disabled* by default. Enabling IGMP snooping allows you to specify use of a multicast router only (see below). To configure IGMP Snooping for individual VLANs, use the **IGMP Snooping** window in the **IGMP** folder.

Multicast router Only	If this option is enabled and IGMP Snooping is also enabled, the Switch forwards all multicast traffic to a multicast-enabled router only. Otherwise, the Switch will forward all multicast traffic to any IP router.
Telnet Status	Telnet configuration is *Enabled* by default. If you do not want to allow configuration of the system through Telnet choose *Disabled*.
Telnet TCP Port Number (1-65535)	The Telnet TCP port number. TCP ports are numbered between 1 and 65535. The "well-known" TCP port for the Telnet protocol is 23.
Web Status	Web-based management is *Enabled* by default. If you choose to disable this by selecting *Disabled*, you will lose the ability to configure the system through the web interface as soon as these settings are applied.
Web TCP Port Number (1-65535)	The TCP port number currently being utilized by the Switch to connect to the web interface. The "well-known" TCP port for the Web interface is 80.
RMON Status	Remote monitoring (RMON) of the Switch is *Enabled* or *Disabled* here.
GVRP	Use this pull-down menu to enable or disable GVRP on the Switch.
Link Aggregation Algorithm	The algorithm that the Switch uses to balance the load across the ports that make up the port trunk group is defined by this definition. Choose *MAC Source, MAC Destination*, *MAC Src & Dest, IP Source, IP Destination*, and *IP Src & Dest.* (See Link Aggregation)
Switch 802.1x	The Switch's 802.1x function may be enabled by port or by MAC Address; the default is *Disabled*. This field must be enabled to view and configure certain windows for 802.1x. More information regarding 802.1x, its functions and implementation can be found later in this section, under the **Port Access Entity** folder. **Port-Based 802.1x** specifies that ports configured for 802.1x are initialized based on the port number only and are subject to any authorization parameters configured. **MAC-based 802.1x** specifies that ports configured for 802.1x are initialized based on the port number and the MAC address of the computer being authorized and are then subject to any authorization parameters configured.
Syslog state	Use this pull-down menu to enable or disable Syslog.

Click **Apply** to implement changes made.

Switch Stack Management

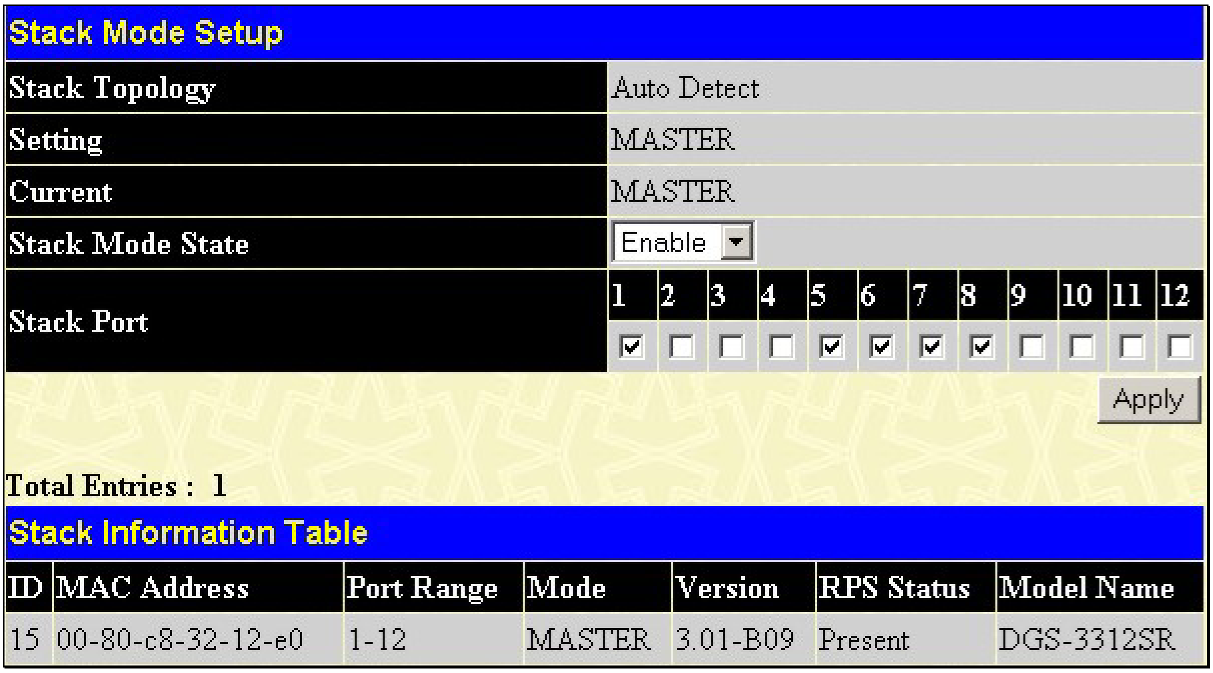
The DGS-3312SR has a possible twelve gigabit ports that may be used in standalone mode or can be used in a stacking configuration to provide up to 576 10/100 Mbps ports and 12 Gigabit ports in a star architecture. For stacking, the DGS-3312SR will be the master switch of a stack of DES-3226S switches, DES-3250TG switches or a combination of both. For more information on stacking see Sections 1 and 2 of this manual regarding stacking and the DGS-3312SR.

Configure Stacking

The web manager can be used to enable or disable the stacking mode and to enable stacking for any of the built-in combination ports.

The Switch stack displayed in the upper right-hand corner of your web-browser is a virtual representation of the actual stack (see example below). The icons appear in the same order as their respective Switches.

When the Switches are properly interconnected, information about the resulting Switch stack is displayed in the **Stack Mode Setup** window. To view stacking information or to enable/disable the stacking mode, click the **Stack Information** link in the **Monitoring** folder.



Stack Mode Setup

Stack Topology	Auto Detect
Setting	MASTER
Current	MASTER
Stack Mode State	Enable

Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	☑	□	□	□	☑	☑	☑	☑	□	□	□	□

Total Entries : 1

Stack Information Table

ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-80-c8-32-12-e0	1-12	MASTER	3.01-B09	Present	DGS-3312SR

Figure 3- 12. Stack Mode Setup (stacking disabled) window

To enable the stacking mode, follow the steps listed below.

1. Select *Enabled* from the Stack Mode State drop-down menu.
2. Click on the **Apply** button.

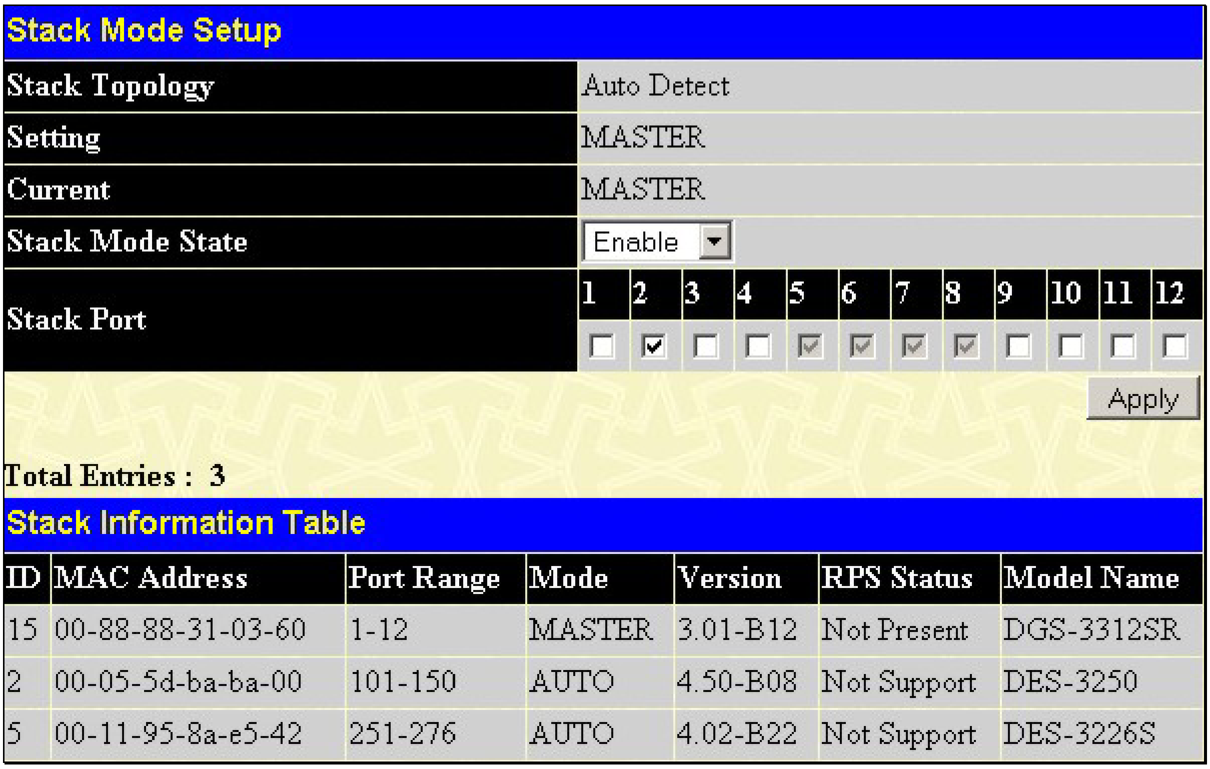
To enable stacking for one or more built-in combination ports, do the following:

1. Select *Enabled* from the Stack Mode State drop-down menu.
2. Select the Stack Port by clicking to check a corresponding selection box.

The **Stack Information Table** displays the read-only information listed in the table on the next page.

The current order in the Switch stack is also displayed on the front panel of each slave Switch, under the STACK NO. heading. The Stack ID LED display on the front panel of the DGS-3312SR will always display an F (15 in hex), regardless of whether the DGS-3312SR is the master Switch in a Switch stack or in standalone mode.

Below is an example of the **Stack Mode Setup** window with stacking mode enabled.



Stack Mode Setup

Stack Topology	Auto Detect
Setting	MASTER
Current	MASTER
Stack Mode State	Enable

Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	□	☑	□	□	☑	☑	☑	☑	□	□	□	□

Total Entries : 3

Stack Information Table

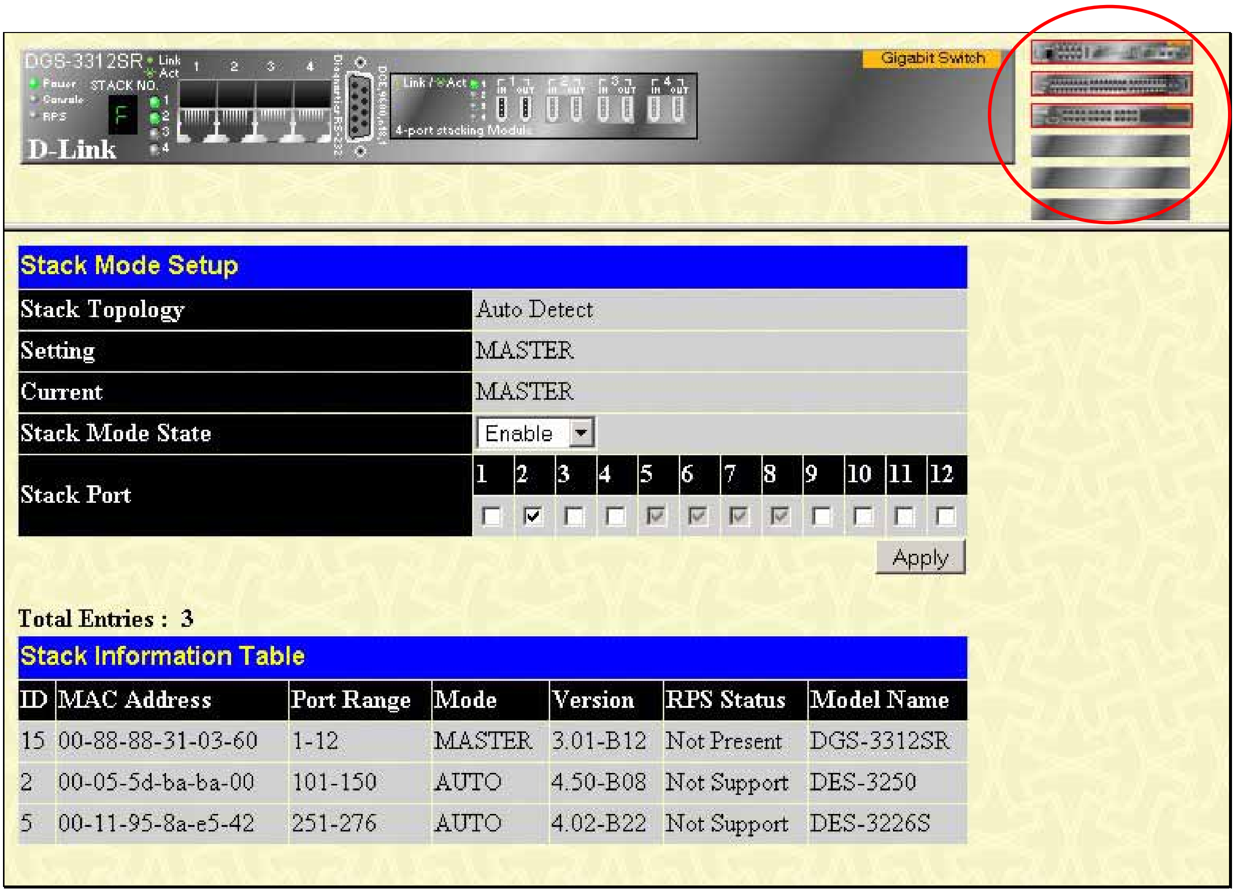
ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-88-88-31-03-60	1-12	MASTER	3.01-B12	Not Present	DGS-3312SR
2	00-05-5d-ba-ba-00	101-150	AUTO	4.50-B08	Not Support	DES-3250
5	00-11-95-8a-e5-42	251-276	AUTO	4.02-B22	Not Support	DES-3226S

Figure 3- 13. Stack Mode Setup (stacking enabled) window

Variables in this window are described below:

Parameter	Description
ID	Displays the Switch’s order in the stack. The Switch with a unit ID of 15 is the master Switch.
MAC Address	Displays the unique address of the Switch assigned by the factory.
Port Range	Displays the total number of ports on the Switch. Note that the stacking port is included in the total count.
Mode	Displays the method used to determine the stacking order of the Switches in the Switch stack.
Version	Displays the version number of the stacking firmware.
RPS Status	Displays the status of an optional Redundant Power Supply.
Model Name	Displays the model name of the corresponding Switch in a stack.

When the stacked group is connected and properly configured, the virtual stack appears in the upper right-hand corner of the web page.



Stack Mode Setup

Stack Topology	Auto Detect											
Setting	MASTER											
Current	MASTER											
Stack Mode State	Enable ▾											
Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	☐	☑	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐

Apply

Total Entries : 3

Stack Information Table

ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-88-88-31-03-60	1-12	MASTER	3.01-B12	Not Present	DGS-3312SR
2	00-05-5d-ba-ba-00	101-150	AUTO	4.50-B08	Not Support	DES-3250
5	00-11-95-8a-e5-42	251-276	AUTO	4.02-B22	Not Support	DES-3226S

Figure 3- 14. Stack Information web page with updated stack configuration

Section 4

Basic Configuration

Switch Information

IP Address

Advanced Settings

Port Configuration

Port Description

Port Mirroring

Traffic Control

Link Aggregation

Port Access Entity

IGMP Snooping

Spanning Tree

Forwarding & Filtering

VLANs

QoS

MAC Notification

Port Security Configuration

System Log Server

SNTP Settings

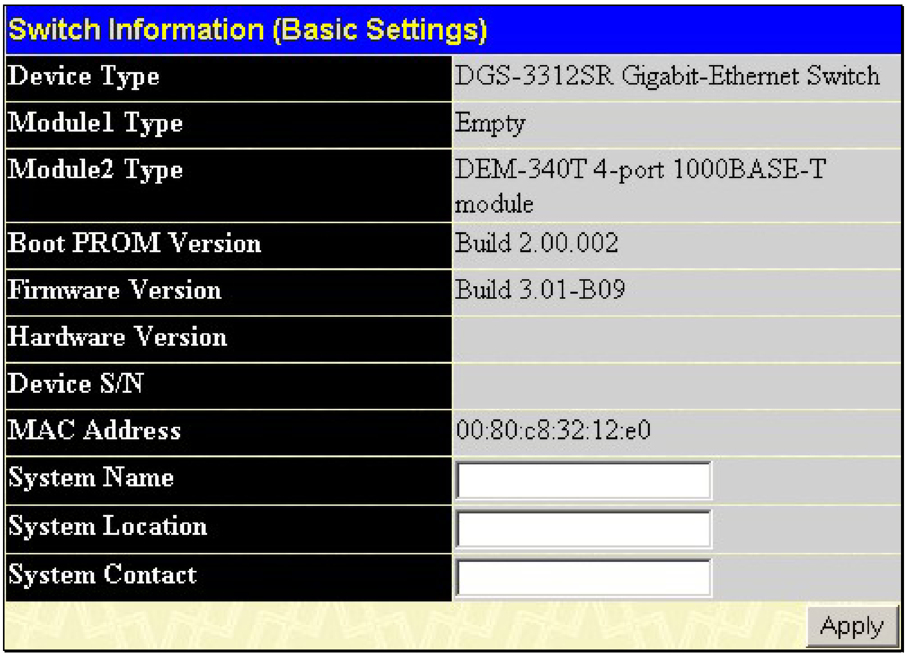
Access Profile Table

Layer 3 IP Networking

The DGS-3312SR's Web interface is divided into six main folders: **Configuration**, **Security**, **Management**, **Monitoring**, **Maintenance**, and **Single IP Management**. This chapter describes all of the **Configuration** sub-folders and windows except those found in the **Layer 3 IP Networking** sub-folder, which are explained in the next chapter.

Switch Information

The first page displayed upon logging in is the **System Information (Basic Settings)** window. This window can be accessed at any time by clicking the **Switch Information** link in the **Configuration** folder.



Switch Information (Basic Settings)

Device Type	DGS-3312SR Gigabit-Ethernet Switch
Module1 Type	Empty
Module2 Type	DEM-340T 4-port 1000BASE-T module
Boot PROM Version	Build 2.00.002
Firmware Version	Build 3.01-B09
Hardware Version	
Device S/N	
MAC Address	00:80:c8:32:12:e0
System Name	
System Location	
System Contact	

Figure 4- 1. Switch Information (Basic Settings) window

This window displays general information about the Switch including its MAC Address, Hardware Boot PROM and Firmware versions, and installed module information.

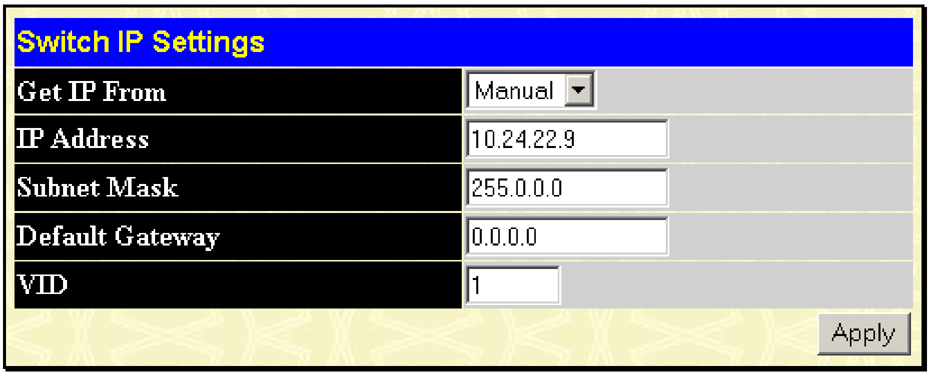
IP Address

Switch IP settings may initially be set using the console interface prior to connecting to it through the Ethernet. If the Switch IP address has not yet been changed, read the Introduction of the CLI Reference or skip ahead to the end of this section for a quick description of how to use the console port and CLI IP settings commands to establish IP settings for the Switch.

To change IP settings using the web manager you must access the **Switch IP Settings** window located in the **Configuration** folder.

To configure the Switch's IP address:

Open the **Configuration** folder and click the **IP Address** link. The web manager will display the **Switch IP Settings** window below:



Switch IP Settings

Get IP From	Manual
IP Address	10.24.22.9
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0
VID	1

Figure 4- 2. Switch IP Settings window

NOTE: The Switch's factory default IP address is 10.90.90.90 with a subnet mask of 255.0.0.0 and a default gateway of 0.0.0.0.

To manually assign the Switch's IP address, subnet mask, and default gateway address:

- Select *Manual* from the Get IP From drop-down menu.
- Enter the appropriate IP address and subnet mask.

If you want to access the Switch from a different subnet from the one it is installed on, enter the IP address of the gateway. If you will manage the Switch from the subnet on which it is installed, you can leave the default address (0.0.0.0) in this field.

If no VLANs have been previously configured on the Switch, you can use the default VLAN ID (VID) 1. The default VLAN contains all of the Switch ports as members. If VLANs have been previously configured on the Switch, you will need to enter the VLAN ID of the VLAN that contains the port connected to the management station that will access the Switch. The Switch will allow management access from stations with the same VID listed here.

To use the BOOTP or DHCP protocols to assign the Switch an IP address, subnet mask, and default gateway address:

Use the Get IP From pull-down menu to choose from *BOOTP* or *DHCP*. This selects how the Switch will be assigned an IP address on the next reboot.

The **Switch IP Settings** options are:

Parameter	Description
BOOTP	The Switch will send out a BOOTP broadcast request when it is powered up. The BOOTP protocol allows IP addresses, network masks, and default gateways to be assigned by a central BOOTP server. If this option is set, the Switch will first look for a BOOTP server to provide it with this information before using the default or previously entered settings.
DHCP	The Switch will send out a DHCP broadcast request when it is powered up. The DHCP protocol allows IP addresses, network masks, and default gateways to be assigned by a DHCP server. If this option is set, the Switch will first look for a DHCP server to provide it with this information before using the default or previously entered settings.
Manual	Allows the entry of an IP address, Subnet Mask, and a Default Gateway for the Switch. These fields should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal form) between *0* and *255*. This address should be a unique address on the network assigned for use by the network administrator. The fields which require entries under this option are as follows:
Subnet Mask	A Bitmask that determines the extent of the subnet that the Switch is on. Should be of the form xxx.xxx.xxx.xxx, where each xxx is a number (represented in decimal) between *0* and *255*. The value should be 255.0.0.0 for a Class A network, 255.255.0.0 for a Class B network, and 255.255.255.0 for a Class C network, but custom subnet masks are allowed.
Default Gateway	IP address that determines where packets with a destination address outside the current subnet should be sent. This is usually the address of a router or a host acting as an IP gateway. If your network is not part of an intranet, or you do not want the Switch to be accessible outside your local network, you can leave this field unchanged.

VID	This allows the entry of a VLAN ID from which a management station will be allowed to manage the Switch using TCP/IP (in-band via web manager or Telnet). Management stations that are on VLANs other than the one entered in the VID field will not be able to manage the Switch in-band unless their IP addresses are entered in the **Security IP Management** window. If VLANs have not yet been configured for the Switch, The default VID (1) contains all of the Switch's ports. There are no entries in the Security IP Management table, by default – so any management station that can connect to the Switch can access the Switch until either Management Station IP Addresses are assigned or SNMP settings are configured to control management access.

Setting the Switch's IP Address using the Console Interface

Each Switch must be assigned its own IP Address, which is used for communication with an SNMP network manager or other TCP/IP application (for example BOOTP, TFTP). The Switch's default IP address is 10.90.90.90. You can change the default Switch IP address to meet the specification of your networking address scheme.

The IP address for the Switch must be set before it can be managed with the Web-based manager. The Switch IP address can be automatically set using BOOTP or DHCP protocols, in which case the actual address assigned to the Switch must be known.

The IP address may be set using the Command Line Interface (CLI) over the console serial port as follows:

Starting at the command line prompt, enter the commands **config ipif System ipaddress xxx.xxx.xxx.xxx/yyy.yyy.yyy.yyy**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **y**'s represent the corresponding subnet mask.

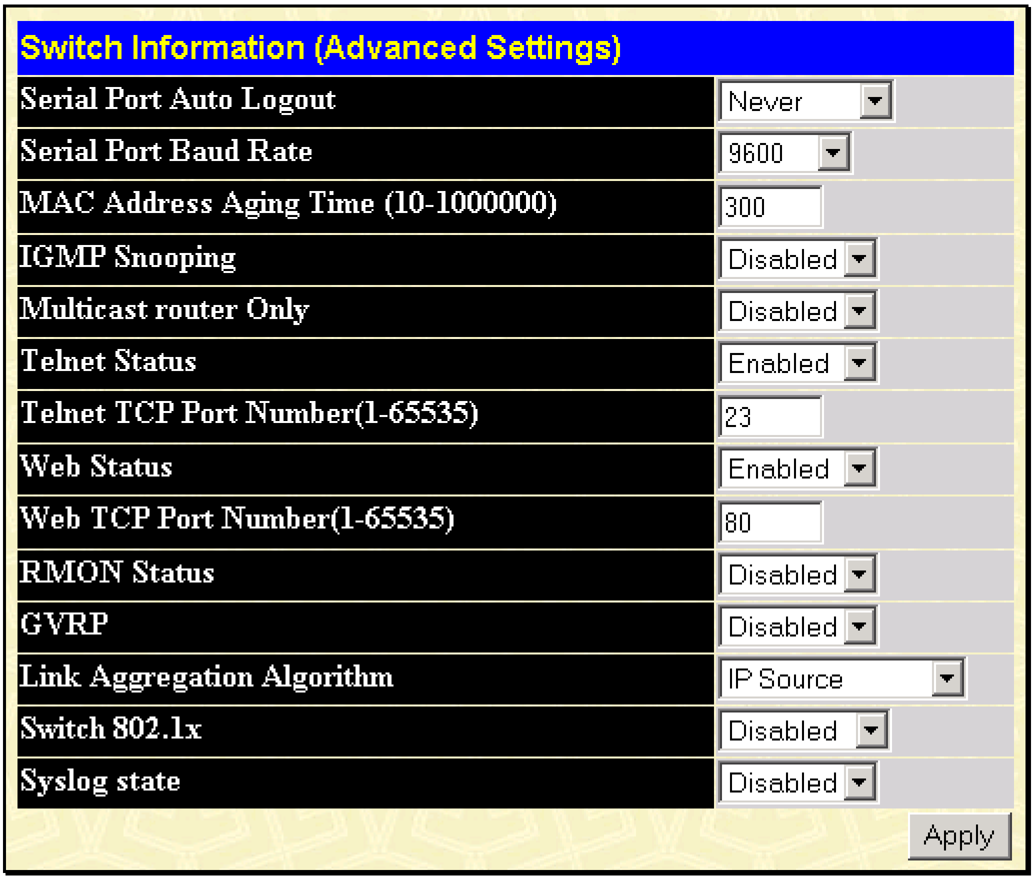
Alternatively, you can enter **config ipif System ipaddress xxx.xxx.xxx.xxx/z**. Where the **x**'s represent the IP address to be assigned to the IP interface named **System** and the **z** represents the corresponding number of subnets in CIDR notation.

The IP interface named **System** on the Switch can be assigned an IP address and subnet mask that can then be used to connect a management station to the Switch's Telnet or Web-based management agent.

The system message **Success** indicates that the command was executed successfully. The Switch can now be configured and managed via Telnet and the CLI or via the Web-based management agent using the above IP address to connect to the Switch.

Advanced Settings

To view the following window, click **Configuration** > **Advanced Settings**:



Switch Information (Advanced Settings)

Serial Port Auto Logout	Never
Serial Port Baud Rate	9600
MAC Address Aging Time (10-1000000)	300
IGMP Snooping	Disabled
Multicast router Only	Disabled
Telnet Status	Enabled
Telnet TCP Port Number(1-65535)	23
Web Status	Enabled
Web TCP Port Number(1-65535)	80
RMON Status	Disabled
GVRP	Disabled
Link Aggregation Algorithm	IP Source
Switch 802.1x	Disabled
Syslog state	Disabled

Figure 4- 3. Switch Information (Advanced Settings) window

The Advanced Settings options are summarized in the table below:

Parameter	Description
Serial Port Auto Logout	Select the logout time used for the console interface. This automatically logs the user out after an idle period of time as defined. Choose from the following options: *2 Minutes, 5 Minutes, 10 Minutes, 15 Minutes* or *Never.*
Serial Port Baud Rate	Select the baud rate used for the console interface. This automatically logs the user out after an idle period of time as defined. Choose from the following options: *9600, 19200, 38400* or *115200*.
MAC Address Aging Time (10-1000000)	This field specifies the length of time a learned MAC Address will remain in the forwarding table without being accessed (that is, how long a learned MAC Address is allowed to remain idle). The default age-out time for the Switch is 300 seconds. To change this, type in a different value representing the MAC address age-out time in seconds. The Aging Time can be set to any value between *10* and *1,000,000* seconds.
IGMP Snooping	To enable system-wide IGMP Snooping capability select *Enabled*. IGMP snooping is *Disabled* by default. Enabling IGMP snooping allows you to specify use of a multicast router only (see below). To configure IGMP Snooping for individual VLANs, use the **IGMP Snooping** window in the **IGMP** folder.

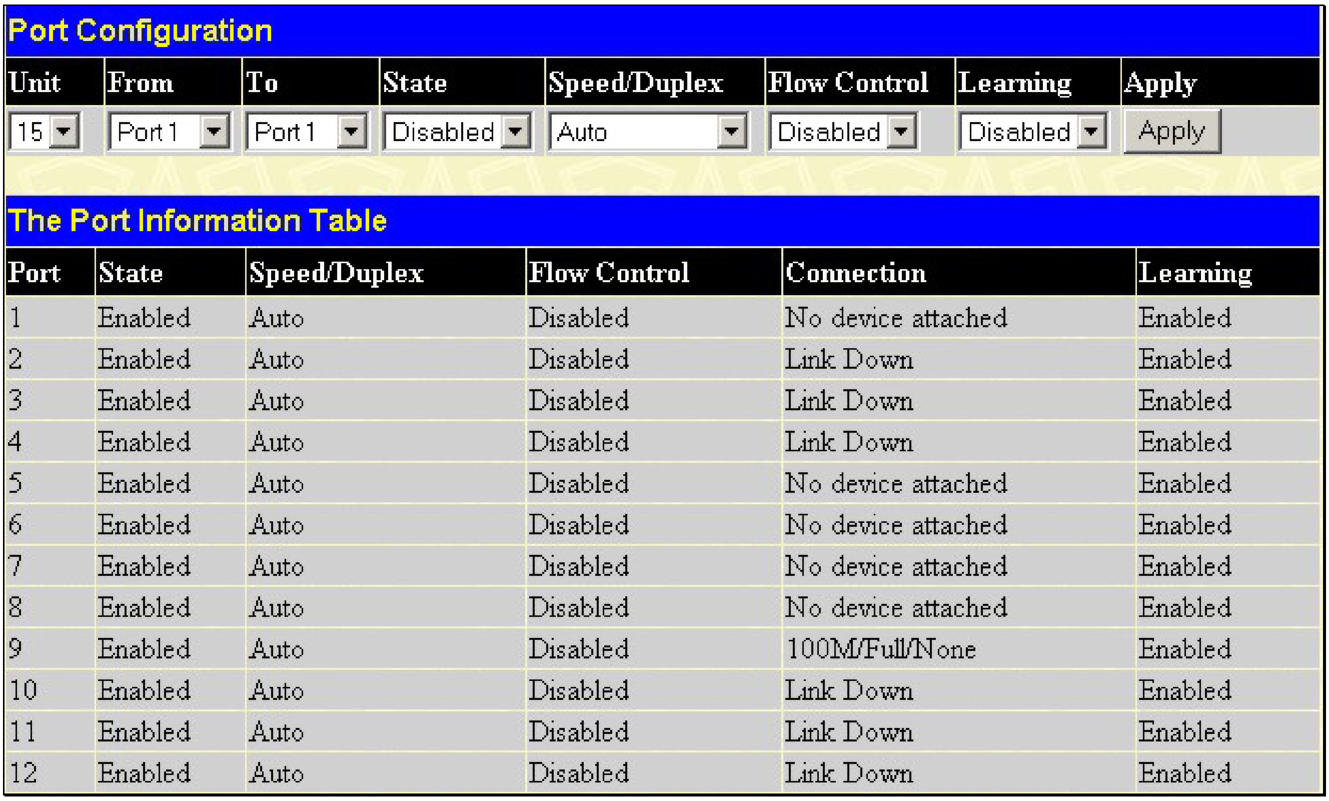
Multicast router Only	If this option is enabled and IGMP Snooping is also enabled, the Switch forwards all multicast traffic to a multicast-enabled router only. Otherwise, the Switch will forward all multicast traffic to any IP router.
Telnet Status	Telnet configuration is *Enabled* by default. If you do not want to allow configuration of the system through Telnet choose *Disabled*.
Telnet TCP Port Number (1-65535)	The Telnet TCP port number. TCP ports are numbered between 1 and 65535. The "well-known" TCP port for the Telnet protocol is 23.
Web Status	Web-based management is *Enabled* by default. If you choose to disable this by selecting *Disabled*, you will lose the ability to configure the system through the web interface as soon as these settings are applied.
Web TCP Port Number(1-65535)	The TCP port number currently being utilized by the Switch to connect to the web interface. The "well-known" TCP port for the Web interface is 80.
RMON Status	Remote monitoring (RMON) of the Switch is *Enabled* or *Disabled* here.
GVRP	Use this pull-down menu to enable or disable GVRP on the Switch.
Link Aggregation Algorithm	The algorithm that the Switch uses to balance the load across the ports that make up the port trunk group is defined by this definition. Choose *MAC Source, MAC Destination*, *MAC Src & Dest, IP Source, IP Destination*, and *IP Src & Dest.* (See Link Aggregation)
Switch 802.1x	The Switch's 802.1x function may be enabled by port or by MAC Address; the default is *Disabled*. This field must be enabled to view and configure certain windows for 802.1x. More information regarding 802.1x, its functions and implementation can be found later in this section, under the **Port Access Entity** folder. **Port-Based 802.1x** specifies that ports configured for 802.1x are initialized based on the port number only and are subject to any authorization parameters configured. **MAC-based 802.1x** specifies that ports configured for 802.1x are initialized based on the port number and the MAC address of the computer being authorized and are then subject to any authorization parameters configured.
Syslog state	Use this pull-down menu to enable or disable Syslog functions on the Switch.

Click **Apply** to implement changes made.

Port Configuration

To configure basic port settings such as port speed, duplex, and learning state, use the **Port Configuration** window.

Click the **Port Configuration** link in the **Configuration** folder:



Port Configuration

Unit	From	To	State	Speed/Duplex	Flow Control	Learning	Apply
15	Port 1	Port 1	Disabled	Auto	Disabled	Disabled	Apply

The Port Information Table

Port	State	Speed/Duplex	Flow Control	Connection	Learning
1	Enabled	Auto	Disabled	No device attached	Enabled
2	Enabled	Auto	Disabled	Link Down	Enabled
3	Enabled	Auto	Disabled	Link Down	Enabled
4	Enabled	Auto	Disabled	Link Down	Enabled
5	Enabled	Auto	Disabled	No device attached	Enabled
6	Enabled	Auto	Disabled	No device attached	Enabled
7	Enabled	Auto	Disabled	No device attached	Enabled
8	Enabled	Auto	Disabled	No device attached	Enabled
9	Enabled	Auto	Disabled	100M/Full/None	Enabled
10	Enabled	Auto	Disabled	Link Down	Enabled
11	Enabled	Auto	Disabled	Link Down	Enabled
12	Enabled	Auto	Disabled	Link Down	Enabled

Figure 4- 4. Port Configuration and The Port Information Table window

To configure Switch ports:

- Choose the **Unit** from the pull-down menu.
- Choose the port or sequential range of ports using the **From…To…** port pull-down menus.
- Use the remaining pull-down menus to configure the parameters described in the table below.

The configurable parameters for ports include the following:

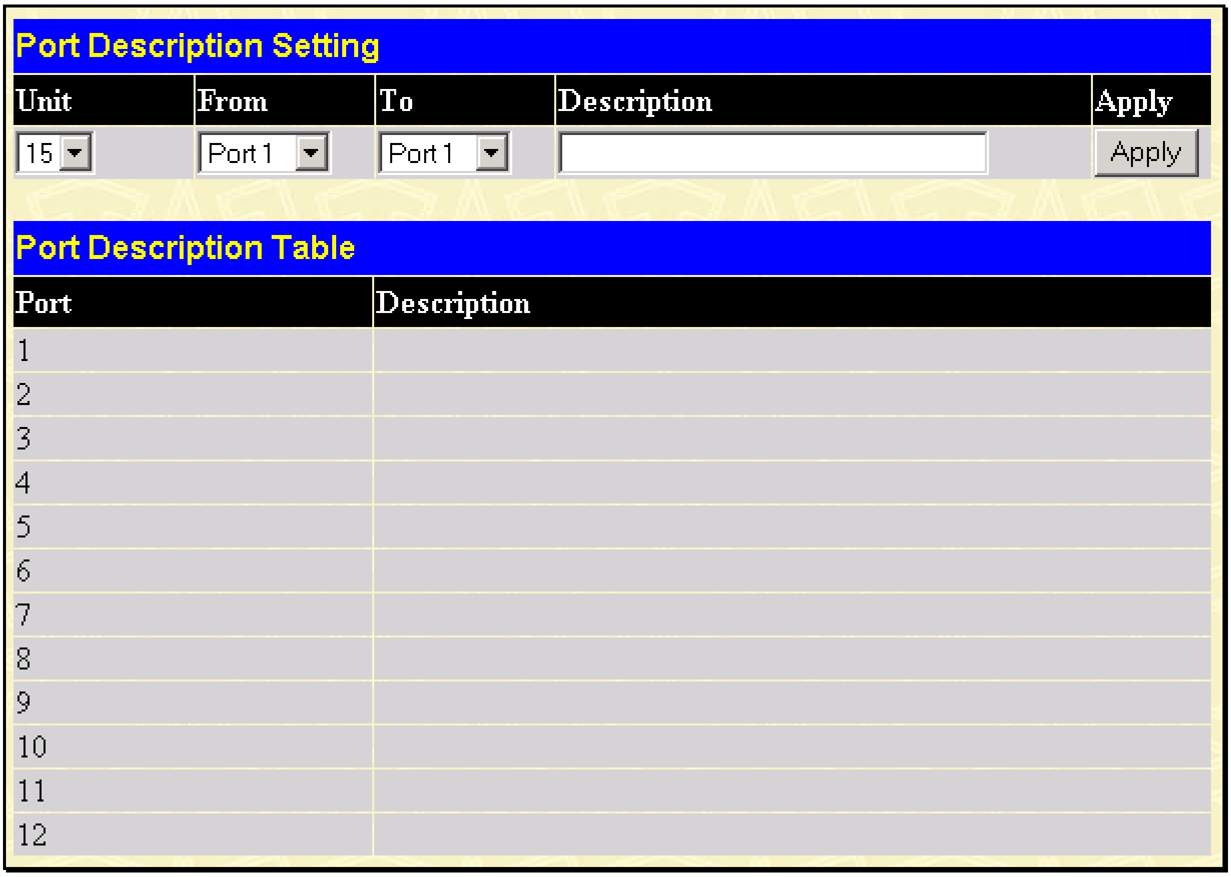
Parameter	Description
Unit	Select the Switch in the Switch stack to be configured using the pull-down menu. 15 a switch in standalone mode.
From… To	Select a port or range of ports to be configured
State <*Enabled*>	Toggle the State field to either enable or disable a given port.
Speed/Duplex <*Auto*>	Toggle the **Speed/Duplex** field to either select the speed and duplex/half-duplex state of the port. *Auto* denotes auto-negotiation between 10 and 100 Mbps devices, in full- or half-duplex. The *Auto* setting allows the port to automatically determine the fastest settings the device the port is connected to can handle, and then to use those settings. The other options are *Auto*, *10M/Half*, *10M/Full, 100M/Half* and *100M/Full*, *1000M/Full_M* and *1000M/Full_S*. There is no automatic adjustment of port settings with any option other than Auto.

	The Switch allows the user to configure two types of gigabit connections; *1000M/Full_M* and *1000M/Full_S*. Gigabit connections are only supported in full duplex connections and take on certain characteristics that are different from the other choices listed. The *1000M/Full_M* (master) and *1000M/Full_S* (slave) parameters refer to connections running a 1000BASE-T cable for connection between the Switch port and other device capable of a gigabit connection. The master setting (*1000M/Full_M)* will allow the port to advertise capabilities related to duplex, speed and physical layer type. The master setting will also determine the master and slave relationship between the two connected physical layers. This relationship is necessary for establishing the timing control between the two physical layers. The timing control is set on a master physical layer by a local source. The slave setting (*1000M/Full_S)* uses loop timing, where the timing comes form a data stream received from the master. If one connection is set for *1000M/Full_M*, the other side of the connection must be set for *1000M/Full_S*. Any other configuration will result in a link down status for both ports.
Flow Control	Displays the flow control scheme used for the various port configurations. Ports configured for full-duplex use 802.3x flow control, half-duplex ports use backpressure flow control, and Auto ports use an automatic selection of the two. The default is *Disabled*.
Learning	Enable or disable MAC address learning for the selected ports. When *Enabled*, destination and source MAC addresses are automatically listed in the forwarding table. When learning is *Disabled*, MAC addresses must be manually entered into the forwarding table. This is sometimes done for reasons of security or efficiency.

Click **Apply** to implement changes made.

Port Description

The Switch supports a port description feature where the user may name various ports on the Switch. To assign names or descriptions to various ports, click **Port Description** on the **Configuration** folder:



Port Description Setting

Unit	From	To	Description	Apply
15 ▾	Port 1 ▾	Port 1 ▾		Apply

Port Description Table

Port	Description
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Figure 4- 5. Port Description Setting window

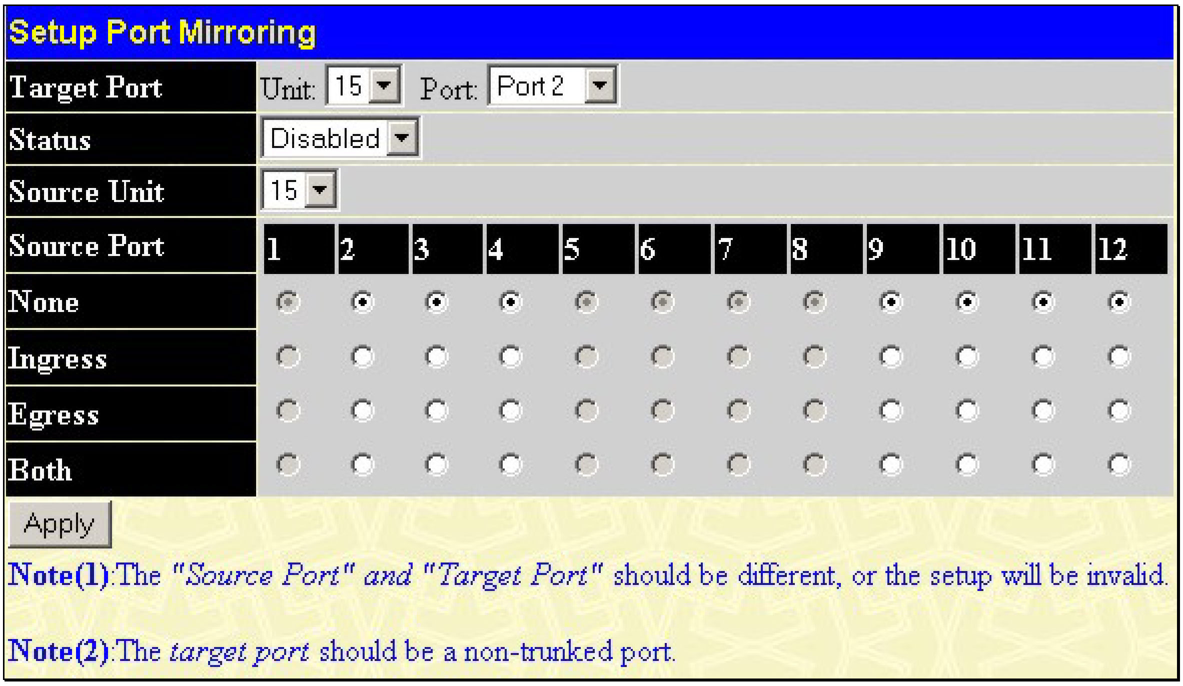
The user may set the following parameters:

Parameter	Description
Unit	This is the Unit ID of a Switch in a Switch stack. The number 15 indicates a DGS-3312SR Switch in standalone mode.
From/To	A consecutive group of ports may be configured starting with the selected port.
Description	Enter a description of the port or ports.

Click **Apply** to implement changes made.

Port Mirroring

The Switch allows you to copy frames transmitted and received on a port and redirect the copies to another port. You can attach a monitoring device to the mirrored port, such as a sniffer or an RMON probe, to view details about the packets passing through the first port. Follow the steps below to set up port mirroring. To view this window, click **Configuration > Port Mirroring**.



Setup Port Mirroring

Target Port	Unit: 15 Port: Port 2											
Status	Disabled											
Source Unit	15											
Source Port	1	2	3	4	5	6	7	8	9	10	11	12
None	●	●	●	●	●	●	●	●	●	●	●	●
Ingress	○	○	○	○	○	○	○	○	○	○	○	○
Egress	○	○	○	○	○	○	○	○	○	○	○	○
Both	○	○	○	○	○	○	○	○	○	○	○	○

Note(1):The *"Source Port" and "Target Port"* should be different, or the setup will be invalid.

Note(2):The *target port* should be a non-trunked port.

Figure 4- 6. Setup Port Mirroring window

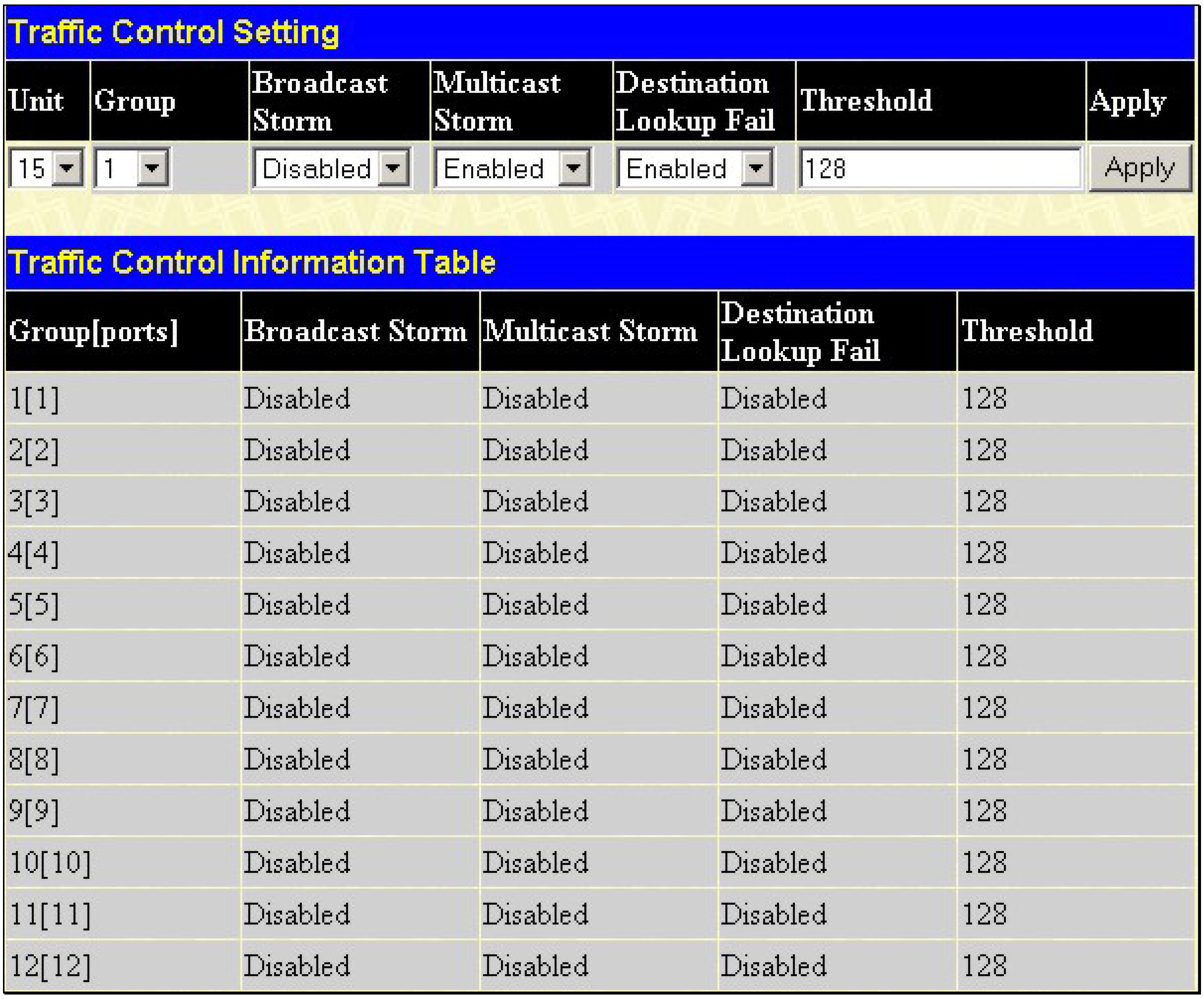
To configure a mirror port:

- Select the **Source Unit** containing the port that is being mirrored.
- Configure how the port is to be mirrored by selecting the direction that will be mirrored. Choose **Ingress**, **Egress**, or **Both** for the mirrored port by clicking the appropriate radio button for the port.
- Select the **Target Port** using the **Unit** and **Port** drop-down menus.
- Change the **Status** drop-down menu to *Enabled*.
- Click **Apply** to let the changes take effect.

NOTE: You cannot mirror a fast port onto a slower port. For example, if you try to mirror the traffic from a 100 Mbps port onto a 10 Mbps port, this can cause throughput problems. The port you are copying frames from should always support an equal or lower speed than the port to which you are sending the copies. In addition, the target port for the mirroring cannot be a member of a trunk group. Please note a target port and a source port cannot be the same port.

Traffic Control

Use the **Traffic Control Setting** window to enable or disable storm control and adjust the threshold for multicast and broadcast storms, as well as DLF (Destination Look Up Failure). Traffic control settings are applied to individual Switch modules. To view this window, click **Configuration > Traffic Control**.



Traffic Control Setting

Unit	Group	Broadcast Storm	Multicast Storm	Destination Lookup Fail	Threshold	Apply
15	1	Disabled	Enabled	Enabled	128	Apply

Traffic Control Information Table

Group[ports]	Broadcast Storm	Multicast Storm	Destination Lookup Fail	Threshold
1[1]	Disabled	Disabled	Disabled	128
2[2]	Disabled	Disabled	Disabled	128
3[3]	Disabled	Disabled	Disabled	128
4[4]	Disabled	Disabled	Disabled	128
5[5]	Disabled	Disabled	Disabled	128
6[6]	Disabled	Disabled	Disabled	128
7[7]	Disabled	Disabled	Disabled	128
8[8]	Disabled	Disabled	Disabled	128
9[9]	Disabled	Disabled	Disabled	128
10[10]	Disabled	Disabled	Disabled	128
11[11]	Disabled	Disabled	Disabled	128
12[12]	Disabled	Disabled	Disabled	128

Figure 4- 7. Traffic Control Setting window

Traffic or storm control is used to stop broadcast, multicast or ARP request storms that may result when a loop is created. The Destination Lookup Failure control is a method of shutting down a loop when a storm is formed because a MAC address cannot be located in the Switch’s forwarding database and it must send a packet to all ports or all ports on a VLAN.

To configure Traffic Control, select the Unit (Unit ID of a Switch in a Switch stack – 15 for a Switch in standalone mode) you want to configure. **Broadcast Storm**, **Multicast Storm** and **Destination Lookup Failure** may be *Enabled* or *Disabled*. The Threshold value is the upper threshold at which the specified traffic control is switched on. This is the number of Broadcast, Multicast or DLF packets, in Kbps, received by the Switch that will trigger the storm traffic control measures. The Threshold value can be set from *0* to *255* packets. The default setting is *128*.

Link Aggregation

Understanding Port Trunk Groups

Port trunk groups are used to combine a number of ports together to make a single high-bandwidth data pipeline.

The DGS-3312SR supports up to six port trunk groups with two to eight ports in each group. A potential bit rate of 8000 Mbps can be achieved.

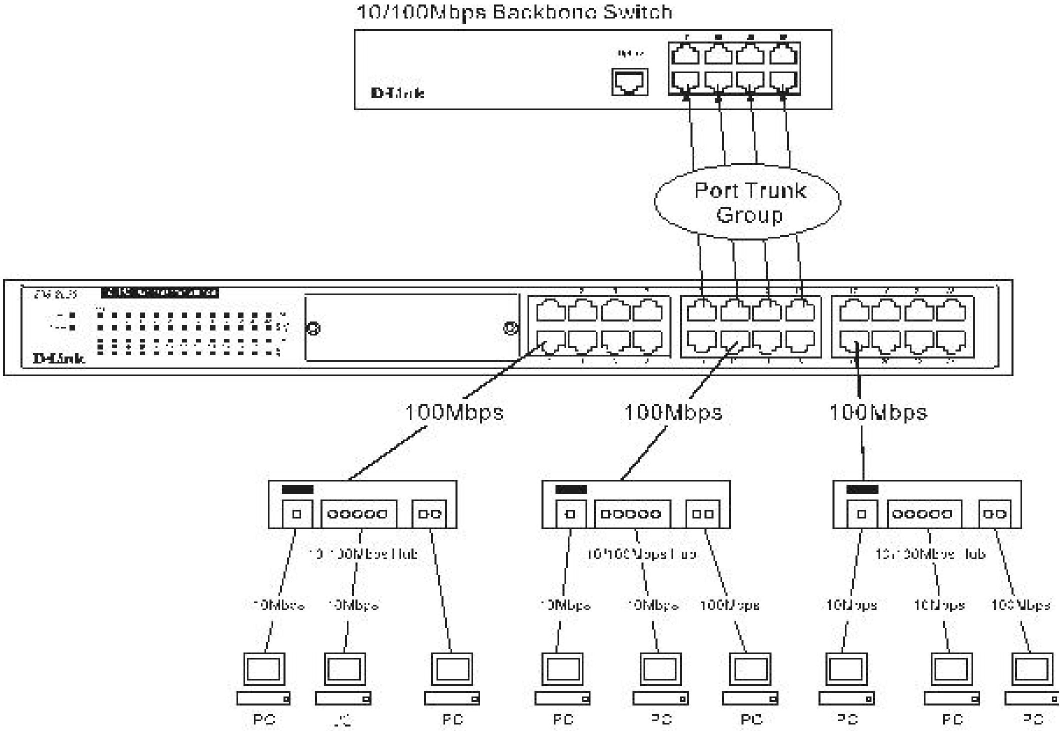


Figure 4- 8. Example of Port Trunk Group

The Switch treats all ports in a trunk group as a single port. Data transmitted to a specific host (destination address) will always be transmitted over the same port in a trunk group. This allows packets in a data stream to arrive in the same order they were sent.

NOTE: If any ports within the trunk group become disconnected, packets intended for the disconnected port will be load shared among the other uplinked ports of the link aggregation group.

Link aggregation allows several ports to be grouped together and to act as a single link. This gives a bandwidth that is a multiple of a single link's bandwidth.

Link aggregation is most commonly used to link a bandwidth intensive network device or devices, such as a server, to the backbone of a network.

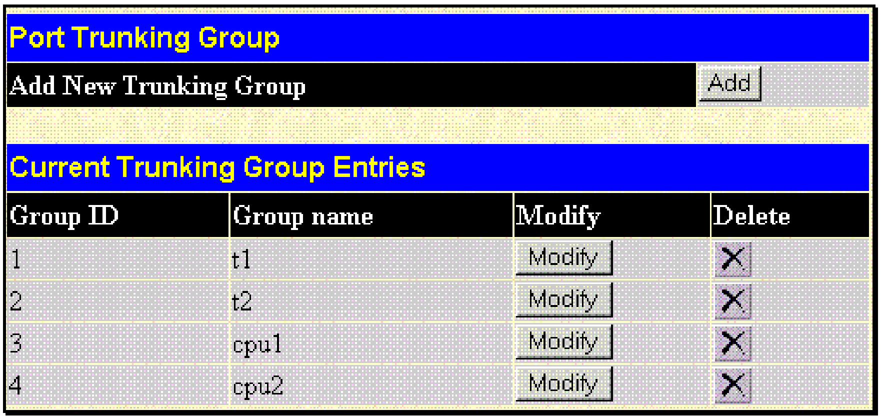
The Switch allows the creation of up to six link aggregation groups, each group consisting of 2 to 8 links (ports). All of the ports in the group must be members of the same VLAN, and their STP status, static multicast, traffic control, traffic segmentation and 802.1p default priority configurations must be identical. Port locking, port mirroring and 802.1X must not be enabled on the trunk group. Further, the aggregated links must all be of the same speed and should be configured as full-duplex.

The Master Port of the group is to be configured by the user, and all configuration options, including the VLAN configuration that can be applied to the Master Port, are applied to the entire link aggregation group.

Load balancing is automatically applied to the ports in the aggregated group, and a link failure within the group causes the network traffic to be directed to the remaining links in the group.

The Spanning Tree Protocol will treat a link aggregation group as a single link, on the Switch level. On the port level, the STP will use the port parameters of the Master Port in the calculation of port cost and in determining the state of the link aggregation group. If two redundant link aggregation groups are configured on the Switch, STP will block one entire group, in the same way STP will block a single port that has a redundant link.

To configure port trunking, click on the **Link Aggregation** hyperlink in the **Configuration** folder and then click **Link Aggregation**:



Port Trunking Group

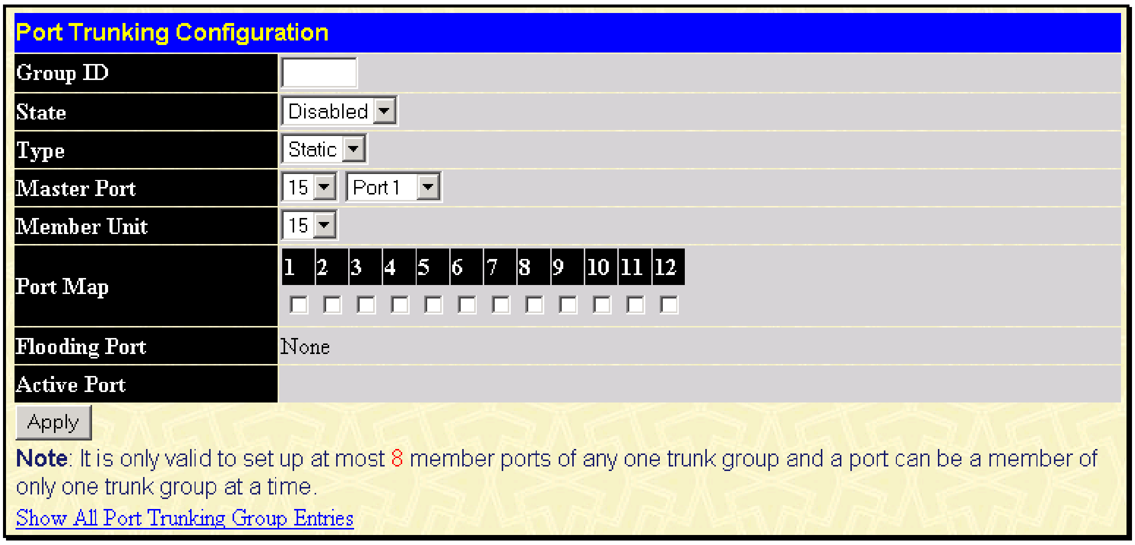
Add New Trunking Group

Current Trunking Group Entries

Group ID	Group name	Modify	Delete
1	t1	Modify	✕
2	t2	Modify	✕
3	cpu1	Modify	✕
4	cpu2	Modify	✕

Figure 4- 9. Port Trunking group window

To configure port trunk groups, click the **Add** button to add a new trunk group and then use the **Port Trunking Configuration** window below to set up trunk groups. To change or delete a port trunk group, click the **Modify** or **Delete** option in the **Current Trunking Group Entries** table pictured above.



Port Trunking Configuration

Group ID	
State	Disabled
Type	Static
Master Port	15 Port 1
Member Unit	15
Port Map	1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 □ 11 □ 12 □
Flooding Port	None
Active Port	

Note: It is only valid to set up at most 8 member ports of any one trunk group and a port can be a member of only one trunk group at a time.

Show All Port Trunking Group Entries

Figure 4- 10. Port Trunking Configuration window

The user-changeable parameters are as follows:

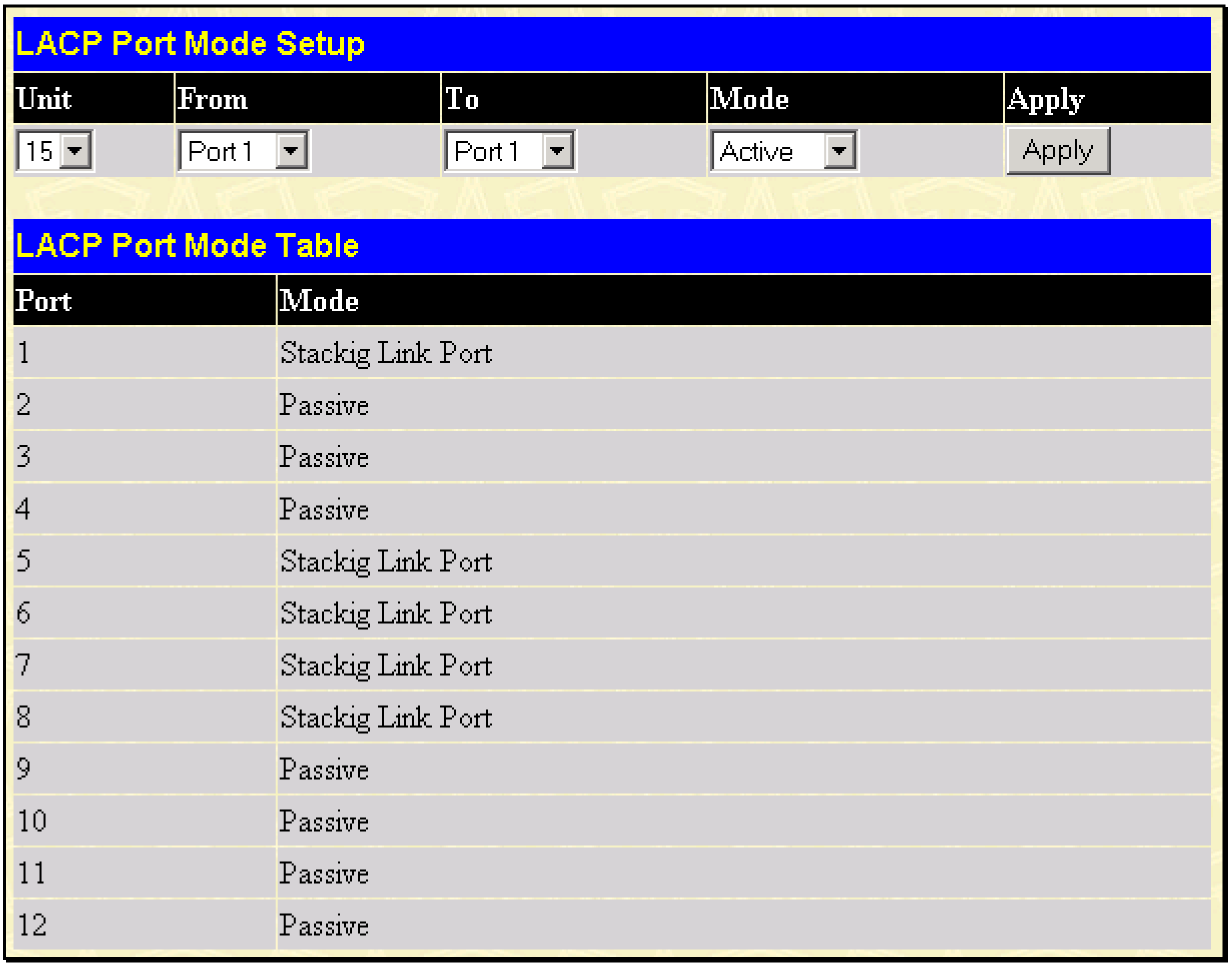
Parameter	Description
Group ID	Select an ID number for the group.
State	Trunk groups can be toggled between *Enabled* and *Disabled*. This is used to turn a port trunking group on or off. This is useful for diagnostics, to quickly isolate a bandwidth intensive network device or to have an absolute backup aggregation group that is not under automatic control.
Type	This pull-down menu allows you to select between *Static* and *LACP* (Link Aggregation Control Protocol.) LACP allows for the automatic detection of links in a Port Trunking Group.

Master Port	Choose the Master port for the trunk group.
Member Unit	Choose the Switch unit on which to set up a trunk group. Link aggregation groups support cross-box configuration, which means that trunking groups can be spread over multiple switches in the switch stack.
Port Map	Choose the members of the trunked group. Up to eight ports per group can be assigned to a group.
Flooding Port	A trunking group must designate one port to allow transmission of broadcasts and unknown unicasts.
Active Port	Shows the port that is currently forwarding packets.

Click **Apply** to implement changes made.

LACP Port Settings

The **LACP Port Mode Setup** window is used in conjunction with the **Link Aggregation** windows to create port trunking groups on the Switch. Using the following window, the user may set which ports will be active and passive in processing and sending LACP control frames. To view the following window, click **Configuration > Link Aggregation > LACP Port Setting**.



LACP Port Mode Setup

Unit	From	To	Mode	Apply
15	Port 1	Port 1	Active	Apply

LACP Port Mode Table

Port	Mode
1	Stackig Link Port
2	Passive
3	Passive
4	Passive
5	Stackig Link Port
6	Stackig Link Port
7	Stackig Link Port
8	Stackig Link Port
9	Passive
10	Passive
11	Passive
12	Passive

Figure 4- 11. LACP Port Mode Table window

The user may set the following parameters:

Parameter	Description
Unit	This is the Unit ID of a Switch in a Switch stack. The number 15 indicates a DGS-3312SR Switch in standalone mode.
From/To	A consecutive group of ports may be configured starting with the selected port.
Mode	*Active* – Active LACP ports are capable of processing and sending LACP control frames. This allows LACP compliant devices to negotiate the aggregated link so the group may be changed dynamically as needs require. In order to utilize the ability to change an aggregated port group, that is, to add or subtract ports from the group, at least one of the participating devices must designate LACP ports as active. Both devices must support LACP. *Passive* – LACP ports that are designated as passive cannot initially send LACP control frames. In order to allow the linked port group to negotiate adjustments and make changes dynamically, at one end of the connection must have “active” LACP ports (see above).

After setting the previous parameters, click **Apply** to allow your changes to be implemented. The **LACP Port Mode Table** shows which ports are active and/or passive.

Port Access Entity (802.1X)

802.1x Port-Based and MAC-Based Access Control

The IEEE 802.1x standard is a security measure for authorizing and authenticating users to gain access to various wired or wireless devices on a specified Local Area Network by using a Client and Server based access control model. This is accomplished by using a RADIUS server to authenticate users trying to access a network by relaying Extensible Authentication Protocol over LAN (EAPOL) packets between the Client and the Server. The following figure represents a basic EAPOL packet:

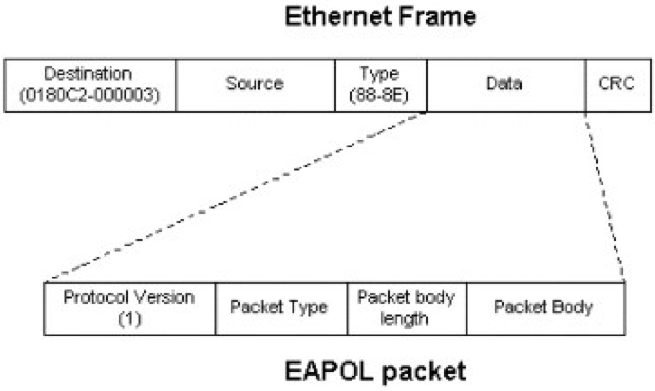


Figure 4- 12. The EAPOL Packet

Utilizing this method, unauthorized devices are restricted from connecting to a LAN through a port to which the user is connected. EAPOL packets are the only traffic that can be transmitted through the specific port until authorization is granted. The 802.1x Access Control method holds three roles, each of which are vital to creating and upkeeping a stable and working Access Control security method.

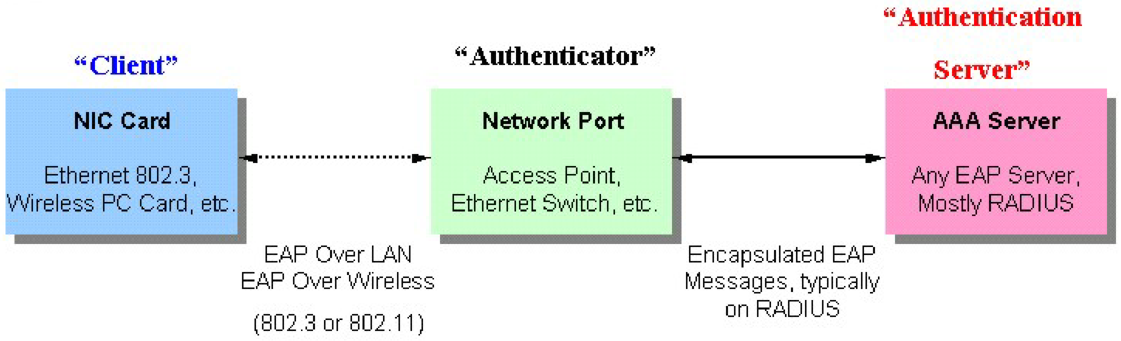

"Client"
NIC Card
Ethernet 802.3, Wireless PC Card, etc.
"Authenticator"
Network Port
Access Point, Ethernet Switch, etc.
"Authentication Server"
AAA Server
Any EAP Server, Mostly RADIUS
EAP Over LAN
EAP Over Wireless
(802.3 or 802.11)
Encapsulated EAP Messages, typically on RADIUS

Figure 4- 13. The three roles of 802.1x

The following section will explain the three roles of Client, Authenticator and Authentication Server in greater detail.

Authentication Server

The Authentication Server is a remote device that must be running a RADIUS Server program and must be configured properly on the Authenticator (Switch). Clients connected to a port on the Switch must be authenticated by the Authentication Server (RADIUS) before attaining any services offered by the Switch on the LAN. The role of the Authentication Server is to certify the identity of the Client attempting to access the network by exchanging secure information between the RADIUS server and the Client through EAPOL packets and, in turn, informs the Switch whether or not the Client is granted access to the LAN and/or switches services.

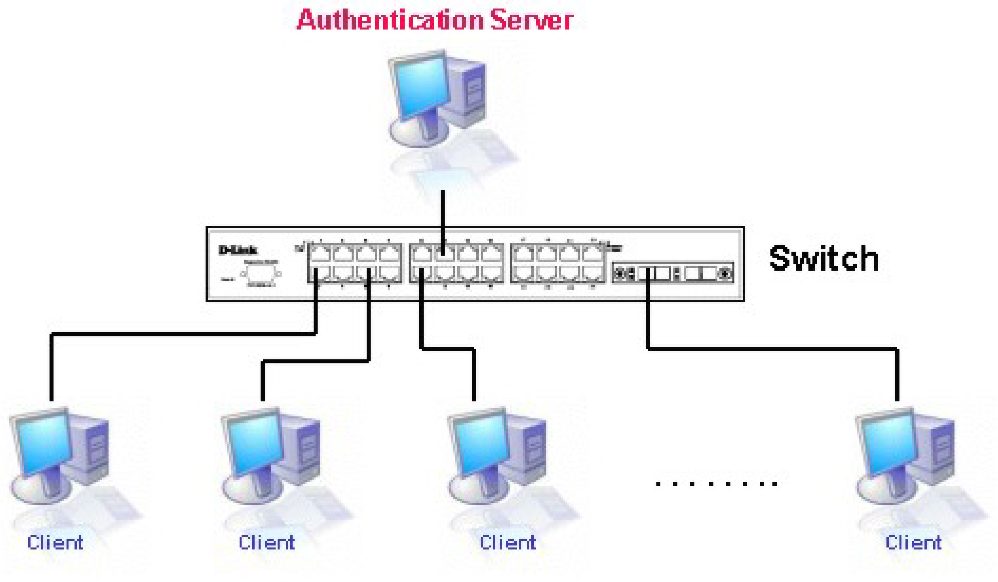


Figure 4- 14. The Authentication Server

Authenticator

The Authenticator (the Switch) is an intermediary between the Authentication Server and the Client. The Authenticator serves two purposes when utilizing 802.1x. The first purpose is to request certification information from the Client through EAPOL packets, which is the only information allowed to pass through the Authenticator before access is granted to the Client. The second purpose of the Authenticator is to verify the information gathered from the Client with the Authentication Server, and to then relay that information back to the Client.

Three steps must be implemented on the Switch to properly configure the Authenticator.

1. The 802.1x State must be *Enabled*. (**Configuration / Advanced Settings**)
2. The 802.1x settings must be implemented by port (**Configuration / Port Access Entity / Configure Authenticator**)
3. A RADIUS server must be configured on the Switch. (**Configuration / Port Access Entity / RADIUS Server**)

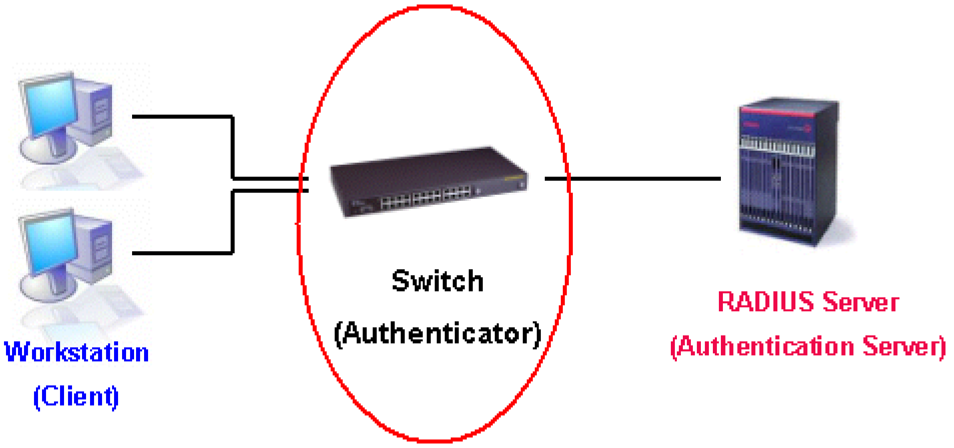


Figure 4- 15. The Authenticator

Client

The Client is simply the end station that wishes to gain access to the LAN or switch services. All end stations must be running software that is compliant with the 802.1x protocol. For users running Windows XP, that software is included within the operating system. All other users are required to attain 802.1x client software from an outside source. The Client will request access to the LAN and or Switch through EAPOL packets and, in turn will respond to requests from the Switch.

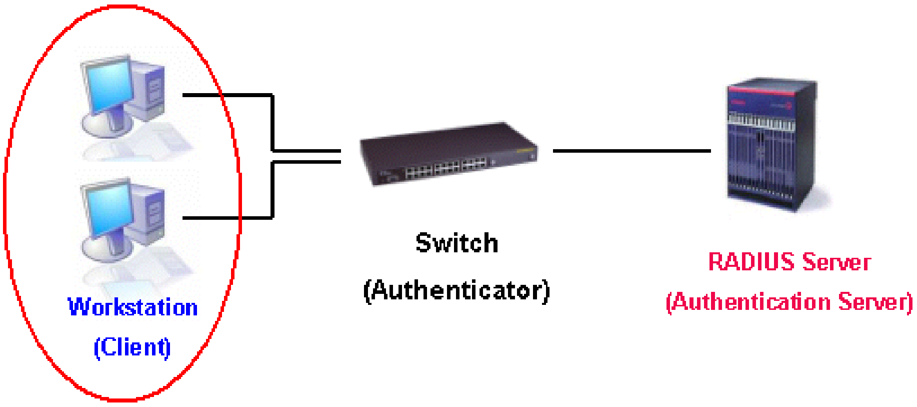


Figure 4- 16. The Client

Authentication Process

Utilizing the three roles stated above, the 802.1x protocol provides a stable and secure way of authorizing and authenticating users attempting to access the network. Only EAPOL traffic is allowed to pass through the specified port before a successful authentication is made. This port is “locked” until the point when a Client with the correct username and password (and MAC address if 802.1x is enabled by MAC address) is granted access and therefore successfully “unlocks” the port. Once unlocked, normal traffic is allowed to pass through the port. The following figure displays a more detailed explanation of how the authentication process is completed between the three roles stated above.

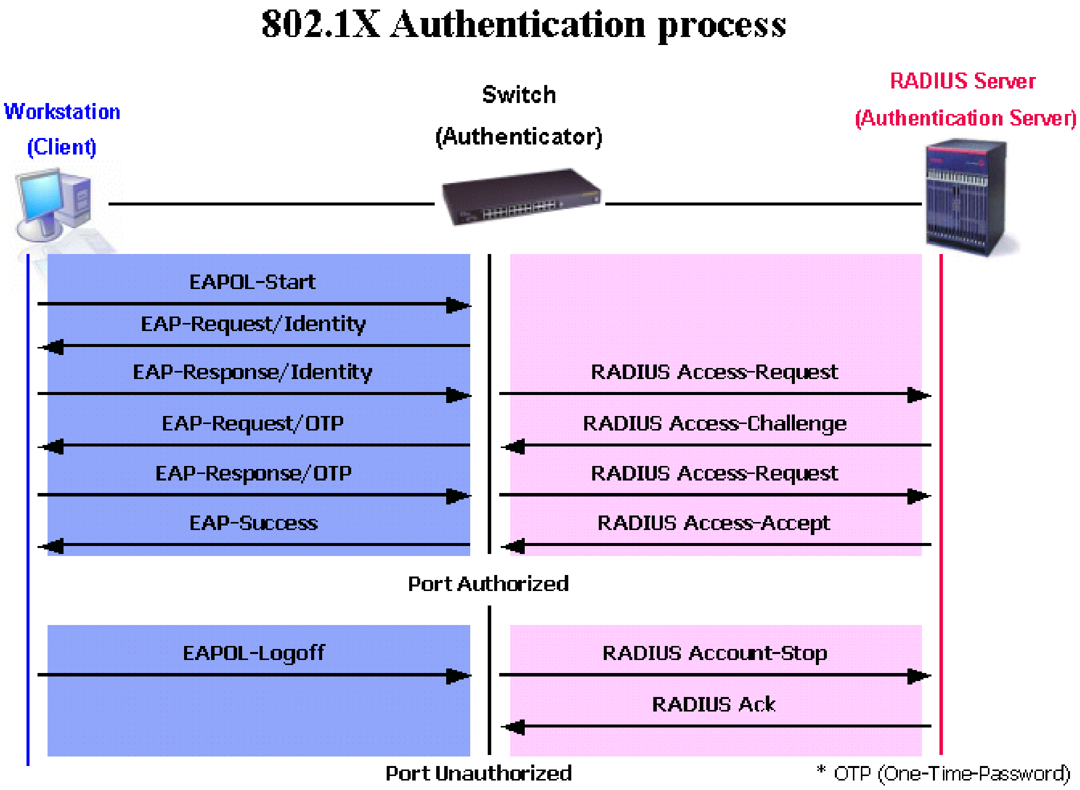


Figure 4- 17. The 802.1x Authentication Process

The D-Link implementation of 802.1x allows network administrators to choose between two types of Access Control used on the Switch, which are:

1. Port-Based Access Control – This method requires only one user to be authenticated per port by a remote RADIUS server to allow the remaining users on the same port access to the network.
2. MAC-Based Access Control – Using this method, the Switch will automatically learn up to three MAC addresses by port and set them in a list. Each MAC address must be authenticated by the Switch using a remote RADIUS server before being allowed access to the Network.

Understanding 802.1x Port-based and MAC-based Network Access Control

The original intent behind the development of 802.1X was to leverage the characteristics of point-to-point in LANs. As any single LAN segment in such infrastructures has no more than two devices attached to it, one of which is a Bridge Port. The Bridge Port detects events that indicate the attachment of an active device at the remote end of the link, or an active device becoming inactive. These events can be used to control the authorization state of the Port and initiate the process of authenticating the attached device if the Port is unauthorized. This is the Port-Based Network Access Control.

Port-Based Network Access Control

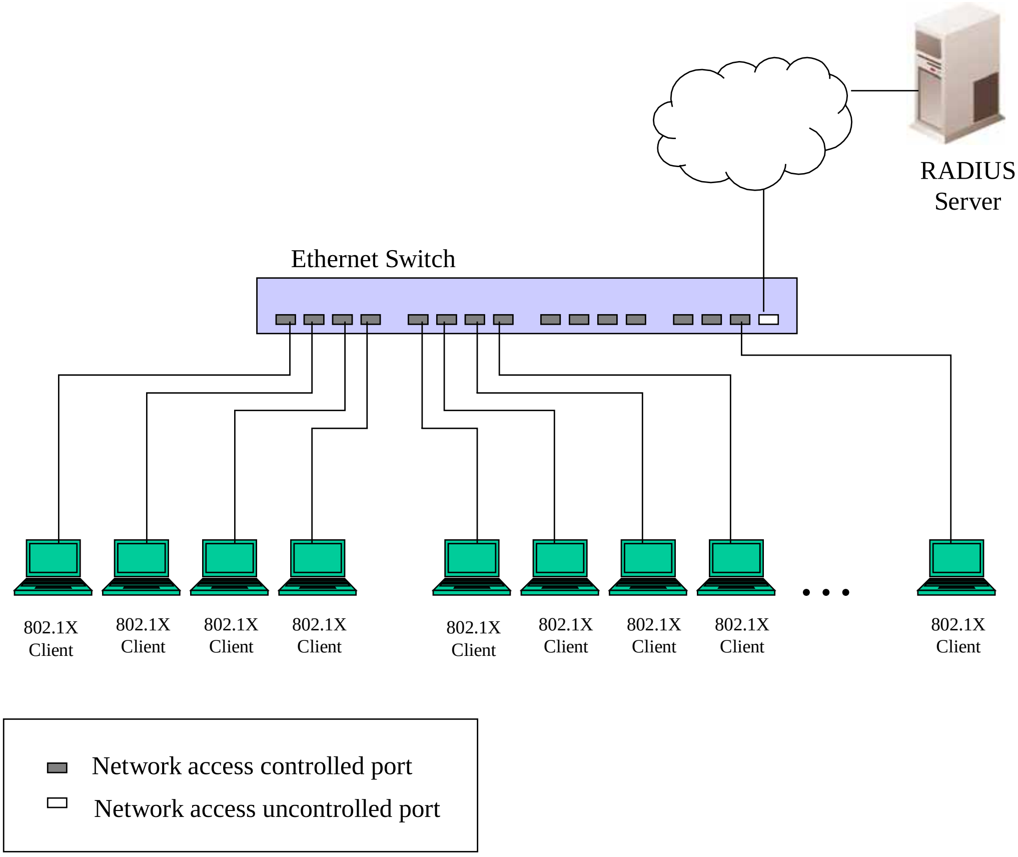


Figure 4- 18. Example of Typical Port-Based Configuration

Once the connected device has successfully been authenticated, the Port then becomes Authorized, and all subsequent traffic on the Port is not subject to access control restriction until an event occurs that causes the Port to become Unauthorized. Hence, if the Port is actually connected to a shared media LAN segment with more than one attached device, successfully authenticating one of the attached devices effectively provides access to the LAN for all devices on the shared segment. Clearly, the security offered in this situation is open to attack.

MAC-Based Network Access Control

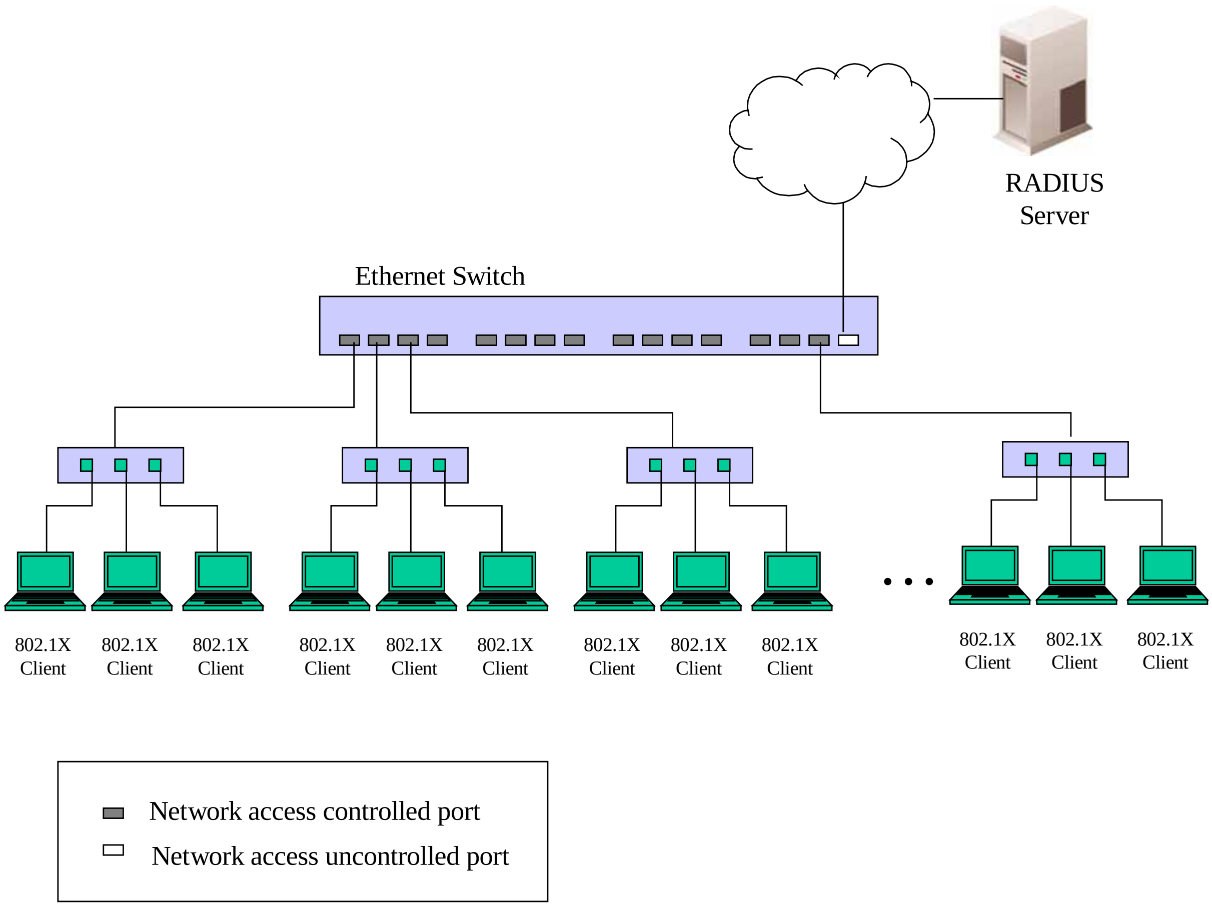
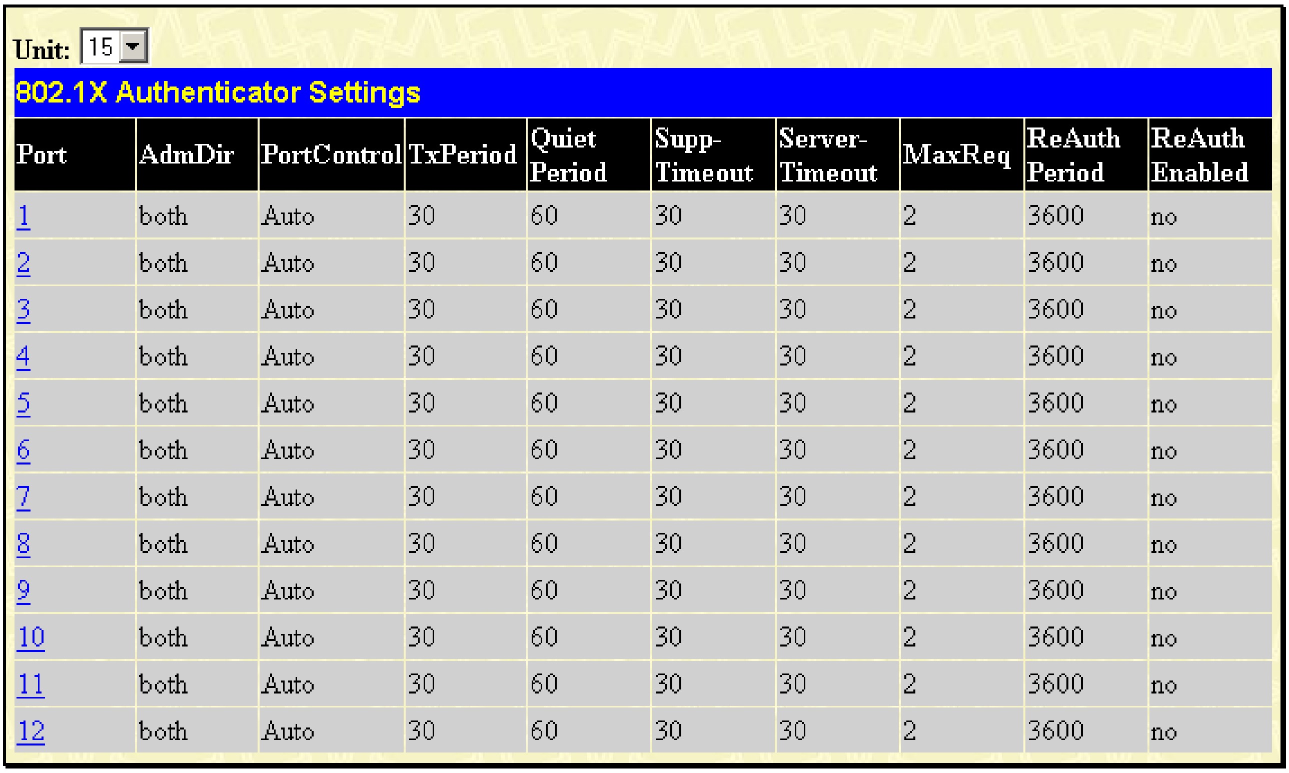


Figure 4- 19. Example of Typical MAC-Based Configuration

In order to successfully make use of 802.1X in a shared media LAN segment, it would be necessary to create “logical” Ports, one for each attached device that required access to the LAN. The Switch would regard the single physical Port connecting it to the shared media segment as consisting of a number of distinct logical Ports, each logical Port being independently controlled from the point of view of EAPOL exchanges and authorization state. The Switch learns each attached devices’ individual MAC addresses, and effectively creates a logical Port that the attached device can then use to communicate with the LAN via the Switch.

802.1X Authenticator Settings

To display the current 802.1X Authenticator Settings on the Switch, click **Configuration** > **Port Access Entity** > **802.1x Authenticator Settings**, which will display the following window.



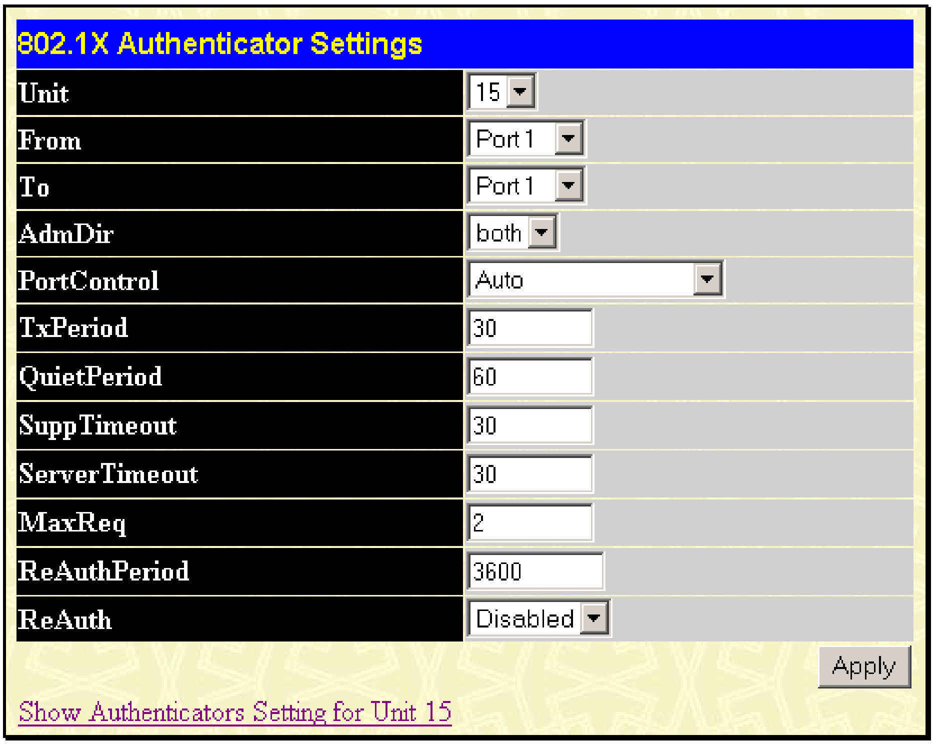
Unit: 15

802.1X Authenticator Settings

Port	AdmDir	PortControl	TxPeriod	Quiet Period	Supp-Timeout	Server-Timeout	MaxReq	ReAuth Period	ReAuth Enabled
1	both	Auto	30	60	30	30	2	3600	no
2	both	Auto	30	60	30	30	2	3600	no
3	both	Auto	30	60	30	30	2	3600	no
4	both	Auto	30	60	30	30	2	3600	no
5	both	Auto	30	60	30	30	2	3600	no
6	both	Auto	30	60	30	30	2	3600	no
7	both	Auto	30	60	30	30	2	3600	no
8	both	Auto	30	60	30	30	2	3600	no
9	both	Auto	30	60	30	30	2	3600	no
10	both	Auto	30	60	30	30	2	3600	no
11	both	Auto	30	60	30	30	2	3600	no
12	both	Auto	30	60	30	30	2	3600	no

Figure 4- 20. 1st 802.1X Authenticator Settings window

To configure the 802.1X Authenticator settings for a given port, click on the blue port number link under the **Port** heading. This will open the second **802.1X Authenticator Settings** window, as shown below.



802.1X Authenticator Settings

Unit	15
From	Port 1
To	Port 1
AdmDir	both
PortControl	Auto
TxPeriod	30
QuietPeriod	60
SuppTimeout	30
ServerTimeout	30
MaxReq	2
ReAuthPeriod	3600
ReAuth	Disabled

Figure 4- 21. 2nd 802.1X Authenticator Settings window

The following Authenticator Settings parameters can be set:

Parameter	Description
Unit	Allows you to specify a Switch in a Switch stack using that Switch's Unit ID. The number 15 indicates a Switch in standalone mode.
From/To	A consecutive group of ports may be configured starting with the selected port.
AdmDir	From the pull-down menu, select whether a controlled Port that is unauthorized will exert control over communication in both receiving and transmitting directions, or just the receiving direction.
PortControl	This allows you to control the port authorization state. Select *Force_authorized* to disable 802.1X and cause the port to transition to the authorized state without any authentication exchange required. This means the port transmits and receives normal traffic without 802.1X-based authentication of the client. If *Force_unauthorized* is selected, the port will remain in the unauthorized state, ignoring all attempts by the client to authenticate. The Switch cannot provide authentication services to the client through the interface. If *Auto* is selected, it will enable 802.1X and cause the port to begin in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. The authentication process begins when the link state of the port transitions from down to up, or when an EAPOL-start frame is received. The Switch then requests the identity of the client and begins relaying authentication messages between the client and the authentication server. The default setting is *Auto*.
TxPeriod	Select the time to wait for a response from a supplicant (user) to send EAP Request/Identity packets.
QuietPeriod	Select the time interval between authentication failure and the start of a new authentication attempt.
SuppTimeout	Select the time to wait for a response from a supplicant (user) for all EAP packets, except for the Request/Identity packets.
ServerTimeout	Select the length of time to wait for a response from a RADIUS server.
MaxReq	Select the maximum number of times to retry sending packets to the supplicant.
ReAuthPeriod	Select the time interval between successive re-authentications.
ReAuth	Enable or disable reauthentication.

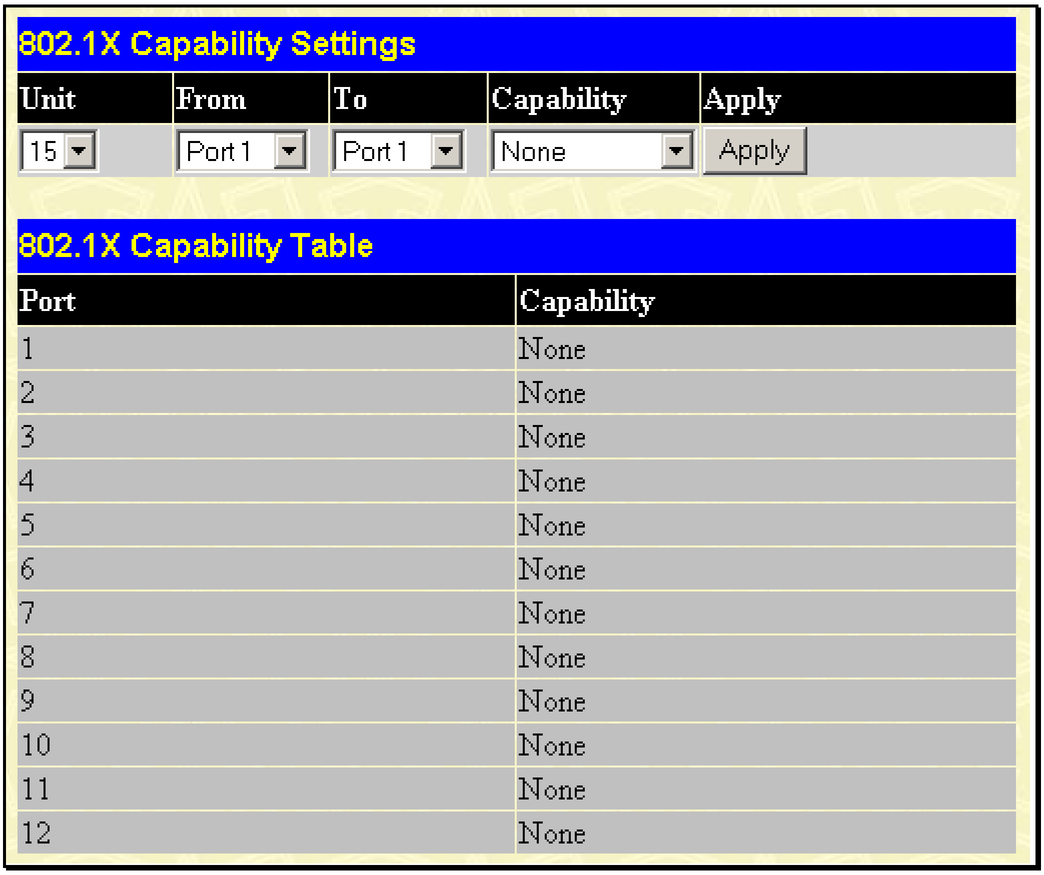
Click **Apply** to implement changes made.

PAE System Control

To set the port authenticating settings, open the **Port Access Entity** folder, and then the **PAE System Control** folder. Finally, click on the **802.1X Capability Settings** link.

802.1X Capability Settings

The following window will allow the user to set the Capability settings for the Switch on a per port basis. This window can be viewed by clicking **Configuration** > **Port Access Entity** > **PAE System Control** > **802.1x Capability Settings**.



802.1X Capability Settings

Unit	From	To	Capability	Apply
15	Port 1	Port 1	None	Apply

802.1X Capability Table

Port	Capability
1	None
2	None
3	None
4	None
5	None
6	None
7	None
8	None
9	None
10	None
11	None
12	None

Figure 4- 22. 802.1X Capability Settings window

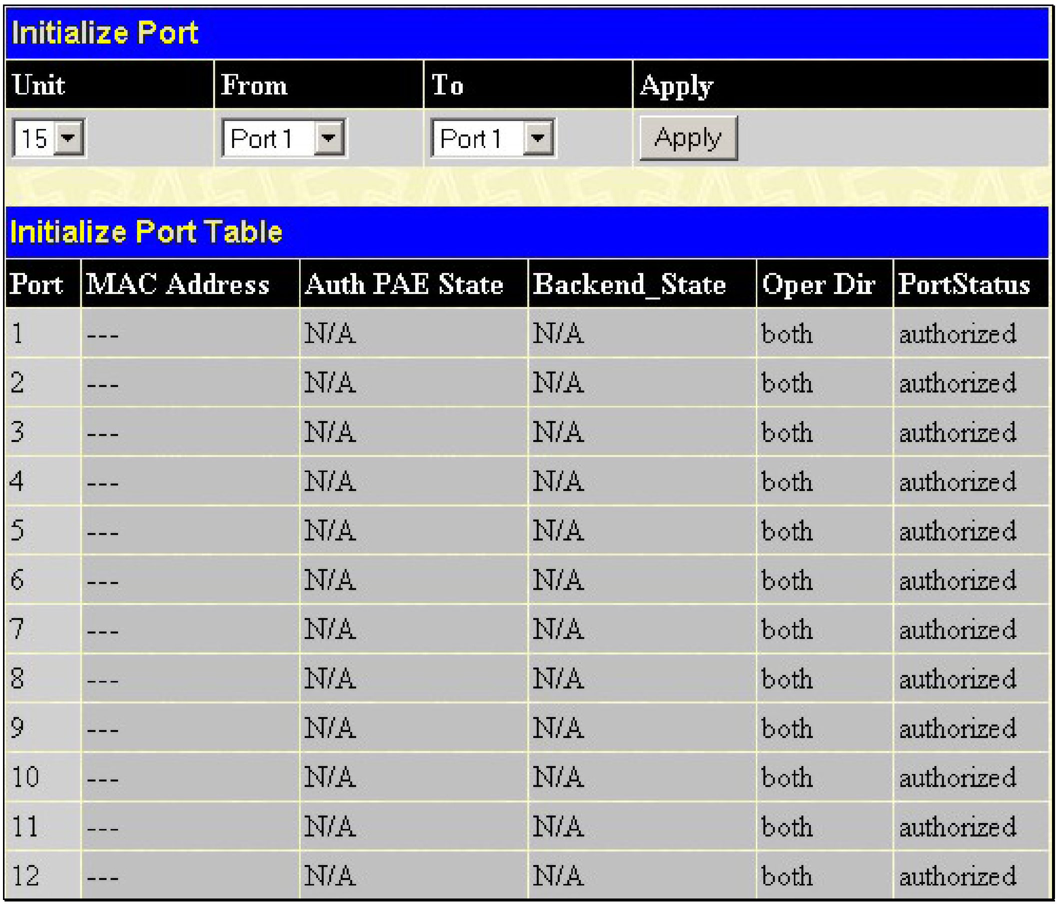
To set up the Switch's 802.1X port-based authentication, select which ports are to be configured in the **From** and **To** fields. Next, enable the ports by selecting *Authenticator* from the drop-down menu under **Capability**.

Click **Apply** to make your changes take effect.

Initializing Ports for Port-Based 802.1x

Existing 802.1x port and MAC settings are displayed and can be configured using the window below.

Click **Configuration > Port Access Entity > PAE System Control > Initialize Port(s)** to open the following window:



Initialize Port

Unit	From	To	Apply
15	Port 1	Port 1	Apply

Initialize Port Table

Port	MAC Address	Auth PAE State	Backend_State	Oper Dir	PortStatus
1	---	N/A	N/A	both	authorized
2	---	N/A	N/A	both	authorized
3	---	N/A	N/A	both	authorized
4	---	N/A	N/A	both	authorized
5	---	N/A	N/A	both	authorized
6	---	N/A	N/A	both	authorized
7	---	N/A	N/A	both	authorized
8	---	N/A	N/A	both	authorized
9	---	N/A	N/A	both	authorized
10	---	N/A	N/A	both	authorized
11	---	N/A	N/A	both	authorized
12	---	N/A	N/A	both	authorized

Figure 4- 23. Initalize Port window for Port-Based 802.1x

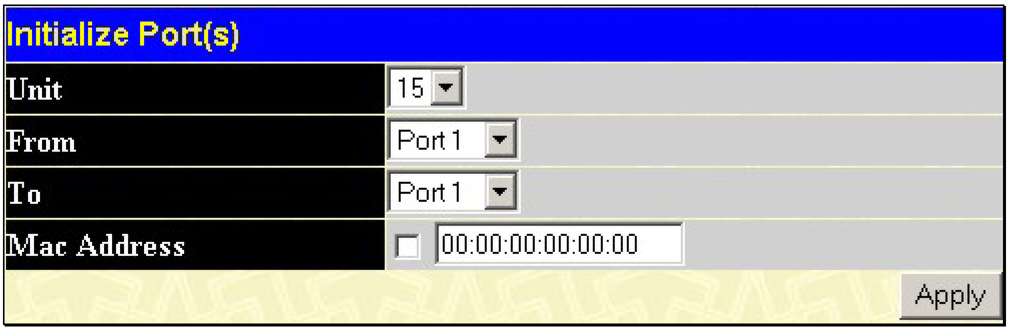
This window allows you to initialize a port or group of ports. The **Initialize Port Table** in the bottom half of the window displays the current status of the port(s).

This window displays the following information:

Parameter	Description
Unit	Choose the Switch ID number of the Switch in the Switch stack to be modified.
From and To	Select ports to be initialized.
Port	A read only field indicating a port on the Switch.
MAC Address	The MAC address of the Switch connected to the corresponding port, if any.
Auth PAE State	The Authenticator PAE State will display one of the following: *Initialize, Disconnected, Connecting, Authenticating, Authenticated, Aborting, Held, ForceAuth, ForceUnauth,* and *N/A.*
Backend State	The Backend Authentication State will display one of the following: *Request, Response, Success, Fail, Timeout, Idle, Initialize,* and *N/A.*
Port Status	The status of the controlled port can be *Authorized, Unauthorized,* or *N/A.*

Initializing Ports for MAC Based 802.1x

To initialize ports for the MAC side of 802.1x, the user must first enable 802.1x by MAC address in the **Advanced Settings** window. Click **Configuration** > **Port Access Entity** > **PAE System Control** > **Initialize Port(s)** to open the following window:



Initialize Port(s)

Unit	15
From	Port 1
To	Port 1
Mac Address	□ 00:00:00:00:00:00

Figure 4- 24. Initialize Ports (MAC based 802.1x)

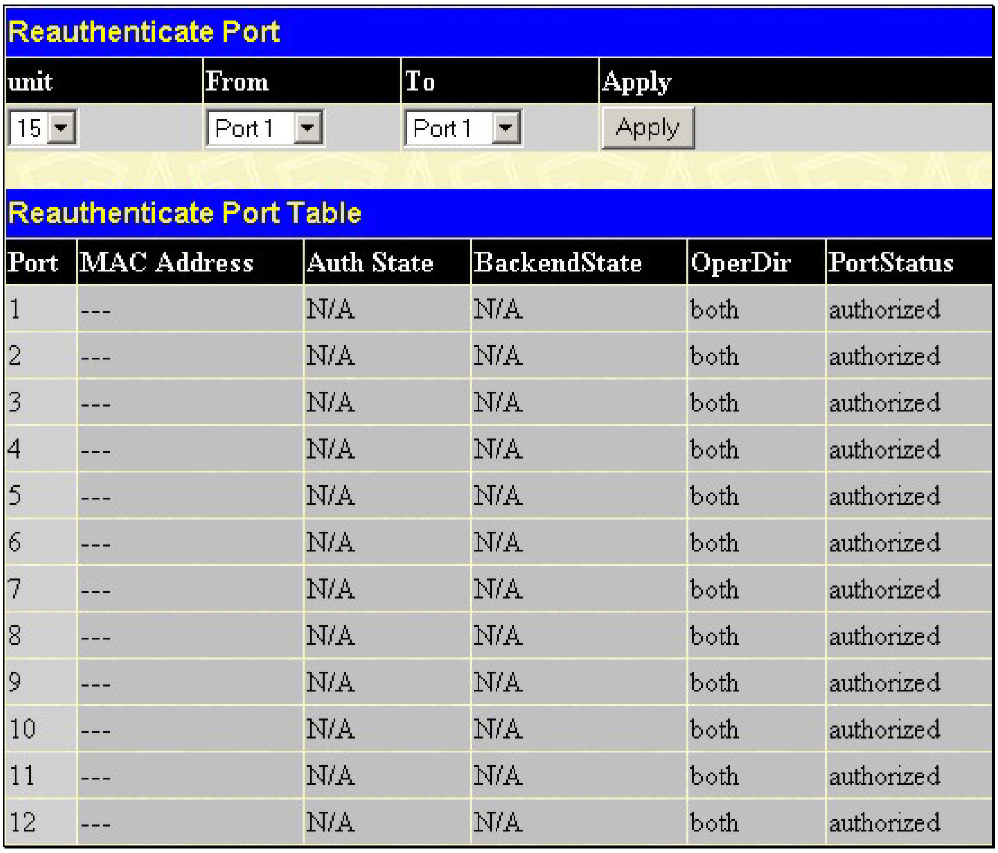
To initialize ports, first choose the Switch in the Switch stack by using the **Unit** pull-down menu, then the range of ports in the **From** and **To** field. Then the user must specify the MAC address to be initialized by entering it into the **MAC Address** field and checking the corresponding check box. To begin the initialization, click **Apply**.

NOTE: The user must first globally enable 802.1X in the **Advanced Settings** window in the **Configuration** folder before initializing ports. Information in the **Initialize Ports Table** cannot be viewed before enabling 802.1X.

Reauthenticate Port(s) for Port Based 802.1x

This window allows you to reauthenticate a port or group of ports by choosing a port or group of ports by using the pull down menus **From** and **To** and clicking **Apply**. The **Reauthenticate Port Table** displays the current status of the reauthenticated port(s) once you have clicked **Apply.**

Click **Configuration** > **Port Access Entity** > **PAE System Control** > **Reauthenticate Port(s)** to open the **Reauthenticate Port(s)** window:



Reauthenticate Port

unit	From	To	Apply
15	Port 1	Port 1	Apply

Reauthenticate Port Table

Port	MAC Address	Auth State	BackendState	OperDir	PortStatus
1	---	N/A	N/A	both	authorized
2	---	N/A	N/A	both	authorized
3	---	N/A	N/A	both	authorized
4	---	N/A	N/A	both	authorized
5	---	N/A	N/A	both	authorized
6	---	N/A	N/A	both	authorized
7	---	N/A	N/A	both	authorized
8	---	N/A	N/A	both	authorized
9	---	N/A	N/A	both	authorized
10	---	N/A	N/A	both	authorized
11	---	N/A	N/A	both	authorized
12	---	N/A	N/A	both	authorized

Figure 4- 25. Reauthenticate Port and Reauthenticate Port Table window

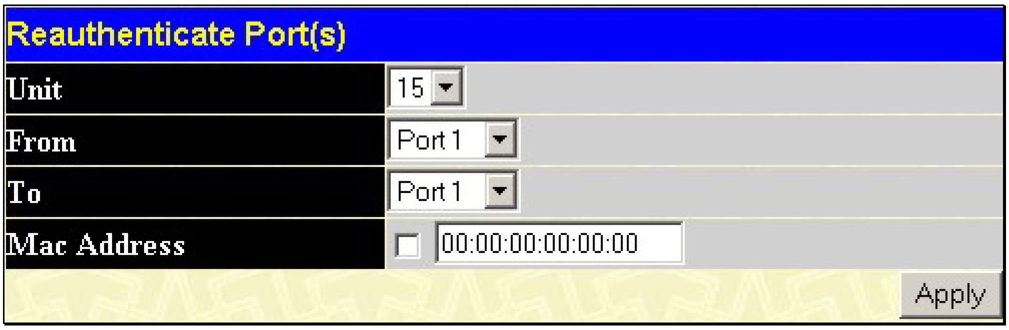
This window displays the following information:

Parameter	Description
Unit	Choose the Switch ID number of the Switch in the Switch stack to be modified.
Port	The port number of the reauthenticated port.
MAC Address	Displays the physical address of the Switch where the port resides.
Auth PAE State	The Authenticator State will display one of the following: *Initialize, Disconnected, Connecting, Authenticating, Authenticated, Aborting, Held, ForceAuth, ForceUnauth,* and *N/A.*
BackendState	The Backend State will display one of the following: *Request, Response, Success, Fail, Timeout, Idle, Initialize,* and *N/A.*
PortStatus	The status of the controlled port can be *Authorized, Unauthorized,* or *N/A*.

NOTE: The user must first globally enable 802.1X in the **Advanced Settings** window in the **Configuration** folder before reauthenticating ports. Information in the **Reauthenticate Ports Table** cannot be viewed before enabling 802.1X.

Reauthenticate Port(s) for MAC-based 802.1x

To reauthenticate ports for the MAC side of 802.1x, the user must first enable 802.1x by MAC address in the **Advanced Settings** window. Click **Configuration > Port Access Entity > PAE System Control > Reauthenticate Port(s)** to open the following window:



Reauthenticate Port(s)

Unit	15
From	Port 1
To	Port 1
Mac Address	□ 00:00:00:00:00:00

Figure 4- 26. Reauthenticate Ports – MAC based 802.1x

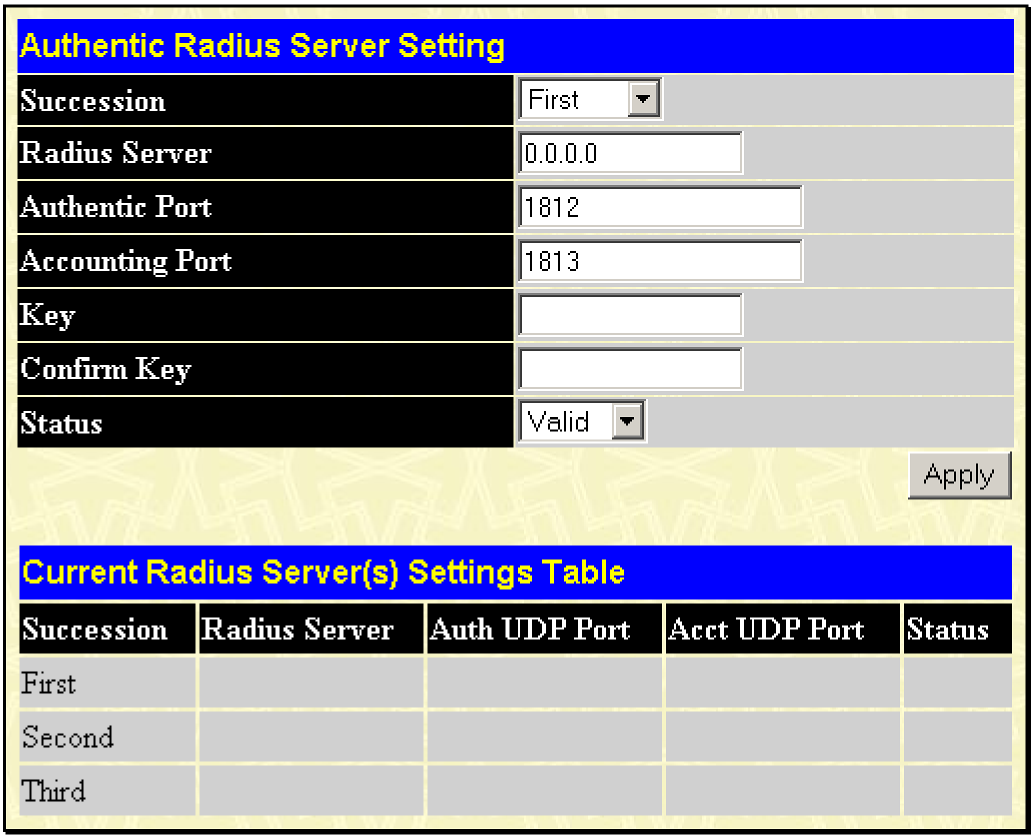
To reauthenticate ports, first choose the Switch in the Switch stack by using the **Unit** pull-down menu, then the range of ports in the **From** and **To** field. Then the user must specify the MAC address to be reauthenticated by entering it into the **MAC Address** field and checking the corresponding check box. To begin the reauthentication, click **Apply**.

RADIUS Server

The RADIUS feature of the Switch allows you to facilitate centralized user administration as well as providing protection against a sniffing, active hacker.

RADIUS Server

Click the **RADIUS Server** link in the **RADIUS Server** folder under **Port Access Entity**.



Authentic Radius Server Setting

Succession	First
Radius Server	0.0.0.0
Authentic Port	1812
Accounting Port	1813
Key	
Confirm Key	
Status	Valid

Current Radius Server(s) Settings Table

Succession	Radius Server	Auth UDP Port	Acct UDP Port	Status
First				
Second				
Third				

Figure 4- 27. Authentic RADIUS Server Setting window

Once the following parameters have been set, click **Apply** to set the RADIUS server settings:

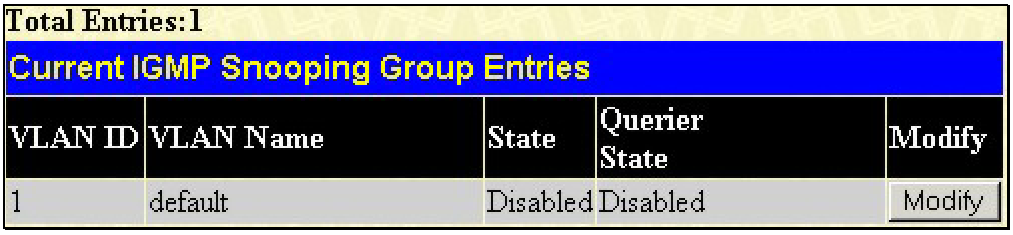
Parameter	Description
Succession	RADIUS server settings index.
RADIUS Server	Type in the IP address of the RADIUS server.
Authentic Port	This is the UDP port on the RADIUS server that will be used to authenticate users. The default is *1812*.
Accounting Port	This is the UDP port on the RADIUS server that will be used to store the account information. The default is *1813*.
Key	Type the shared-secret key used by the RADIUS server and the Switch. Up to 32 characters can be used.
Confirm Key	Retype the Key information from the Key field above.
Status	This drop-down menu allows you to select *Valid* or *Invalid*.

IGMP Snooping

In order to use IGMP Snooping it must first be enabled for the entire Switch (see **Advanced Settings**). You may then fine-tune the settings for each VLAN using the **IGMP Snooping Settings** window. When enabled for IGMP snooping, the Switch can open or close a port to a specific Multicast group member based on IGMP messages sent from the device to the IGMP host or vice versa. The Switch monitors IGMP messages and discontinues forwarding multicast packets when there are no longer hosts requesting that they continue.

IGMP Snooping Configuration

Use this window, which can be viewed by clicking **Configuration** > **IGMP Snooping** > **IGMP Snooping**, to view the IGMP Snooping status. To modify settings, click the **Modify** button for the VLAN ID to change.



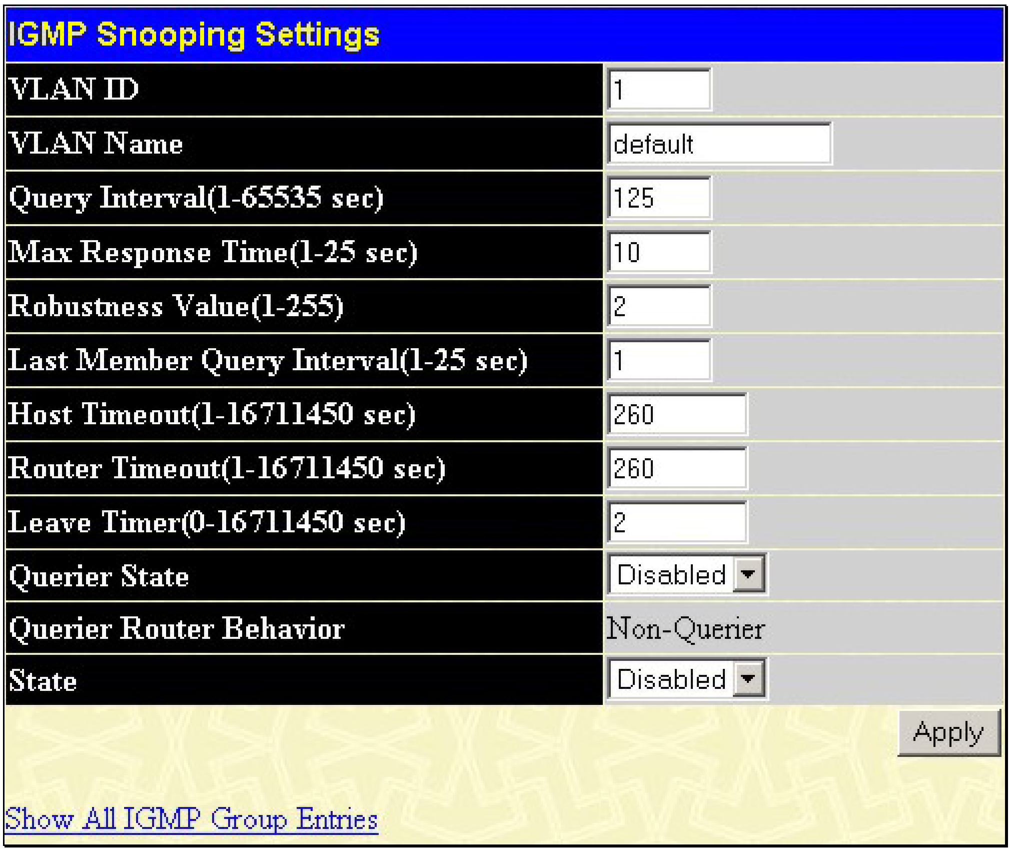
Total Entries:1

Current IGMP Snooping Group Entries

VLAN ID	VLAN Name	State	Querier State	Modify
1	default	Disabled	Disabled	Modify

Figure 4- 28. Current IGMP Snooping Group Entries window

Click the **Modify** button to bring up the **IGMP Snooping Settings** window pictured below.



IGMP Snooping Settings

VLAN ID	1
VLAN Name	default
Query Interval(1-65535 sec)	125
Max Response Time(1-25 sec)	10
Robustness Value(1-255)	2
Last Member Query Interval(1-25 sec)	1
Host Timeout(1-16711450 sec)	260
Router Timeout(1-16711450 sec)	260
Leave Timer(0-16711450 sec)	2
Querier State	Disabled
Querier Router Behavior	Non-Querier
State	Disabled

Figure 4- 29. IGMP Snooping Settings window

The IGMP Snooping Settings are described below:

Parameter	Description
VLAN ID	The VLAN ID number.
VLAN Name	The VLAN name.
Query Interval	The Query Interval field is used to set the time (in seconds) between transmitting IGMP queries. Entries between *1* and *65535* seconds are allowed. The default value is *125*.
Max Response Time	This determines the maximum amount of time in seconds allowed before sending an IGMP response report. The Max Response Time field allows an entry between *1* and *25* (seconds). The default value is *10*.
Robustness Variable	Adjust this variable according to expected packet loss. If packet loss on the VLAN is expected to be high, the Robustness Variable should be increased to accommodate increased packet loss. This entry field allows an entry of *2* to *255*. The default value is *2*.
Last Member Query Interval	Specifies the maximum amount of time between group-specific query messages, including those sent in response to leave group messages. The default value is *1*.
Host Timeout	This is the maximum amount of time in seconds allowed for a host to continue membership in a multicast group without the Switch receiving a host membership report. The default value is *260*.
Route Timeout	This is the maximum amount of time in seconds a route is kept in the forwarding table without receiving a membership report. The default value is *260*.
Leave Timer	This specifies the maximum amount of time in seconds between the Switch receiving a leave group message from a host, and the Switch issuing a group membership query. If no response to the membership query is received before the Leave Timer expires, the (multicast) forwarding entry for that host is deleted.
Querier State	Choose *Enabled* to enable transmitting IGMP Query packets. The default value is *Disabled*.
Querier Router Behavior	This read-only field describes the behavior of the router for sending query packets. *Querier* will denote that the router is sending out IGMP query packets. *Non-Querier* will denote that the router is not sending out IGMP query packets. This field will only read *Querier* when the **Querier State** and the **State** fields have been Enabled.
State	Select *Enabled* to implement IGMP Snooping. This is *Disabled* by default.

Click **Apply** to implement changes made.

Static Router Ports

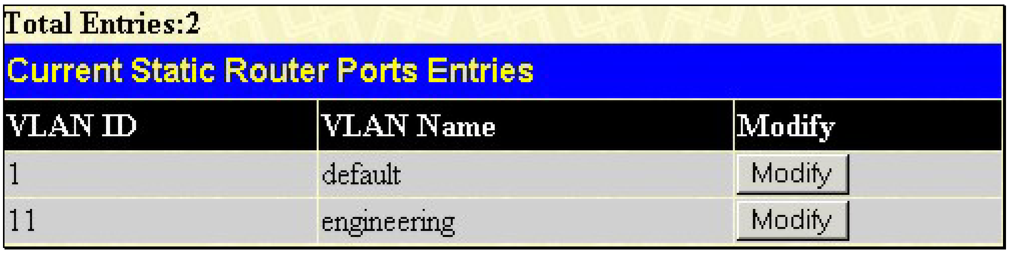
A static router port is a port that has a multicast router attached to it. Generally, this router would have a connection to a WAN or to the Internet. Establishing a router port will allow multicast packets coming from the router to be propagated through the network, as well as allowing multicast messages (IGMP) coming from the network to be propagated to the router.

A router port has the following behavior:

- All IGMP Report packets will be forwarded to the router port.
- IGMP queries (from the router port) will be flooded to all ports.
- All UDP multicast packets will be forwarded to the router port. Because routers do not send IGMP reports or implement IGMP snooping, a multicast router connected to the router port of the Layer 3 Switch would not be able to receive UDP data streams unless the UDP multicast packets were all forwarded to the router port.

A router port will be dynamically configured when IGMP query packets, RIPv2 multicast, DVMRP multicast, and PIM-DM multicast packets are detected flowing into a port.

Open the **IGMP** folder and the click on the **Static Router Ports Entry** link to open the **Current Static Router Ports Entries** window, as shown below.



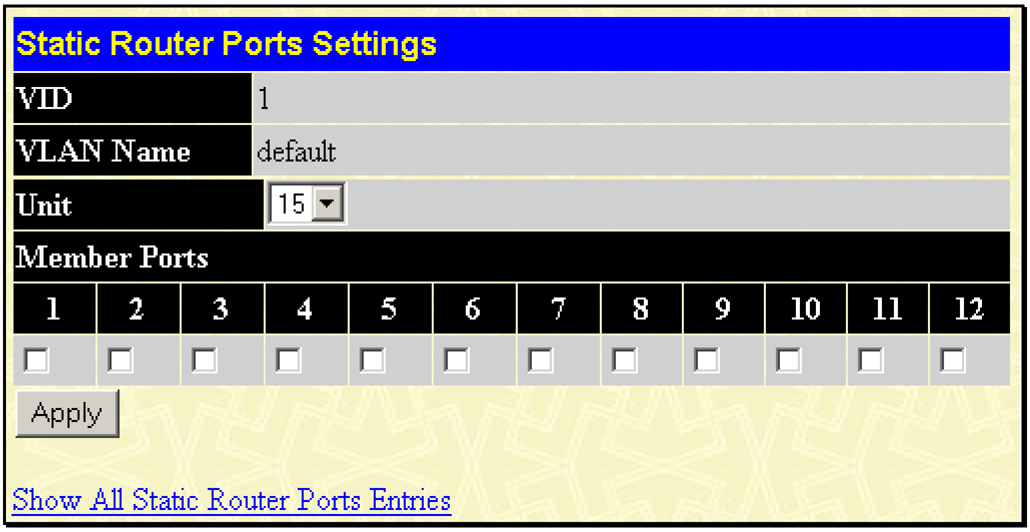
Total Entries:2

Current Static Router Ports Entries

VLAN ID	VLAN Name	Modify
1	default	Modify
11	engineering	Modify

Figure 4- 30. Current Static Router Port Entries window

The window displays all of the current entries to the Switch's static router port table. To modify an entry, click the **Modify** button. This will open the **Static Router Ports Settings** window, as shown below.



Static Router Ports Settings

VID	1
VLAN Name	default
Unit	15

Member Ports

1	2	3	4	5	6	7	8	9	10	11	12
□	□	□	□	□	□	□	□	□	□	□	□

Figure 4- 31. Static Router Ports Settings window

To configure a static router port(s):

1. Select the Unit containing the static router port.
2. Select the Port or Ports that will become static router ports.
3. Click **Apply** to let the changes take effect.

The following parameters are listed in the **Static Router Port** windows.

Parameter	Description
VLAN ID (VID)	This is the VLAN ID that, along with the VLAN name, identifies the VLAN where the multicast router is attached.
VLAN Name	This is the name of the VLAN where the multicast router is attached.
Unit	This is the Unit ID of the Switch in a Switch stack for which you are creating an entry into the Switch's static router port table.
Member Ports	There are the ports on the Switch that will have a multicast router attached to them.

Click **Apply** to implement changes made.

Spanning Tree

This Switch supports three versions of the Spanning Tree Protocol; 802.1d STP, 802.1w Rapid STP and 802.1s MSTP. 802.1d STP will be familiar to most networking professionals. However, since 802.1w RSTP and 802.1s MSTP has been recently introduced to D-Link managed Ethernet switches, a brief introduction to the technology is provided below followed by a description of how to set up 802.1d STP, 802.1w RSTP and 802.1s MSTP.

802.1s MSTP

Multiple Spanning Tree Protocol, or MSTP, is a standard defined by the IEEE community that allows multiple VLANs to be mapped to a single spanning tree instance, which will provide multiple pathways across the network. Therefore, these MSTP configurations will balance the traffic load, preventing wide scale disruptions when a single spanning tree instance fails. This will allow for faster convergences of new topologies for the failed instance. Frames designated for these VLANs will be processed quickly and completely throughout interconnected bridges utilizing either of the three spanning tree protocols (STP, RSTP or MSTP).

This protocol will also tag BDPU packets so receiving devices can distinguish spanning tree instances, spanning tree regions and the VLANs associated with them. These instances will be classified by an MSTI ID. MSTP will connect multiple spanning trees with a Common and Internal Spanning Tree (CIST). The CIST will automatically determine each MSTP region, its maximum possible extent and will appear as one virtual bridge that runs a single spanning tree. Consequentially, frames assigned to different VLANs will follow different data routes within administratively established regions on the network, continuing to allow simple and full processing of frames, regardless of administrative errors in defining VLANs and their respective spanning trees.

Each switch utilizing the MSTP on a network will have a single MSTP configuration that will have the following three attributes:

1. A configuration name defined by an alphanumeric string of up to 32 characters (defined in the **MST Configuration Table** window in the **Configuration Name** field).
2. A configuration revision number (named here as a **Revision Level** and found in the **MST Configuration Table** window) and;
3. A 4094 element table (defined here as a **VID List** in the **MST Configuration Table** window) which will associate each of the possible 4094 VLANs supported by the Switch for a given instance.

To utilize the MSTP function on the Switch, three steps need to be taken:

1. The Switch must be set to the MSTP setting (found in the **STP Bridge Global Settings** window in the **STP Version** field)
2. The correct spanning tree priority for the MSTP instance must be entered (defined here as a **Priority** in the **MST Configuration Table** window when configuring an **MSTI ID** settings).
3. VLANs that will be shared must be added to the **MSTP Instance ID** (defined here as a **VID List** in the **MST Configuration Table** window when configuring an MSTI ID settings).

802.1w Rapid Spanning Tree

The Switch implements three versions of the Spanning Tree Protocol, the Multiple Spanning Tree Protocol (MSTP) as defined by the IEEE 802.1s, the Rapid Spanning Tree Protocol (RSTP) as defined by the IEEE 802.1w specification and a version compatible with the IEEE 802.1d STP. RSTP can operate with legacy equipment implementing IEEE 802.1d, however the advantages of using RSTP will be lost.

The IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) evolved from the 802.1d STP standard. RSTP was developed in order to overcome some limitations of STP that impede the function of some recent switching innovations, in particular, certain Layer 3 functions that are increasingly handled by Ethernet switches. The basic function and much of the terminology is the same as STP. Most of the settings configured for STP are also used for RSTP. This section introduces some new Spanning Tree concepts and illustrates the main differences between the two protocols.

Port Transition States

An essential difference between the three protocols is in the way ports transition to a forwarding state and in the way this transition relates to the role of the port (forwarding or not forwarding) in the topology. MSTP and RSTP combine the transition states disabled, blocking and listening used in 802.1d and creates a single state Discarding. In either case, ports do not forward packets. In the STP port transition states disabled, blocking or listening or in the RSTP/MSTP port state discarding, there is no functional difference, the port is not active in the network topology. Table 6-1 below compares how the three protocols differ regarding the port state transition.

All three protocols calculate a stable topology in the same way. Every segment will have a single path to the root bridge. All bridges listen for BPDU packets. However, BPDU packets are sent more frequently - with every Hello packet. BPDU packets are sent even if a BPDU packet was not received. Therefore, each link between bridges is sensitive to the status of the link. Ultimately this difference results in faster detection of failed links, and thus faster topology adjustment. A draw-back of 802.1d is this absence of immediate feedback from adjacent bridges.

802.1d MSTP	802.1w RSTP	802.1d STP	Forwarding	Learning
Discarding	Discarding	Disabled	No	No
Discarding	Discarding	Blocking	No	No
Discarding	Discarding	Listening	No	No
Learning	Learning	Learning	No	Yes
Forwarding	Forwarding	Forwarding	Yes	Yes

Table 4- 1. Comparing Port States

RSTP is capable of a more rapid transition to a forwarding state - it no longer relies on timer configurations - RSTP compliant bridges are sensitive to feedback from other RSTP compliant bridge links. Ports do not need to wait for the topology to stabilize before transitioning to a forwarding state. In order to allow this rapid transition, the protocol introduces two new variables: the edge port and the point-to-point (P2P) port.

Edge Port

The edge port is a configurable designation used for a port that is directly connected to a segment where a loop cannot be created. An example would be a port connected directly to a single workstation. Ports that are designated as edge ports transition to a forwarding state immediately without going through the listening and learning states. An edge port loses its status if it receives a BPDU packet, immediately becoming a normal spanning tree port.

P2P Port

A P2P port is also capable of rapid transition. P2P ports may be used to connect to other bridges. Under RSTP/MSTP, all ports operating in full-duplex mode are considered to be P2P ports, unless manually overridden through configuration.

802.1d / 802.1w / 802.1s Compatibility

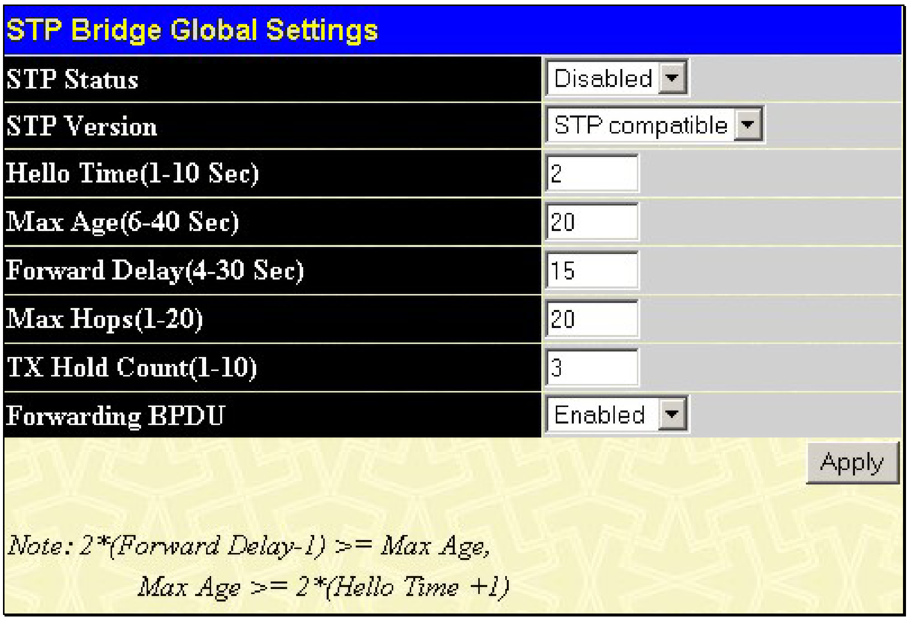
MSTP or RSTP can interoperate with legacy equipment and is capable of automatically adjusting BPDU packets to 802.1d format when necessary. However, any segment using 802.1d STP will not benefit from the rapid transition and rapid topology change detection of MSTP or RSTP. The protocol also provides for a variable used for migration in the event that legacy equipment on a segment is updated to use RSTP or MSTP.

The Spanning Tree Protocol (STP) operates on two levels:

1. On the Switch level, the settings are globally implemented.
2. On the port level, the settings are implemented on a per user-defined group of ports basis.

STP Bridge Global Settings

To open the following window, open the **Spanning Tree** folder in the **Configuration** menu and click the **STP Bridge Global Settings** link.

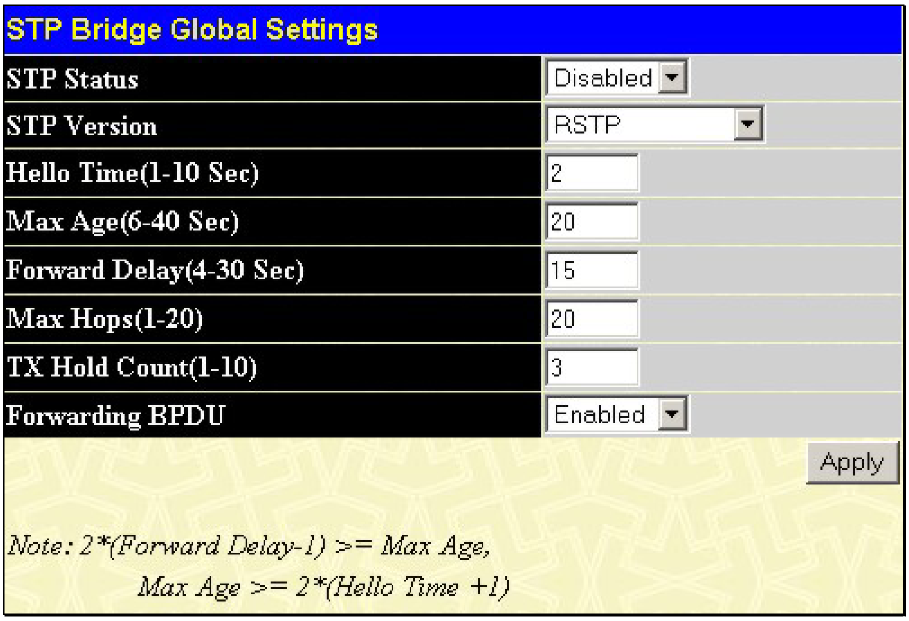


STP Bridge Global Settings

STP Status	Disabled
STP Version	STP compatible
Hello Time(1-10 Sec)	2
Max Age(6-40 Sec)	20
Forward Delay(4-30 Sec)	15
Max Hops(1-20)	20
TX Hold Count(1-10)	3
Forwarding BPDU	Enabled

Note: 2(Forward Delay-1) >= Max Age,*
Max Age >= 2(Hello Time +1)*

Figure 4- 32. STP Bridge Global Settings – STP compatible

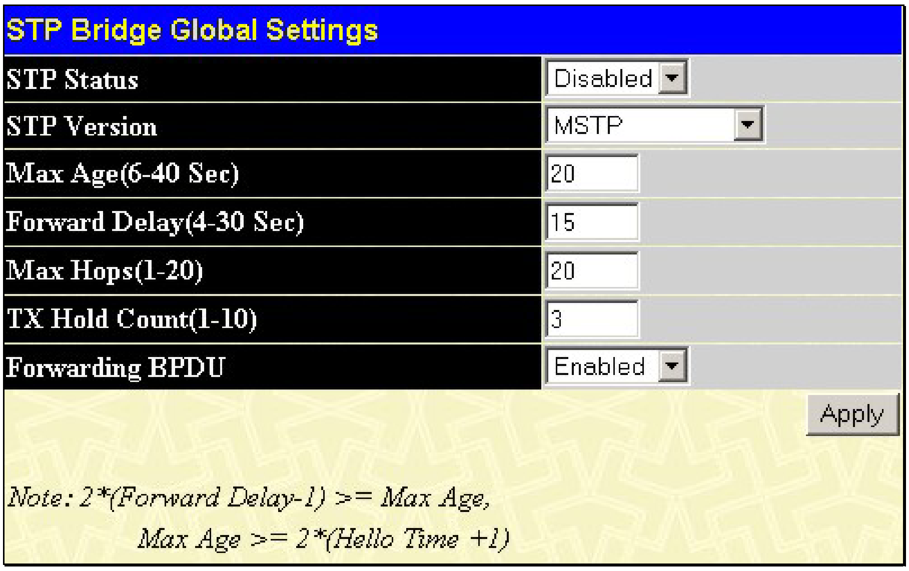


STP Bridge Global Settings

STP Status	Disabled
STP Version	RSTP
Hello Time(1-10 Sec)	2
Max Age(6-40 Sec)	20
Forward Delay(4-30 Sec)	15
Max Hops(1-20)	20
TX Hold Count(1-10)	3
Forwarding BPDU	Enabled

Note: 2(Forward Delay-1) >= Max Age,*
Max Age >= 2(Hello Time +1)*

Figure 4- 33. STP Bridge Global Settings - RSTP (default)



STP Bridge Global Settings

STP Status	Disabled
STP Version	MSTP
Max Age(6-40 Sec)	20
Forward Delay(4-30 Sec)	15
Max Hops(1-20)	20
TX Hold Count(1-10)	3
Forwarding BPDU	Enabled

Note: 2(Forward Delay-1) >= Max Age,*
Max Age >= 2(Hello Time +1)*

Figure 4- 34. STP Bridge Global Settings - MSTP

The following parameters can be set:

Parameter	Description
STP Status	Use the pull-down menu to enable or disable STP globally on the Switch. The default is *Disabled*.
STP Version	Use the pull-down menu to choose the desired version of STP to be implemented on the Switch. There are three choices: *STP* - Select this parameter to set the Spanning Tree Protocol (STP) globally on the Switch. *RSTP* - Select this parameter to set the Rapid Spanning Tree Protocol (RSTP) globally on the Switch. *MSTP* - Select this parameter to set the Multiple Spanning Tree Protocol (MSTP) globally on the Switch.
Hello Time: *(1 - 10 sec)*	The **Hello Time** can be set from 1 to 10 seconds. This is the interval between two transmissions of BPDU packets sent by the Root Bridge to tell all other switches that it is indeed the Root Bridge. This field will only appear here when STP or RSTP is selected for the STP Version. For MSTP, the Hello Time must be set on a port per port basis. See the **MSTP Port Information** section for further details.
Max Age: *(6 - 40 sec)*	The **Max Age** may be set to ensure that old information does not endlessly circulate through redundant paths in the network, preventing the effective propagation of the new information. Set by the Root Bridge, this value will aid in determining that the Switch has spanning tree configuration values consistent with other devices on the bridged LAN. If the value ages out and a BPDU has still not been received from the Root Bridge, the Switch will start sending its own BPDU to all other switches for permission to become the Root Bridge. If it turns out that your switch has the lowest Bridge Identifier, it will become the Root Bridge. The user may choose a time between 6 and 40 seconds. The default value is 20.
Forward Delay: (4 - 30 sec)	The **Forward Delay** can be from 4 to 30 seconds. Any port on the Switch spends this time in the listening state while moving from the blocking state to the forwarding state.

Max Hops (1-20)	Used to set the number of hops between devices in a spanning tree region before the BPDU (bridge protocol data unit) packet sent by the Switch will be discarded. Each switch on the hop count will reduce the hop count by one until the value reaches zero. The Switch will then discard the BDPU packet and the information held for the port will age out. The user may set a hop count from 1 to 20. The default is 20.
TX Hold Count (1-10)	Used to set the maximum number of Hello packets transmitted per interval. The count can be specified from 1 to 10. The default is 3.
Forwarding BPDU	This field can be *Enabled* or *Disabled.* When *Enabled,* it allows the forwarding of STP BPDU packets from other network devices. The default is Enabled.

Click **Apply** to implement changes made.

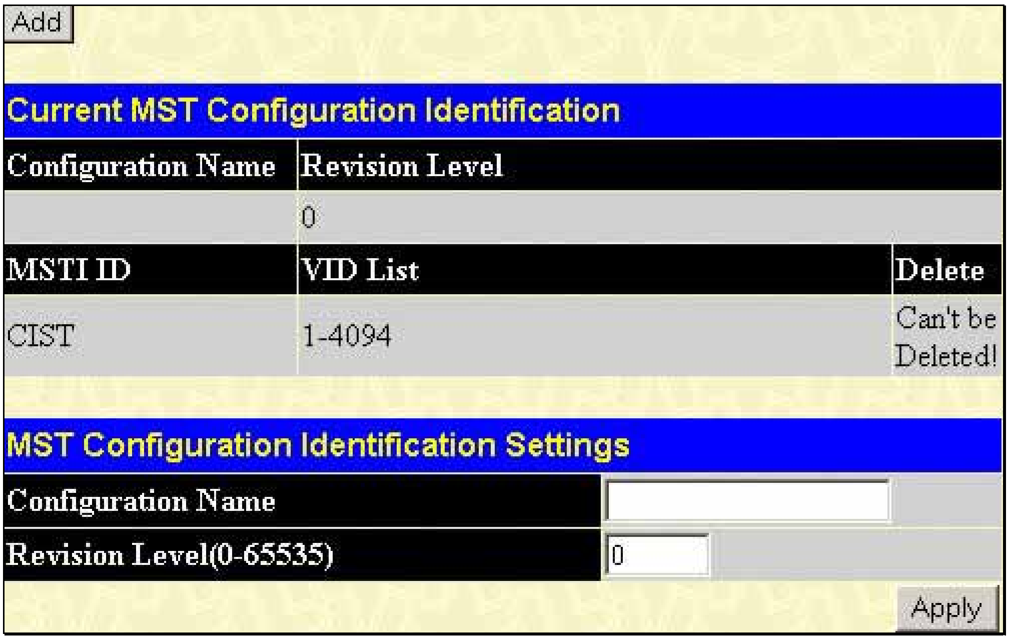
NOTE: The Hello Time cannot be longer than the Max. Age. Otherwise, a configuration error will occur. Observe the following formulas when setting the above parameters:

Max. Age ≤ 2 x (Forward Delay - 1 second)

Max. Age ≥ 2 x (Hello Time + 1 second)

MST Configuration Table

The following screens in the **MST Configuration Table** window allow the user to configure a MSTI instance on the Switch. These settings will uniquely identify a multiple spanning tree instance set on the Switch. The Switch initially possesses one *CIST* or Common Internal Spanning Tree of which the user may modify the parameters for but cannot change the MSTI ID for, and cannot be deleted. To view the **MST Configuration Identification** window, click **Configuration > Spanning Tree > MST Configuration Identification:**



Current MST Configuration Identification

Configuration Name	Revision Level	
	0	
MSTI ID	**VID List**	**Delete**
CIST	1-4094	Can't be Deleted!

MST Configuration Identification Settings

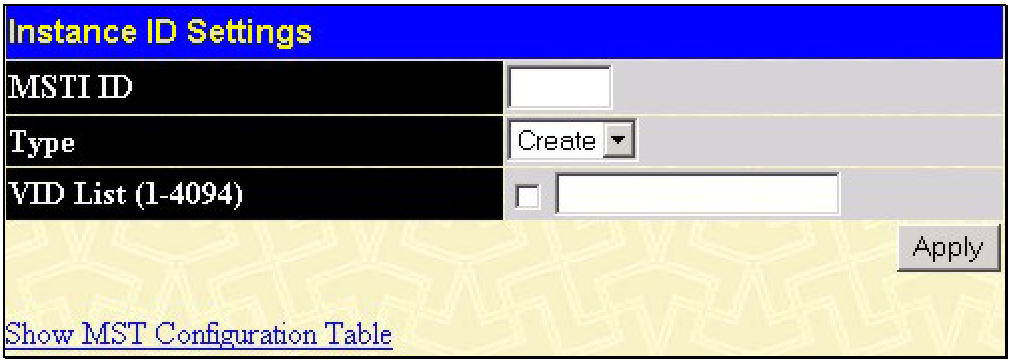
Configuration Name	
Revision Level(0-65535)	0

Figure 4- 35. MST Configuration Identification window

The window above contains the following information:

Parameter	Description
Configuration Name	A previously configured name set on the Switch to uniquely identify the MSTI (Multiple Spanning Tree Instance). If a configuration name is not set, this field will show the MAC address to the device running MSTP.
Revision Level	This value, along with the **Configuration Name** will identify the MSTP region configured on the Switch.
MSTI ID	This field shows the **MSTI ID**s currently set on the Switch. This field will always have the CIST MSTI, which may be configured but not deleted. Clicking the hyperlinked name will open a new window for configuring parameters associated with that particular MSTI.
VID List	This field displays the VLAN IDs associated with the specific MSTI.

To delete a previously set MSTI Instance ID, click the corresponding ☒ under the **Delete** heading in the **MST Configuration Identification** window. Note that the CIST cannot be deleted. Clicking the **Add** button will reveal the following window to configure:



Instance ID Settings

MSTI ID

Type: Create

VID List (1-4094) □

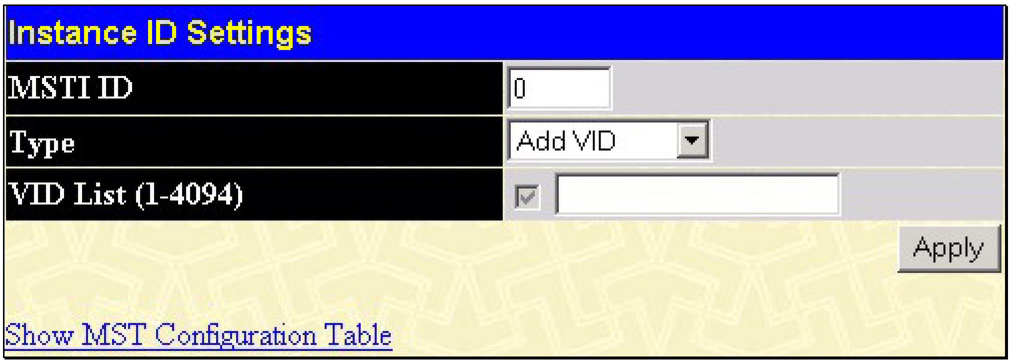
Figure 4- 36. Instance ID Settings window- Add

The user may configure the following parameters to create a MSTI in the Switch.

Parameter	Description
MSTI ID	Enter a number between 1 and 15 to set a new MSTI on the Switch.
Type	*Create* is selected to create a new MSTI. No other choices are available for this field when creating a new MSTI.
VID List (1-4094)	This field is used to specify the VID range from configured VLANs set on the Switch. Supported VIDs on the Switch range from ID number 1 to 4094.

Click **Apply** to implement changes made.

To configure the settings for the CIST, click on its hyperlinked **MSTI ID** number in the **MST Configuration Identification** window, which will reveal the following window to configure:



Instance ID Settings

MSTI ID: 0

Type: Add VID

VID List (1-4094) ☑

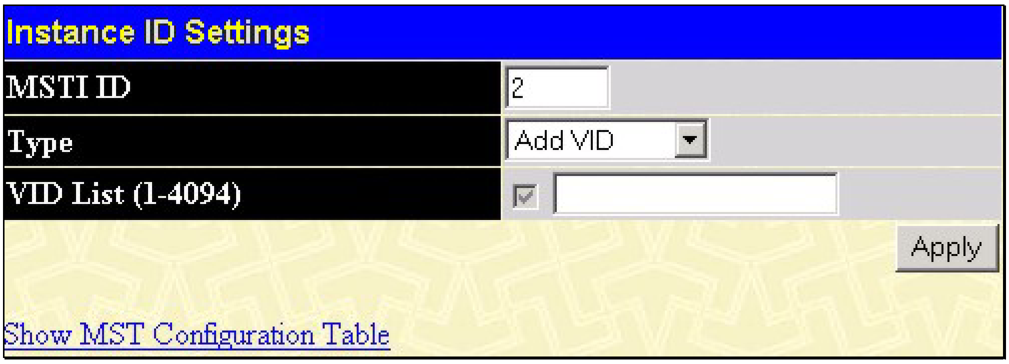
Figure 4- 37. Instance ID Settings window - CIST modify

The user may configure the following parameters to configure the CIST on the Switch.

Parameter	Description
MSTI ID	The MSTI ID of the CIST is 0 and cannot be altered.
Type	This field allows the user to choose a desired method for altering the MSTI settings. The user has 2 choices. • *Add VID* - Select this parameter to add VIDs to the MSTI ID, in conjunction with the VID List parameter. • *Remove VID* - Select this parameter to remove VIDs from the MSTI ID, in conjunction with the VID List parameter.
VID List (1-4094)	This field is used to specify the VID range from configured VLANs set on the Switch. Supported VIDs on the Switch range from ID number 1 to 4094.

Click **Apply** to implement changes made.

To configure the parameters for a previously set MSTI, click on its hyperlinked **MSTI ID** number, which will reveal the following screen for configuration.



Instance ID Settings

MSTI ID	2
Type	Add VID
VID List (1-4094)	☑

Figure 4- 38. Instance ID Settings window - Modify

The user may configure the following parameters for a MSTI on the Switch.

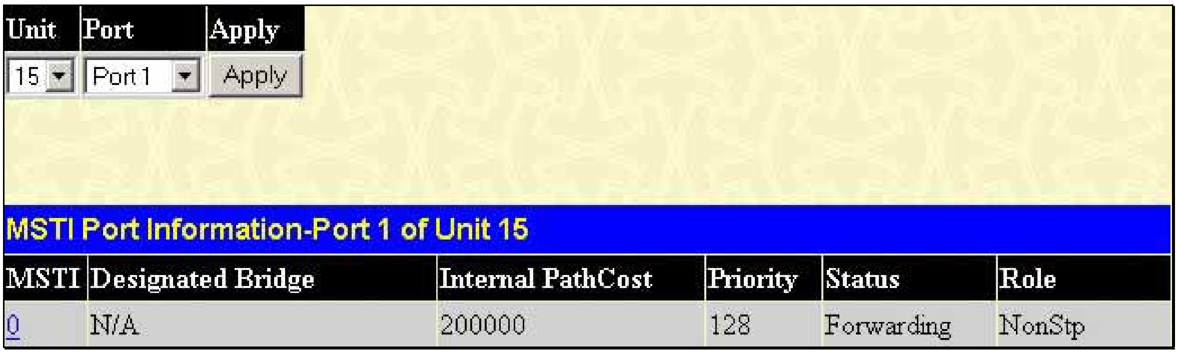
Parameter	Description
MSTI ID	Displays the MSTI ID previously set by the user.
Type	This field allows the user to choose a desired method for altering the MSTI settings. The user has 2 choices. • *Add VID* - Select this parameter to add VIDs to the MSTI ID, in conjunction with the VID List parameter. • *Remove VID* - Select this parameter to remove VIDs from the MSTI ID, in conjunction with the VID List parameter.
VID List (1-4094)	This field is used to specify the VID range from configured VLANs set on the Switch that the user wishes to add to this MSTI ID. Supported VIDs on the Switch range from ID number 1 to 4094. This parameter can only be utilized if the **Type** chosen is *Add* or *Remove*.

Click **Apply** to implement changes made.

MSTI Settings

This window displays the current MSTI configuration settings and can be used to update the port configuration for an MSTI ID. If a loop occurs, the MSTP function will use the port priority to select an interface to put into the forwarding state. Set a higher priority value for interfaces to be selected for forwarding first. In instances where the priority value is identical, the MSTP function will implement the lowest port number into the forwarding state and other interfaces will be blocked. Remember that lower priority values mean higher priorities for forwarding packets.

To view the following window, click **Configuration** > **Spanning Tree** > **MSTI Settings**:



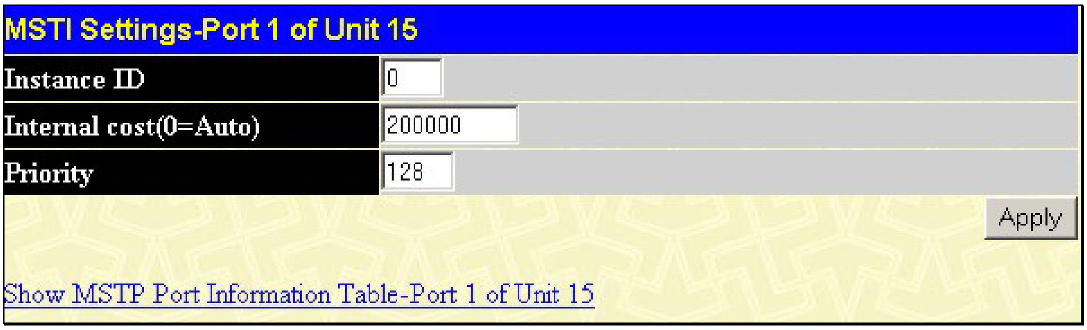
Unit	Port	Apply
15 ▾	Port 1 ▾	Apply

MSTI Port Information-Port 1 of Unit 15

MSTI	Designated Bridge	Internal PathCost	Priority	Status	Role
0	N/A	200000	128	Forwarding	NonStp

Figure 4- 39. MSTP Port Information window

To view the MSTI settings for a particular port, select the **Port** number, located in the top left hand corner of the screen and click **Apply**. To modify the settings for a particular **MSTI Instance**, click on its hyperlinked MSTI ID, which will reveal the following window.



MSTI Settings-Port 1 of Unit 15

Instance ID	0
Internal cost(0=Auto)	200000
Priority	128

Show MSTP Port Information Table-Port 1 of Unit 15

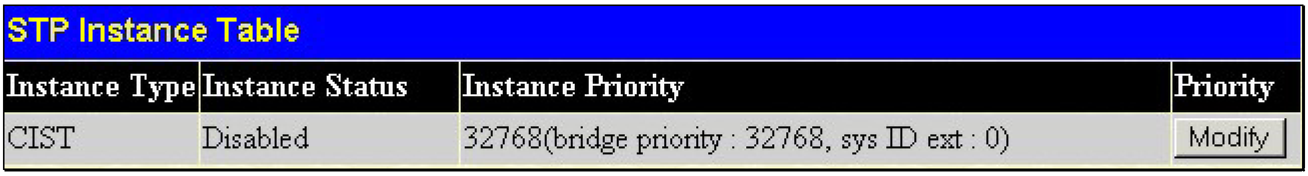
Figure 4- 40. MSTI Settings window

Parameter	Description
Instance ID	Displays the MSTI ID of the instance being configured. An entry of 0 in this field denotes the CIST (default MSTI).
Internal cost	This parameter is set to represent the relative cost of forwarding packets to specified ports when an interface is selected within a STP instance. The default setting is 0 (auto). There are two options: • *0 (auto)* - Selecting this parameter for the *internalCost* will set quickest route automatically and optimally for an interface. The default value is derived from the media speed of the interface. • *value 1-200000000* - Selecting this parameter with a value in the range of 1-200000000 will set the quickest route when a loop occurs. A lower Internal cost represents a quicker transmission.
Priority	Enter a value between 0 and 240 to set the priority for the port interface. A higher priority will designate the interface to forward packets first. A lower number denotes a higher priority. This entry must be divisible by 16. The default priority setting is 128.

Click **Apply** to implement changes made.

STP Instance Settings

The following window displays MSTIs currently set on the Switch. To view the following table, click **Configuration** > **Spanning Tree** > **STP Instance Settings**:



STP Instance Table

Instance Type	Instance Status	Instance Priority	Priority
CIST	Disabled	32768(bridge priority : 32768, sys ID ext : 0)	Modify

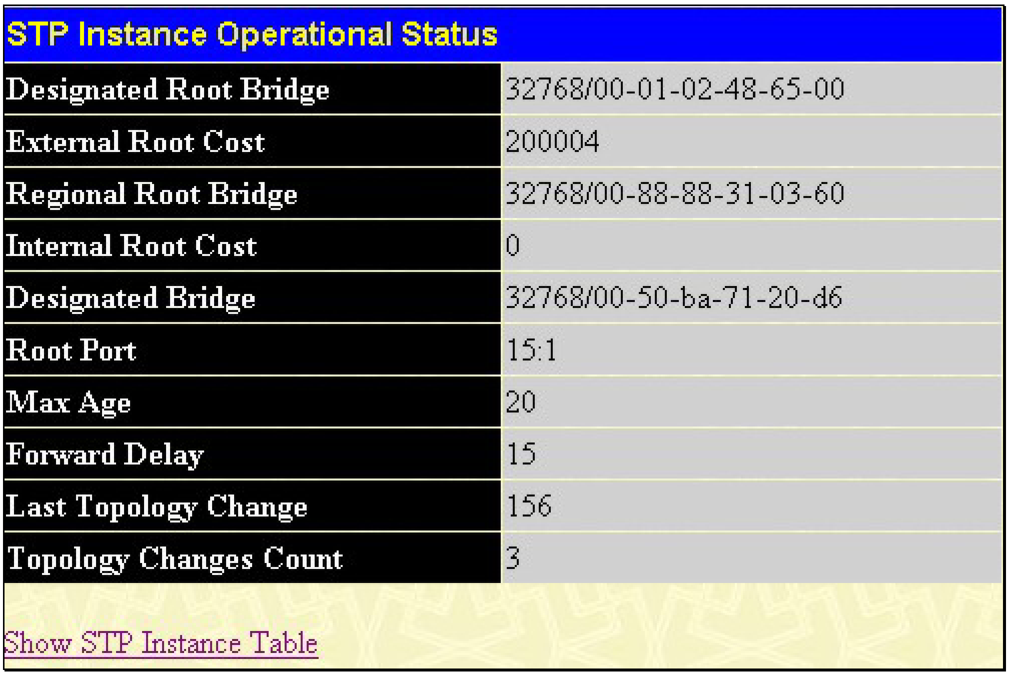
Figure 4- 41. STP Instance Settings

The following information is displayed:

Parameter	Description
Instance Type	Displays the instance type(s) currently configured on the Switch. Each instance type is classified by a MSTI ID. CIST refers to the default MSTI configuration set on the Switch.
Instance Status	Displays the current status of the corresponding MSTI ID
Instance Priority	Displays the priority of the corresponding MSTI Instance Type. The lowest priority will be the root bridge.
Priority	Click the **Modify** button to change the priority of the MSTI. This will open the Instance ID Settings window to configure. The **Type** field in this window will be permanently set to *Set Priority Only*. Enter the new priority in the **Priority** field and click **Apply** to implement the new priority setting.

Click **Apply** to implement changes made.

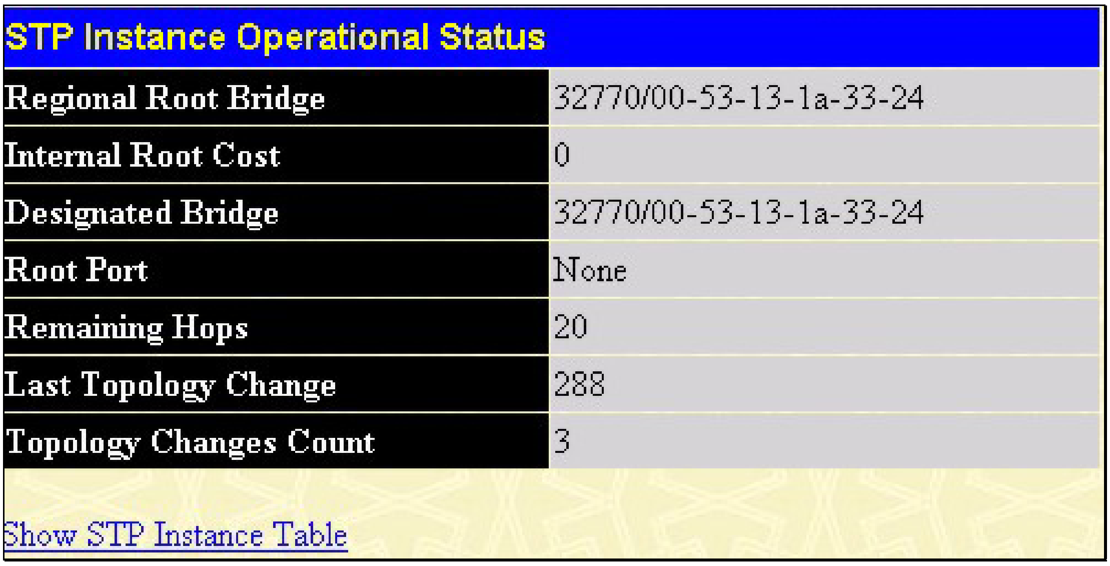
Clicking the hyperlinked name will allow the user to view the current parameters set for the MSTI Instance.



STP Instance Operational Status

Designated Root Bridge	32768/00-01-02-48-65-00
External Root Cost	200004
Regional Root Bridge	32768/00-88-88-31-03-60
Internal Root Cost	0
Designated Bridge	32768/00-50-ba-71-20-d6
Root Port	15:1
Max Age	20
Forward Delay	15
Last Topology Change	156
Topology Changes Count	3

Figure 4- 42. STP Instance Operational Status – CIST



STP Instance Operational Status

Regional Root Bridge	32770/00-53-13-1a-33-24
Internal Root Cost	0
Designated Bridge	32770/00-53-13-1a-33-24
Root Port	None
Remaining Hops	20
Last Topology Change	288
Topology Changes Count	3

Show STP Instance Table

Figure 4- 43. STP Instance Operational Status – Previously Configured MSTI

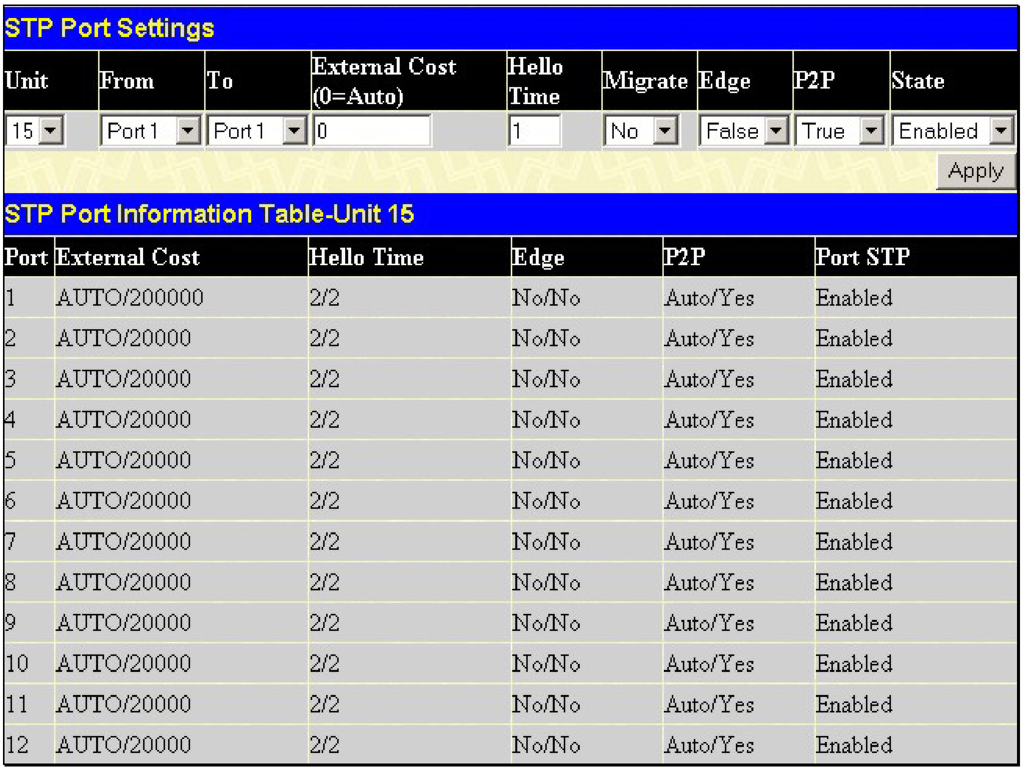
The following parameters may be viewed in the **STP Instance Operational Status** windows:

Parameter	Description
Designated Root Bridge	This field will show the priority and MAC address of the Root Bridge.
External Root Cost	This defines a metric that indicates the relative cost of forwarding packets to the specified port list. Port cost can be set automatically or as a metric value. The default value is 0 (auto). • *0 (auto)* - Setting 0 for the external cost will automatically set the speed for forwarding packets to the specified port(s) in the list for optimal efficiency. Default port cost: 100Mbps port = 200000. Gigabit port = 20000. • *value 1-200000000* - Define a value between 1 and 200000000 to determine the external cost. The lower the number, the greater the probability the port will be chosen to forward packets.
Regional Root Bridge	This field will show the priority and MAC address of the Regional (Internal) Root Bridge. This MAC address should be the MAC address of the Switch.
Internal Root Cost	This parameter is set to represent the relative cost of forwarding packets to specified ports when an interface is selected within a STP instance. The default setting is 0 (auto). There are two options: • *0 (auto)* - Selecting this parameter for the *internalCost* will set quickest route automatically and optimally for an interface. The default value is derived from the media speed of the interface. • *value 1-2000000* - Selecting this parameter with a value in the range of 1-2000000 will set the quickest route when a loop occurs. A lower Internal cost represents a quicker transmission.
Designated Bridge	This field will show the priority and MAC address of the Designated Bridge. The information shown in this table comes from a BPDU packet originating from this bridge.
Root Port	This is the port on the Switch that is physically connected to the Root Bridge.

Max Age	The **Max Age** may be set to ensure that old information does not endlessly circulate through redundant paths in the network, preventing the effective propagation of the new information. Set by the Root Bridge, this value will aid in determining that the Switch has spanning tree configuration values consistent with other devices on the bridged LAN. If the value ages out and a BPDU has still not been received from the Root Bridge, the Switch will start sending its own BPDU to all other switches for permission to become the Root Bridge. If it turns out that your switch has the lowest Bridge Identifier, it will become the Root Bridge. The user may choose a time between 6 and 40 seconds. The default value is 20.
Forward Delay	The **Forward Delay** can be from 4 to 30 seconds. Any port on the Switch spends this time in the listening state while moving from the blocking state to the forwarding state.
Last Topology Change	This field shows the time, in seconds, since the last spanning tree topology change.
Topology Changes Count	This field displays the number of times that the spanning tree topology has changed since the original initial boot up of the Switch.

STP Port Settings

STP can be set up on a port per port basis. To view the following window click **Configuration** > **Spanning Tree** > **STP Port Settings**:



STP Port Settings

Unit	From	To	External Cost (0=Auto)	Hello Time	Migrate	Edge	P2P	State
15	Port 1	Port 1	0	1	No	False	True	Enabled

STP Port Information Table-Unit 15

Port	External Cost	Hello Time	Edge	P2P	Port STP
1	AUTO/200000	2/2	No/No	Auto/Yes	Enabled
2	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
3	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
4	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
5	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
6	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
7	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
8	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
9	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
10	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
11	AUTO/20000	2/2	No/No	Auto/Yes	Enabled
12	AUTO/20000	2/2	No/No	Auto/Yes	Enabled

Figure 4- 44. STP Port Settings and Table window

In addition to setting Spanning Tree parameters for use on the Switch level, the Switch allows for the configuration of groups of ports, each port-group of which will have its own spanning tree, and will require some of its own configuration settings. An STP Group will use the Switch-level parameters entered above, with the addition of **Port Priority** and **Port Cost**.

An STP Group spanning tree works in the same way as the Switch-level spanning tree, but the root bridge concept is replaced with a root port concept. A root port is a port of the group that is elected based on port priority and port cost, to be the connection to the network for the group. Redundant links will be blocked, just as redundant links are blocked on the Switch level.

The STP on the Switch level blocks redundant links between switches (and similar network devices). The port level STP will block redundant links within an STP Group.

It is advisable to define an STP Group to correspond to a VLAN group of ports.

The following fields can be set:

Parameter	Description
Unit	Choose the Switch ID number of the Switch in the Switch stack to be modified.
From/To	A consecutive group of ports may be configured starting with the selected port.
External Cost (*0 = Auto)*	**External Cost** - This defines a metric that indicates the relative cost of forwarding packets to the specified port list. Port cost can be set automatically or as a metric value. The default value is 0 (auto). • *0 (auto)* - Setting 0 for the external cost will automatically set the speed for forwarding packets to the specified port(s) in the list for optimal efficiency. Default port cost: 100Mbps port = 200000. Gigabit port = 20000. • *value 1-200000000* - Define a value between 1 and 200000000 to determine the external cost. The lower the number, the greater the probability the port will be chosen to forward packets.
Hello Time	The time interval between the transmission of configuration messages by the designated port, to other devices on the bridged LAN, thus stating that the Switch is still functioning. The user may choose a time between 1 and 10 seconds. The default is 2 seconds. This field is only operable when the Switch is enabled for MSTP.
Migrate	Setting this parameter as "*yes*" will set the ports to send out BDPU packets to other bridges, requesting information on their STP setting If the Switch is configured for RSTP, the port will be capable to migrate from 802.1d STP to 802.1w RSTP. If the Switch is configured for MSTP, the port is capable of migrating from 802.1d STP to 802.1s MSTP. RSTP and MSTP can coexist with standard STP, however the benefits of RSTP and MSTP are not realized on a port where an 802.1d network connects to an 802.1w or 802.1s enabled network. Migration should be set as yes on ports connected to network stations or segments that are capable of being upgraded to 802.1w RSTP or 802.1s MSTP on all or some portion of the segment.
Edge	Choosing the true parameter designates the port as an edge port. Edge ports cannot create loops, however an edge port can lose edge port status if a topology change creates a potential for a loop. An edge port normally should not receive BPDU packets. If a BPDU packet is received, it automatically loses edge port status. Choosing the false parameter indicates that the port does not have edge port status.
P2P	Choosing the *True* parameter indicates a point-to-point (P2P) shared link. P2P ports are similar to edge ports, however they are restricted in that a P2P port must operate in full-duplex. Like edge ports, P2P ports transition to a forwarding state rapidly thus benefiting from RSTP. A p2p value of *false* indicates that the port cannot have p2p status. *Auto* allows the port to have p2p status whenever possible and operate as if the p2p status were true. If the port cannot maintain this status, (for example if the port is forced to half-duplex operation) the p2p status changes to operate as if the p2p value were *False*. The default setting for this parameter is *True*.
State	This drop-down menu allows you to enable or disable STP for the selected group of ports. The default is *Enabled*.

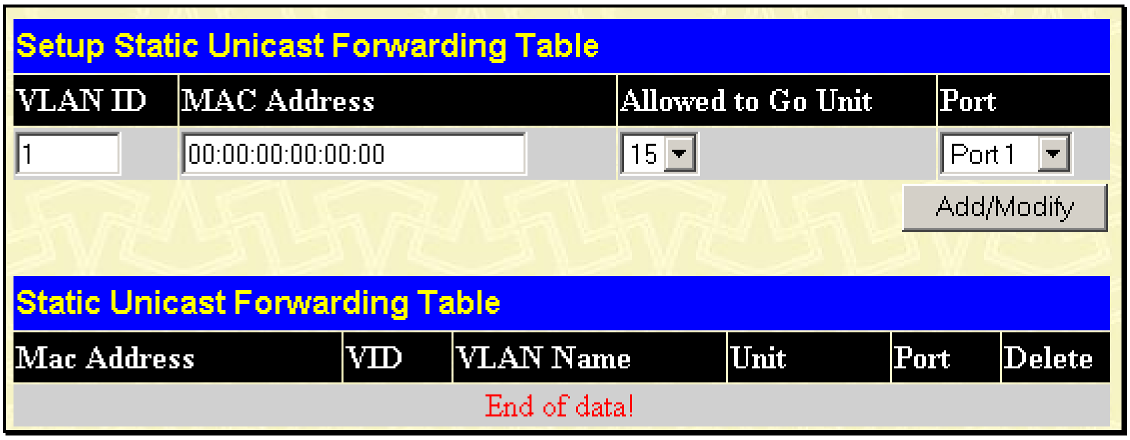
Click **Apply** to implement changes made.

Forwarding & Filtering

The Switch allows permanent or static entries into the forwarding database (FDB). These FDB entries are MAC addresses that will not age out. In addition, multicast forwarding may be customized to conform to rules for the different ports by setting up multicast filter modes for each port.

Unicast Forwarding

Open the **Forwarding & Filtering** folder and click on the **Unicast Forwarding** link. This will open the **Setup Static Unicast Forwarding Table** window, as shown below.



Setup Static Unicast Forwarding Table

VLAN ID	MAC Address	Allowed to Go Unit	Port
1	00:00:00:00:00:00	15	Port 1

Static Unicast Forwarding Table

Mac Address	VID	VLAN Name	Unit	Port	Delete

End of data!

Figure 4- 45. Setup Static Unicast Forwarding Table window

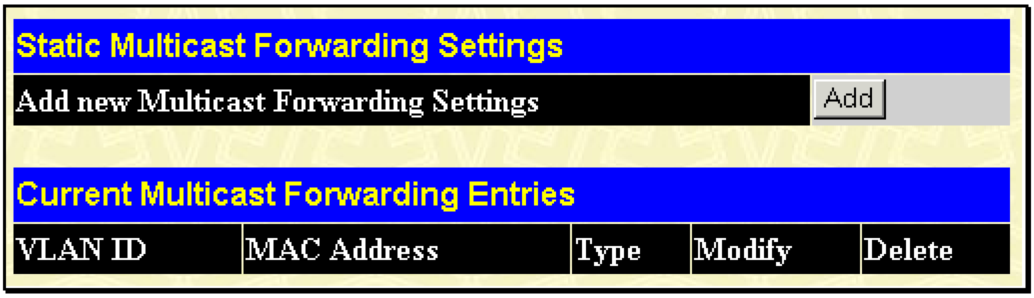
To add an entry, define the following parameters:

Parameter	Description
VLAN ID	The VLAN ID number of the VLAN on which the above Unicast MAC address resides.
MAC Address	The MAC address to which packets will be statically forwarded. This must be a unicast MAC address.
Allowed to Go Unit	Allows the designation of the module on which the above MAC address resides.
Port	Choose the port on which the MAC address resides.

Click on the **Add/Modify** button to add a unicast MAC address to the Switch's forwarding table, or to modify a previous entry.

Multicast Forwarding

The following figure and table describe how to set up Multicast forwarding on the Switch. Open the **Forwarding & Filtering** folder and click on the **Multicast Forwarding** link to see the entry window below:



Static Multicast Forwarding Settings

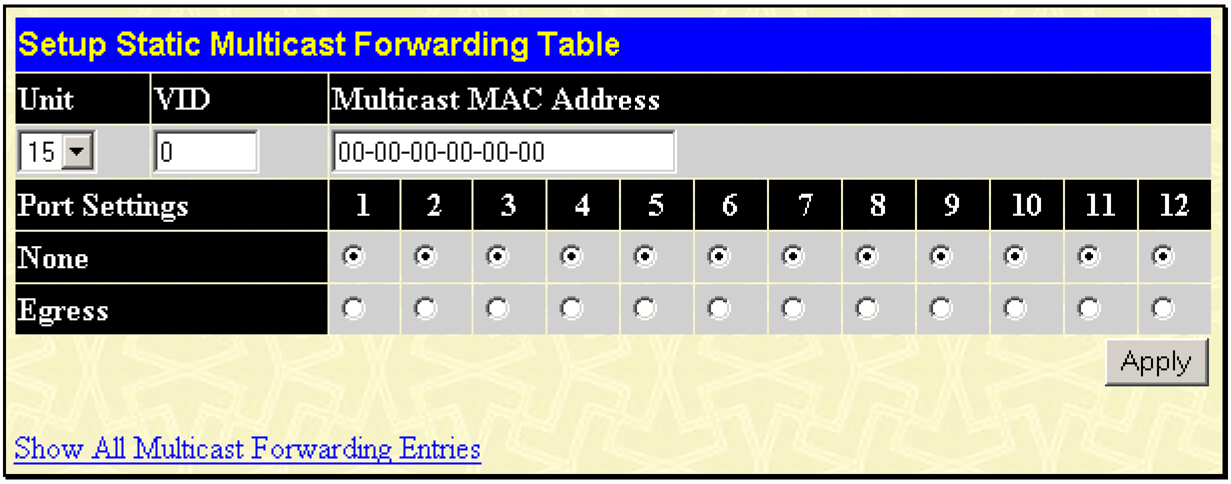
Add new Multicast Forwarding Settings	Add

Current Multicast Forwarding Entries

VLAN ID	MAC Address	Type	Modify	Delete

Figure 4- 46. Static Multicast Forwarding Settings window

The **Static Multicast Forwarding Settings** window displays all of the entries made into the Switch's static multicast forwarding table. Click the **Add** button to open the **Setup Static Multicast Forwarding Table** window, as shown below.



Setup Static Multicast Forwarding Table

Unit	VID	Multicast MAC Address
15	0	00-00-00-00-00-00

Port Settings	1	2	3	4	5	6	7	8	9	10	11	12
None	●	●	●	●	●	●	●	●	●	●	●	●
Egress	○	○	○	○	○	○	○	○	○	○	○	○

Apply

Show All Multicast Forwarding Entries

Figure 4- 47. Setup Static Multicast Forwarding Table window

The following parameters can be set:

Parameter	Description
Unit	Select the Switch in the Switch stack to configure. 15 represents the Switch in standalone mode.
VID	The VLAN ID of the VLAN to which the MAC address below belongs.
Multicast MAC Address	The MAC address of the static source of multicast packets. This must be a multicast MAC address.
Port Settings	Allows the selection of ports that will be members of the static multicast group and ports that are either forbidden from joining dynamically, or that can join the multicast group dynamically, using GMRP. The options are None and Egress. None means there are no restrictions on the port dynamically joining the multicast group. If None is chosen, then an end station attached to the port can join the multicast group using GMRP. Egress means the port is a static member of the multicast group.

Click **Apply** to implement changes made.

VLANs

The Switch Web Manager's VLANs sub-folder is divided into two main windows, **802.1Q Static VLANs** and **802.1Q Port Settings**. Each is described after a short overview of VLANs.

VLANs can function somewhat differently in a Layer 3 Switch, that is when the VLANs are Layer 3-based, than if they are strictly based on Layer 2 information. Since IP Switching among VLANs may be unfamiliar to users who are otherwise well acquainted with conventional VLANs used in standard Ethernet Switches, some explanation of VLANs used in Layer 3 Switching is presented below. It is essential to fully grasp this difference to take advantage of the improved efficiency of Layer 3 Switching.

VLANs in Layer 2

In normal 802.1Q VLAN implementation, packets cannot cross VLANs in a Switch that is limited to Layer 2 functions. If a member of one VLAN wants to connect to another VLAN, the link must be through an external router.

Layer 3-Based VLANs

Layer 3-based VLANs use network-layer addresses (subnet address for TCP/IP) to determine VLAN membership. These VLANs are based on layer 3 information, however this does not constitute a 'routing' function.

The DGS-3312SR and associated DGS-3312SR series Switches allow an IP subnet to be configured for each 802.1Q VLAN that exists on the Switch. That is, a VLAN can be associated or attached to an IP subnet. This represents an improvement in performance since it bypasses any routing functions, packets transferred between subnets are reduced to a "hardware" decision.

Even though a Switch inspects a packet's IP address to determine VLAN membership, no route calculation is performed, the RIP protocol is not employed, and packets traversing the Switch are bridged using the Spanning Tree algorithm.

A Switch that implements layer 3 (or 'subnet') VLANs without performing any routing function between these VLANs is referred to as performing 'IP Switching'.

Planning VLAN Layout

VLANs on the DGS-3312SR, DES-3226S and he DES-3250TG series of Switches have considerably more functions and are more complex than on a traditional layer 2 Switch, and must therefore be laid-out and configured with a bit more forethought. VLANs with an IP interface assigned to them could be thought of as network links – not just as a collection of associated end users. Further, VLANs assigned an IP network address and subnet mask enables IP routing between them.

VLANs must be configured on the Switch before they can be assigned IP subnets. Furthermore, the static VLAN configuration is specified on a per port basis. On the DGS-3312SR, a VLAN can consist of end-nodes – just like a traditional layer 2 Switch, but a VLAN can also consist of one or more Switches – each of which is connected to multiple end-nodes or network resources.

Therefore, the IP subnets for a network must be determined first, and the VLANs configured on the Switch to accommodate the IP subnets. Finally, the IP subnets can be assigned to the VLANs.

Assigning IP Network Addresses and Subnet Masks to VLANs

The DGS-3312SR allows the assignment of IP subnets to individual VLANs. This is the fundamental advantage of VLANs in IP Switching.

Developing an IP addressing scheme is a complex subject, but it is sufficient here to mention that the total number of anticipated end nodes – for each IP interface – must be accommodated with a unique IP address. It should be noted that the Switch regards a VLAN with an IP network address and corresponding subnet mask assigned as an IP interface.

Understanding 802.1Q VLANs

This review of 802.1Q VLANs presents some basic background about how VLANs work according to the IEEE 802.1Q standard. VLANs operate according to the same rules regardless of whether the Switching environment is Layer 2 or Layer 3. The difference is primarily that in a Layer 3 Switch there is an added capability of unique association between a VLAN and an IP interface or subnet group.

A VLAN is a collection of end nodes grouped by logic rather than physical location. End nodes that frequently communicate with each other are assigned to the same VLAN, regardless of where they are located physically on the network. Logically, a VLAN can be equated to a broadcast domain, because broadcast packets are forwarded only to members of the VLAN on which the broadcast was initiated.

IEEE 802.1Q VLANs

Some relevant terms:

- Tagging - The act of putting 802.1Q VLAN information into the header of a packet.
- Untagging - The act of stripping 802.1Q VLAN information out of the packet header.
- Ingress port - A port on a Switch where packets are flowing into the Switch and VLAN decisions must be made.
- Egress port - A port on a Switch where packets are flowing out of the Switch, either to another Switch or to an end station, and tagging decisions must be made.

IEEE 802.1Q (tagged) VLANs are implemented on the DGS-3312SR Switch. 802.1Q VLANs require tagging, which enables the VLANs to span an entire network (assuming all Switches on the network are IEEE 802.1Q-compliant).

Any port can be configured as either *tagging* or *untagging*. The *untagging* feature of IEEE 802.1Q VLANs allow VLANs to work with legacy Switches that don't recognize VLAN tags in packet headers. The *tagging* feature allows VLANs to span multiple 802.1Q VLAN compliant Switches through a single physical connection and allows Spanning Tree to be enabled on all ports and work normally.

802.1Q VLAN Packet Forwarding

Packet forwarding decisions are made based upon the following three types of rules:

- Ingress rules – rules relevant to the classification of received frames belonging to a VLAN.
- Forwarding rules between ports – decides filter or forward the packet
- Egress rules – determines if the packet must be sent tagged or untagged.

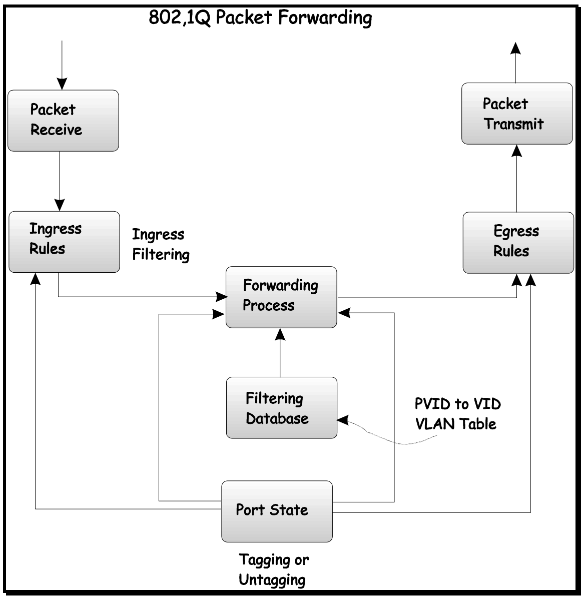


Figure 4- 48. 802.1Q Packet Forwarding

802.1Q VLAN Tags

The figure below shows the 802.1Q VLAN tag. There are four additional octets inserted after the source MAC address. Their presence is indicated by a value of 0x8100 in the EtherType field. When a packet's EtherType field is equal to 0x8100, the packet carries the IEEE 802.1Q/802.1p tag. The tag is contained in the following two octets and consists of three bits or user priority, one bit of Canonical Format Identifier (CFI – used for encapsulating Token Ring packets so they can be carried across Ethernet backbones) and twelve bits of VLAN ID (VID). The three bits of user priority are used by 802.1p. The VID is the VLAN identifier and is used by the 802.1Q standard. Because the VID is twelve bits long, 4094 unique VLANs can be identified.

The tag is inserted into the packet header making the entire packet longer by four octets. All of the information contained in the packet originally is retained.

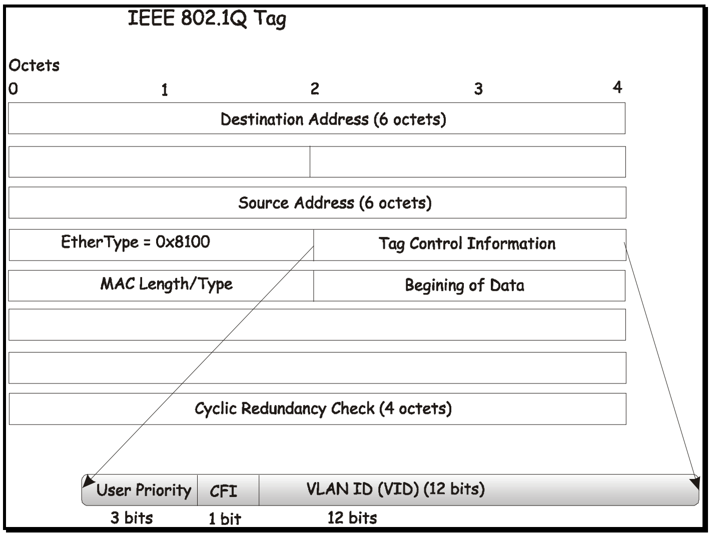


Figure 4- 49. IEEE 802.1Q Tag

The EtherType and VLAN ID are inserted after the MAC source address, but before the original EtherType/Length or Logical Link Control. Because the packet is now a bit longer than it was originally, the Cyclic Redundancy Check (CRC) must be recalculated.

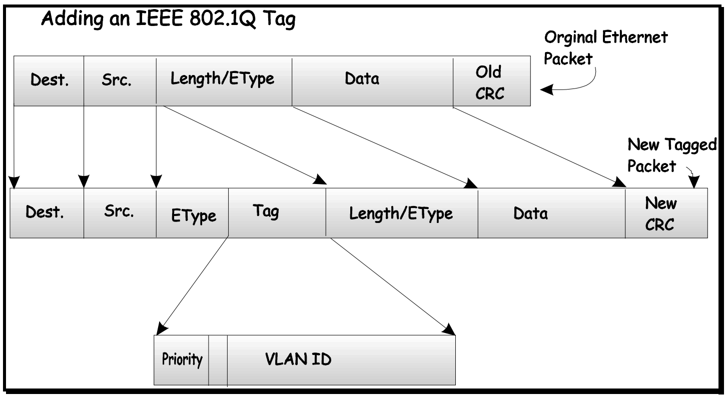


Figure 4- 50. Adding an IEEE 802.1Q Tag

Port VLAN ID

Packets that are tagged (are carrying the 802.1Q VID information) can be transmitted from one 802.1Q compliant network device to another with the VLAN information intact. This allows 802.1Q VLANs to span network devices (and indeed, the entire network – if all network devices are 802.1Q compliant).

Unfortunately, not all network devices are 802.1Q compliant. These devices are referred to as *tag-unaware.* 802.1Q devices are referred to as *tag-aware.*

Prior to the adoption 802.1Q VLANs, port-based and MAC-based VLANs were in common use. These VLANs relied upon a Port VLAN ID (PVID) to forward packets. A packet received on a given port would be assigned that port's PVID and then be forwarded to the port that corresponded to the packet's destination address (found in the Switch's forwarding table). If the PVID of the port that received the packet is different from the PVID of the port that is to transmit the packet, the Switch will drop the packet.

Within the Switch, different PVIDs mean different VLANs. (remember that two VLANs cannot communicate without an external router). So, VLAN identification based upon the PVIDs cannot create VLANs that extend outside a given Switch (or Switch stack).

Every physical port on a Switch has a PVID. 802.1Q ports are also assigned a PVID, for use within the Switch. If no VLANs are defined on the Switch, all ports are then assigned to a default VLAN with a PVID equal to 1. Untagged packets are assigned the PVID of the port on which they were received. Forwarding decisions are based upon this PVID, in so far as VLANs are concerned. Tagged packets are forwarded according to the VID contained within the tag. Tagged packets are also assigned a PVID, but the PVID is not used to make packet forwarding decisions, the VID is.

Tag-aware Switches must keep a table to relate PVIDs within the Switch to VIDs on the network. The Switch will compare the VID of a packet to be transmitted to the VID of the port that is to transmit the packet. If the two VIDs are different, the Switch will drop the packet. Because of the existence of the PVID for untagged packets and the VID for tagged packets, tag-aware and tag-unaware network devices can coexist on the same network.

A Switch port can have only one PVID, but can have as many VIDs as the Switch has memory in its VLAN table to store them.

Because some devices on a network may be tag-unaware, a decision must be made at each port on a tag-aware device before packets are transmitted – should the packet to be transmitted have a tag or not? If the transmitting port is connected to a tag-unaware device, the packet should be untagged. If the transmitting port is connected to a tag-aware device, the packet should be tagged.

Tagging and Untagging

Every port on an 802.1Q compliant Switch can be configured as *tagging* or *untagging.*

Ports with tagging enabled will put the VID number, priority and other VLAN information into the header of all packets that flow into and out of it. If a packet has previously been tagged, the port will not alter the packet, thus keeping the VLAN information intact. The VLAN information in the tag can then be used by other 802.1Q compliant devices on the network to make packet forwarding decisions.

Ports with untagging enabled will strip the 802.1Q tag from all packets that flow into and out of those ports. If the packet doesn’t have an 802.1Q VLAN tag, the port will not alter the packet. Thus, all packets received by and forwarded by an untagging port will have no 802.1Q VLAN information. (Remember that the PVID is only used internally within the Switch). Untagging is used to send packets from an 802.1Q-compliant network device to a non-compliant network device.

Ingress Filtering

A port on a Switch where packets are flowing into the Switch and VLAN decisions must be made is referred to as an *ingress port*. If ingress filtering is enabled for a port, the Switch will examine the VLAN information in the packet header (if present) and decide whether or not to forward the packet.

If the packet is tagged with VLAN information, the ingress port will first determine if the ingress port itself is a member of the tagged VLAN. If it is not, the packet will be dropped. If the ingress port is a member of the 802.1Q VLAN, the Switch then determines if the destination port is a member of the 802.1Q VLAN. If it is not, the packet is dropped. If the destination port is a member of the 802.1Q VLAN, the packet is forwarded and the destination port transmits it to its attached network segment.

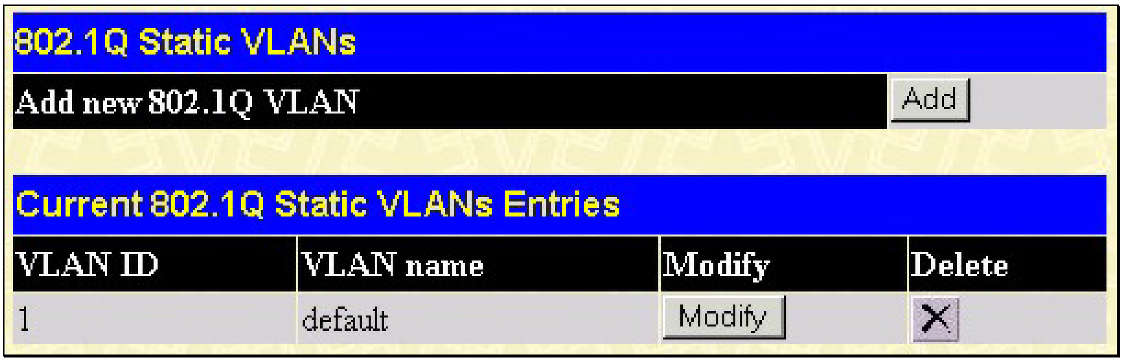
If the packet is not tagged with VLAN information, the ingress port will tag the packet with its own PVID as a VID (if the port is a tagging port). The Switch then determines if the destination port is a member of the same VLAN (has the same VID) as the ingress port. If it does not, the packet is dropped. If it has the same VID, the packet is forwarded and the destination port transmits it on its attached network segment.

This process is referred to as *ingress filtering* and is used to conserve bandwidth within the Switch by dropping packets that are not on the same VLAN as the ingress port at the point of reception. This eliminates the subsequent processing of packets that will just be dropped by the destination port.

802.1Q Static VLANs

To create or modify an 802.1Q VLAN:

In the **Configuration** folder, open the **VLANs** folder and click the **Static VLAN Entry** link to open the following window:



802.1Q Static VLANs

Add new 802.1Q VLAN [Add]

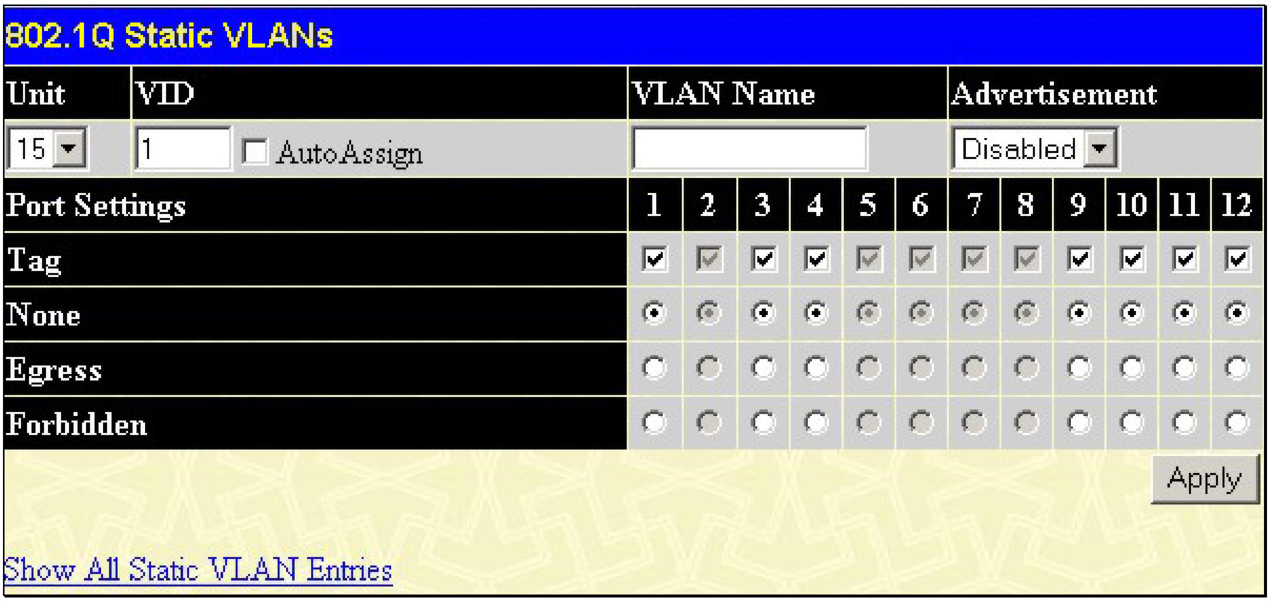
Current 802.1Q Static VLANs Entries

VLAN ID	VLAN name	Modify	Delete
1	default	Modify	☒

Figure 4- 51. 802.1Q Static VLANs and Current 802.1Q Static VLAN Entries window

The first **802.1Q Static VLANs** window lists all previously configured VLANs by VLAN ID and name. To delete an existing 802.1Q VLAN, click the corresponding **Delete** button.

To create a new 802.1Q VLAN, click the **Add** button. A new window appears, use this to configure the port settings and to assign a unique name and number to the new VLAN. See the table below for a description of the parameters in the new window.



802.1Q Static VLANs

Unit	VID	VLAN Name	Advertisement
15	1 □ AutoAssign		Disabled

Port Settings	1	2	3	4	5	6	7	8	9	10	11	12
Tag	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
None	●	●	●	●	●	●	●	●	●	●	●	●
Egress	○	○	○	○	○	○	○	○	○	○	○	○
Forbidden	○	○	○	○	○	○	○	○	○	○	○	○

[Apply]

Show All Static VLAN Entries

Figure 4- 52. 802.1Q Static VLANs window - Add

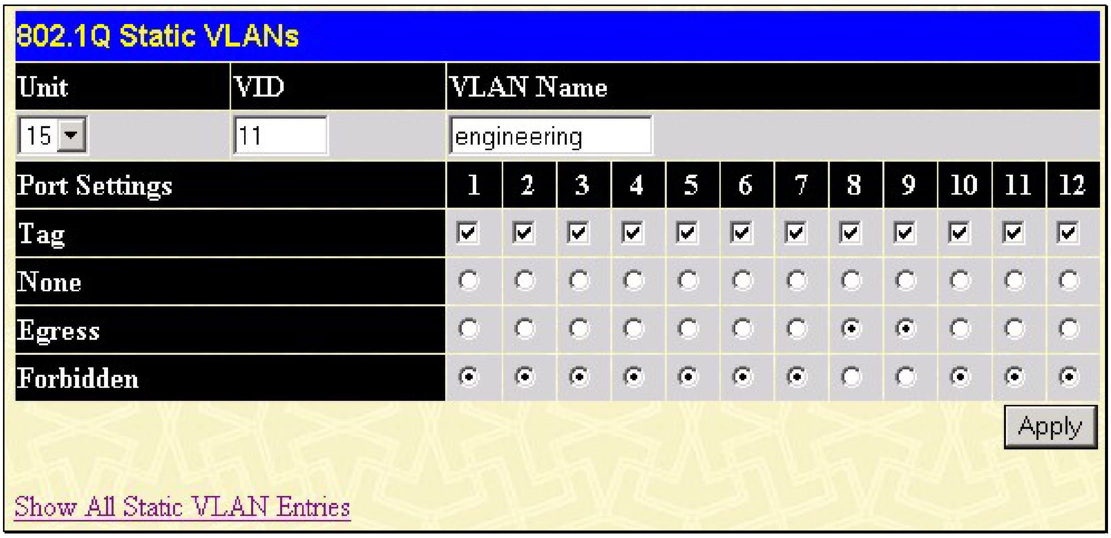
To configure the newly created VLAN, select the Switch being configured from the **Unit** drop-down menu and provide a unique VLAN identifier and name. Configure the port settings for VLAN membership by selecting the appropriate options for each port. Click the **Apply** button to configure the VLAN port membership settings. A success or fail message appears to confirm whether the settings have been applied. To view the VLANs that have been thus far configured, click the Show All Static VLAN Entries hyperlink (see example below). To add another new VLAN entry, click the **Add** button again in the first **802.1Q Static VLANs** window.

See the table below for a description of the port VLAN membership settings.

The following fields can then be set in either the **Add** or **Modify** 802.1Q Static VLANs windows:

Parameter	Description
Unit	Choose the Switch on which the VLAN will be created.
VID (VLAN ID)	For a new VLAN entry, type in a unique identifier. This number is used to configure other settings such as GVRP status for ports in the VLAN. *Auto Assign* – Checking this box will automatically assign a VID to the new VLAN entry.
VLAN Name	For a new VLAN entry type in a unique name. This name can be used to identify the VLAN for IP interface assignment. Remember that VLAN names are case-sensitive when referring to them for other applications (such as setting up IP interfaces).
Advertisement	Enabling this function will allow the Switch to send out GVRP packets to outside sources, notifying that they may join the existing VLAN.
Port	Configure each individual port to be specified as member or nonmember of the VLAN.
Tag	Specifies the port as either 802.1Q tagging or 802.1Q untagged. Checking the box will designate the port as Tagged.
None	Specifies the port as not being a static member of the VLAN, but with no restrictions for joining the VLAN dynamically through GVRP.
Egress	Select this to specify the port as a static member of the VLAN. Egress member ports are ports that will be transmitting traffic for the VLAN. These ports can be either tagged or untagged.
Forbidden	Select this to specify the port as not being a member of the VLAN and that the port is forbidden from becoming a member of the VLAN dynamically.

The illustration below displays the port settings for a new VLAN (engineering) with a VID of 11.



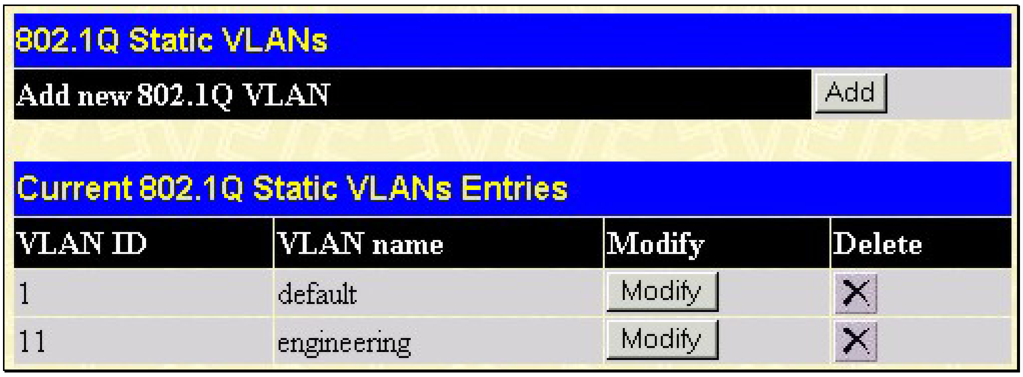
802.1Q Static VLANs

Unit	VID	VLAN Name
15	11	engineering

Port Settings	1	2	3	4	5	6	7	8	9	10	11	12
Tag	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
None	○	○	○	○	○	○	○	○	○	○	○	○
Egress	○	○	○	○	○	○	○	●	●	○	○	○
Forbidden	●	●	●	●	●	●	●	○	○	●	●	●

Figure 4- 53. Add New Static VLAN Example window

Click the Show All Static VLAN Entries link to return to the first **802.1Q Static VLANs** window, the new VLAN entry appears listed in the current entries table.



802.1Q Static VLANs

Add new 802.1Q VLAN	Add

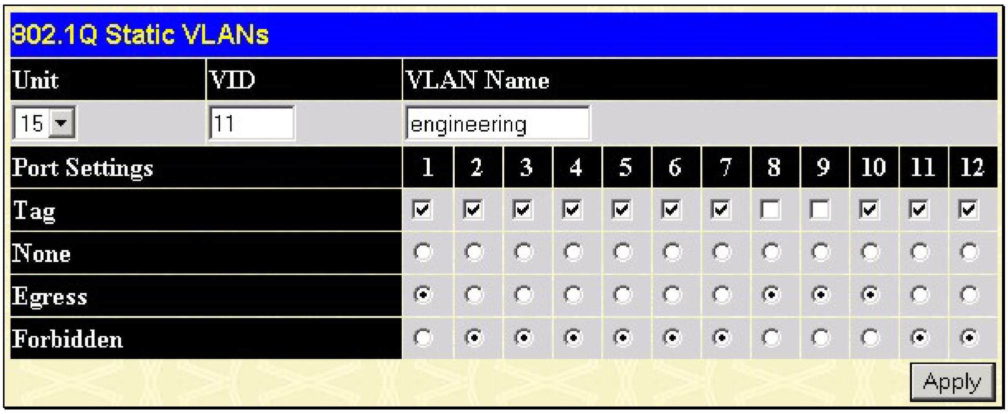
Current 802.1Q Static VLANs Entries

VLAN ID	VLAN name	Modify	Delete
1	default	Modify	☒
11	engineering	Modify	☒

Figure 4- 54. 802.1Q Static VLANs With Added VLAN window

To change the port settings of any listed VLAN, click the **Modify** button.

Now click the **Modify** button in the first **802.1Q Static VLANs** window for the newly created VLAN (engineering). A new window appears, use this to configure the port settings to the existing VLAN, exactly as in the add new VLAN window. Notice that the VID and name cannot be changed. If you want to change the VID or VLAN Name it will be necessary to delete the existing entry and create a new one.



802.1Q Static VLANs

Unit	VID	VLAN Name
15	11	engineering

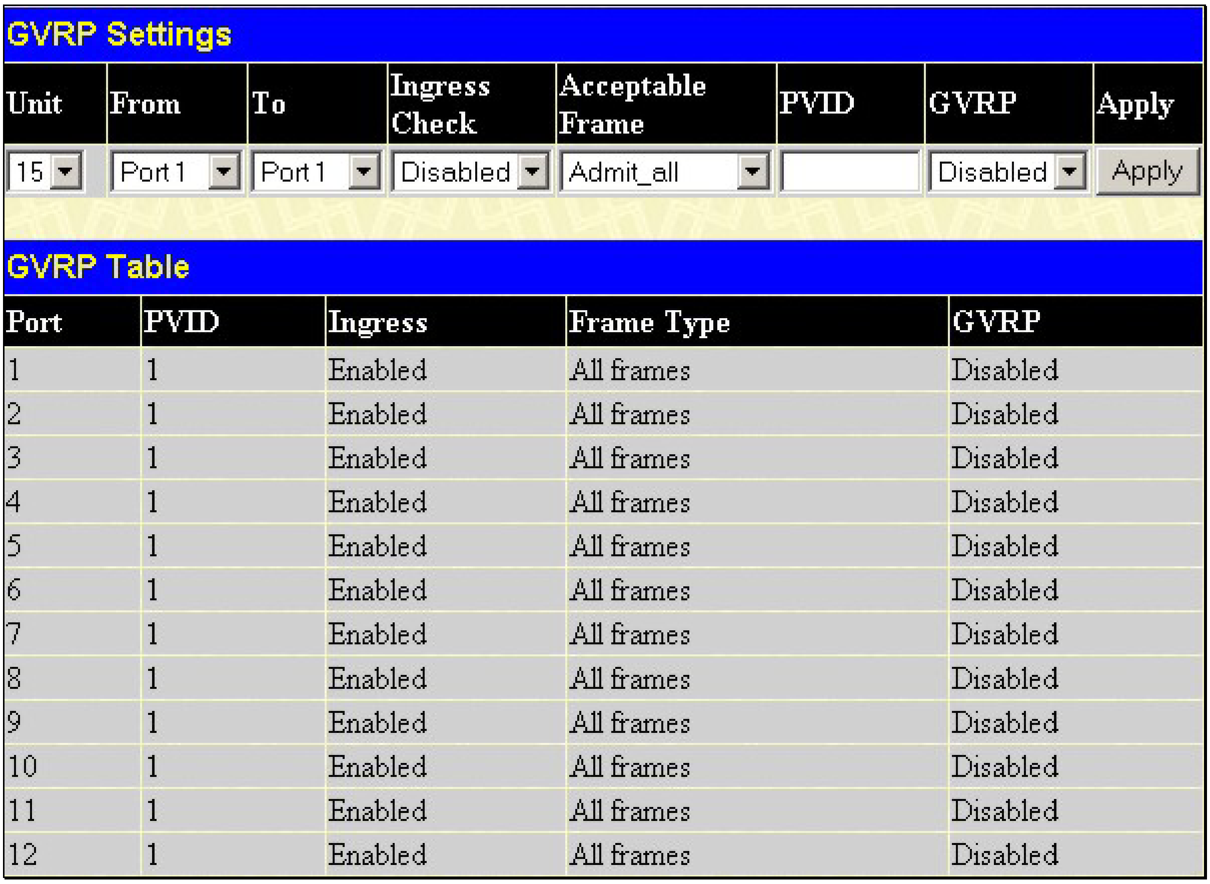
Port Settings	1	2	3	4	5	6	7	8	9	10	11	12
Tag	☑	☑	☑	☑	☑	☑	☑	□	□	☑	☑	☑
None	○	○	○	○	○	○	○	○	○	○	○	○
Egress	●	○	○	○	○	○	○	●	●	●	○	○
Forbidden	○	●	●	●	●	●	●	○	○	○	●	●

Figure 4- 55. 802.1Q Static VLANs – Modify window

GVRP Settings

Open the **GVRP Settings** window and select the Unit and range of ports to configure. For the selected port or group of ports, choose to enable or disable Ingress checking and establish an acceptable packet rule. Ingress Checking is used to limit traffic by filtering incoming packets that have a PVID does not match the PVID of the port. 802.1Q port settings are also used to determine whether the Switch will share its VLAN configuration information with GARP VLAN Registration Protocol (GVRP) enabled Switches.

The window and table below describe how to configure the 802.1Q VLAN port settings for the Switch.



GVRP Settings

Unit	From	To	Ingress Check	Acceptable Frame	PVID	GVRP	Apply
15	Port 1	Port 1	Disabled	Admit_all		Disabled	Apply

GVRP Table

Port	PVID	Ingress	Frame Type	GVRP
1	1	Enabled	All frames	Disabled
2	1	Enabled	All frames	Disabled
3	1	Enabled	All frames	Disabled
4	1	Enabled	All frames	Disabled
5	1	Enabled	All frames	Disabled
6	1	Enabled	All frames	Disabled
7	1	Enabled	All frames	Disabled
8	1	Enabled	All frames	Disabled
9	1	Enabled	All frames	Disabled
10	1	Enabled	All frames	Disabled
11	1	Enabled	All frames	Disabled
12	1	Enabled	All frames	Disabled

Figure 4- 56. 802.1Q Port Settings window

Configure the 802.1p Port Settings by implementing the parameters listed below:

Parameter	Description
Unit	Select the relevant Switch in the Switch stack for configuration.
From [ ] To [ ]	Use these drop-down menus to specify the range of ports that will be included in the VLAN.
Ingress Check	This field can be toggled using the space bar between *Enabled* and *Disabled*. *Enabled* enables the port to compare the VID tag of an incoming packet with the PVID number assigned to the port. If the two are different, the port filters (drops) the packet. *Disabled* disables Ingress filtering. Ingress Checking is disabled by default.
Acceptable Frame (Frame Type)	Allows you to specify the action the Switch will take when a packet is received. If you specify *Admit_all* the Switch will receive and forward all packets to this VLAN regardless of whether or not the packet has an 802.1Q VLAN tag or not. If you specify *Tagged_only* the Switch will drop and untagged packets it receives for this VLAN.

PVID	A Port VLAN Identifier is a classification mechanism that associates a port with a specific VLAN and is used to make forwarding decisions for untagged packets received by the port. For example, if port 2 is assigned a PVID of 3, then all untagged packets received on port 2 will be assigned to VLAN 3. This number is generally the same as the VID number assigned to the port in the Edit 802.1Q VLANs window above.
GVRP	The Group VLAN Registration Protocol (GVRP) enables the port to dynamically become a member of a VLAN. GVRP is disabled by default.

Click **Apply** to implement changes made.

QoS

The DGS-3312SR supports 802.1p priority queuing Quality of Service. The following section discusses the implementation of QoS (Quality of Service) and benefits of using 802.1p priority queuing.

The Advantages of QoS

QoS is an implementation of the IEEE 802.1p standard that allows network administrators a method of reserving bandwidth for important functions that require a large bandwidth or have a high priority, such as VoIP (voice-over Internet Protocol), web browsing applications, file server applications or video conferencing. Not only can a larger bandwidth be created, but other less critical traffic can be limited, so excessive bandwidth can be saved. The Switch has separate hardware queues on every physical port to which packets from various applications can be mapped to, and, in turn prioritized. View the following map to see how the DGS-3312SR family of switches implements basic 802.1P priority queuing.

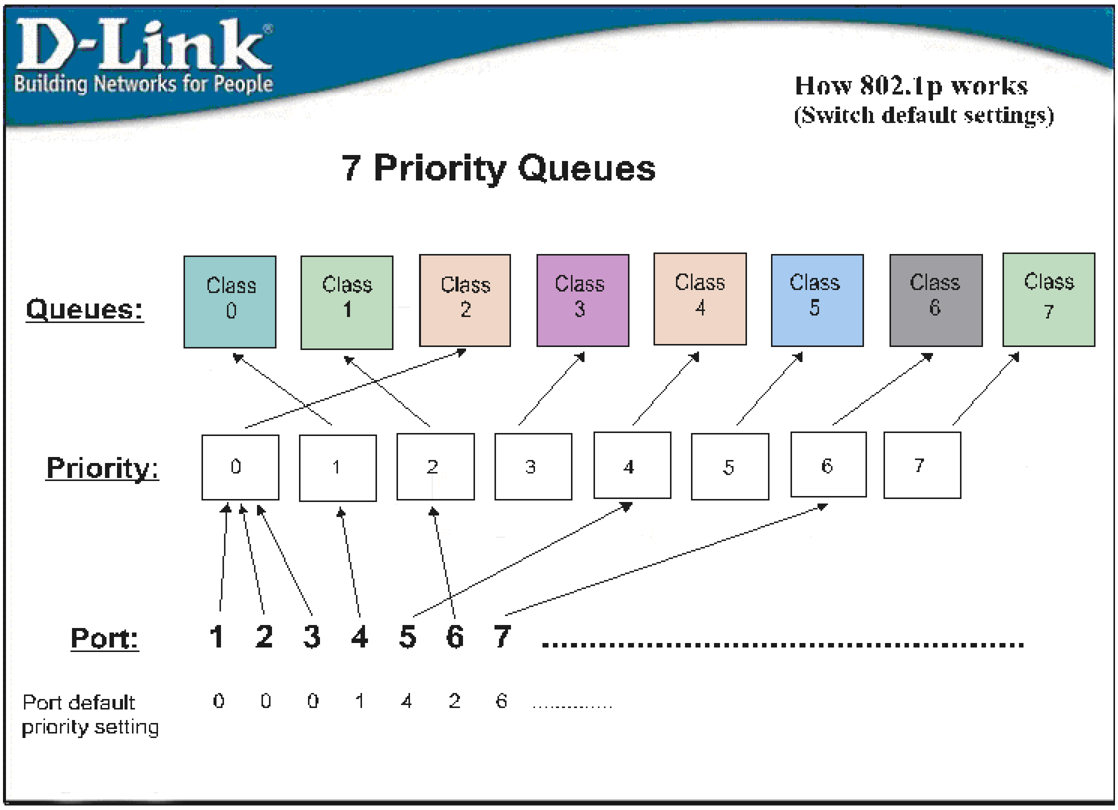


Figure 4- 57. An Example of the Default QoS Mapping on the Switch

The picture above shows the default priority setting for the Switch. Class-7 has the highest priority of the seven priority classes of service on the Switch. In order to implement QoS, the user is required to instruct the Switch to examine the header of a packet to see if it has the proper identifying tag. Then the user may forward these tagged packets to designated classes of service on the Switch where they will be emptied, based on priority.

For example, lets say a user wishes to have a video conference between two remotely set computers. The administrator can add priority tags to the video packets being sent out, utilizing the Access Profile commands. Then, on the receiving end, the administrator instructs the Switch to examine packets for this tag, acquires the tagged packets and maps them to a class queue on the Switch. Then in turn, the administrator will set a priority for this queue so that will be emptied before any other packet is forwarded. This results in the end user receiving all packets sent as quickly as possible, thus prioritizing the queue and allowing for an uninterrupted stream of packets, which optimizes the use of bandwidth available for the video conference.

Understanding QoS

The Switch has nine priority classes of service, one of which is internal and not configurable. These priority classes of service are labeled as 7, the high class to 0, the lowest class. The eight priority tags, specified in IEEE 802.1p are mapped to the Switch's priority classes of service as follows:

- Priority 0 is assigned to the Switch's Q2 class.
- Priority 1 is assigned to the Switch's Q0 class.
- Priority 2 is assigned to the Switch's Q1 class.
- Priority 3 is assigned to the Switch's Q3 class.
- Priority 4 is assigned to the Switch's Q4 class.
- Priority 5 is assigned to the Switch's Q5 class.
- Priority 6 is assigned to the Switch's Q6 class.
- Priority 7 is assigned to the Switch's Q7 class.

For strict priority-based scheduling, any packets residing in the higher priority classes of service are transmitted first. Multiple strict priority classes of service are emptied based on their priority tags. Only when these classes are empty, are packets of lower priority transmitted.

For weighted round-robin queuing, the number of packets sent from each priority queue depends upon the assigned weight. For a configuration of 8 CoS queues, A~H with their respective weight value: 8~1, the packets are sent in the following sequence: A1, B1, C1, D1, E1, F1, G1, H1, A2, B2, C2, D2, E2, F2, G2, A3, B3, C3, D3, E3, F3, A4, B4, C4, D4, E4, A5, B5, C5, D5, A6, B6, C6, A7, B7, A8, A1, B1, C1, D1, E1, F1, G1, H1.

For weighted round-robin queuing, if each CoS queue has the same weight value, then each CoS queue has an equal opportunity to send packets just like round-robin queuing.

For weighted round-robin queuing, if the weight for a CoS is set to 0, then it will continue processing the packets from this CoS until there are no more packets for this CoS. The other CoS queues that have been given a nonzero value, and depending upon the weight, will follow a common weighted round-robin scheme.

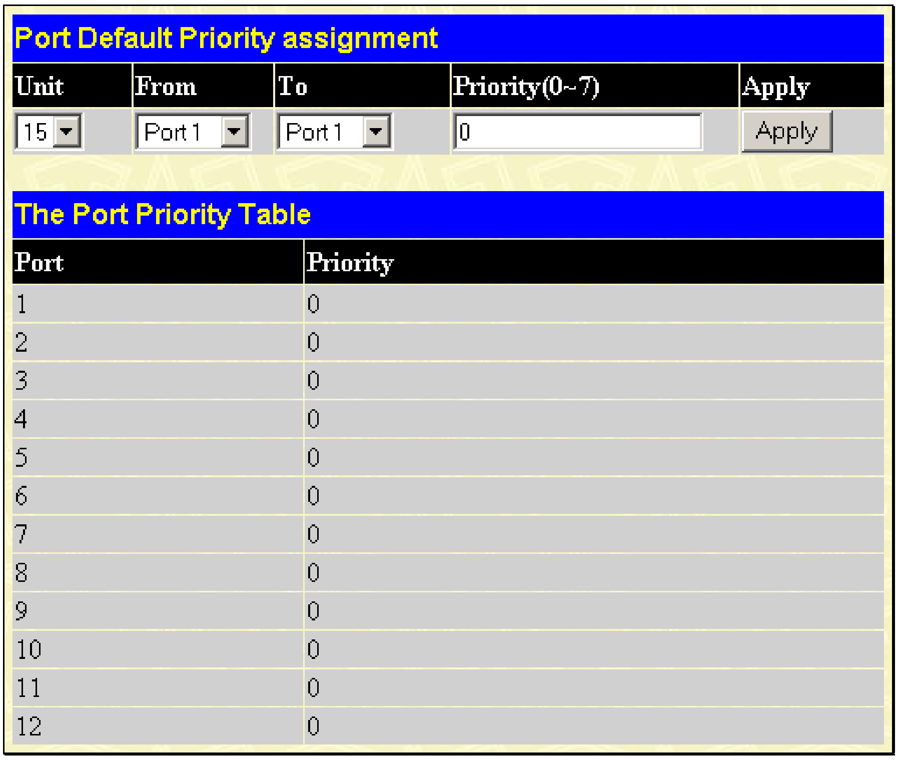
Remember that the DGS-3312SR has eight configurable priority queues (and eight Classes of Service) for each port on the Switch.

NOTICE: The Switch contains nine classes of service for each port on the Switch. One of these classes is reserved for internal use on the Switch and is therefore not configurable. All references in the following section regarding classes of service will refer to only the seven classes of service that may be used and configured by the Switch’s Administrator.

802.1p Default Priority

The Switch allows the assignment of a default 802.1p priority to each port on the Switch.

Click on the **802.1p Default Priority** link in the **QoS** sub-folder:



Port Default Priority assignment

Unit	From	To	Priority(0~7)	Apply
15	Port 1	Port 1	0	Apply

The Port Priority Table

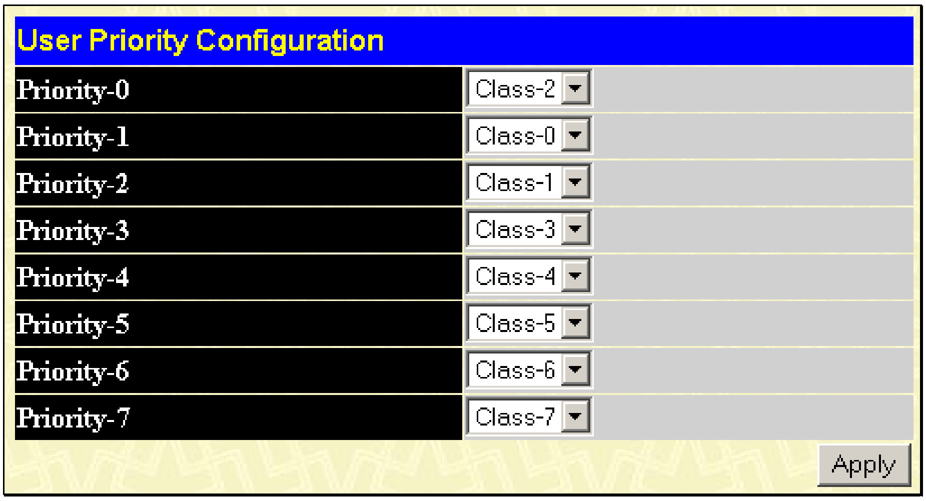
Port	Priority
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0

Figure 4- 58. Port Default Priority assignment and The Port Priority Table window

This page allows you to assign a default 802.1p priority to any given port on the Switch. The priority queues are numbered from 0 – the lowest priority – to 7 – the highest priority.

802.1p User Priority

The DGS-3312SR allows the assignment of a User Priority to each of the 802.1p priorities.



User Priority Configuration

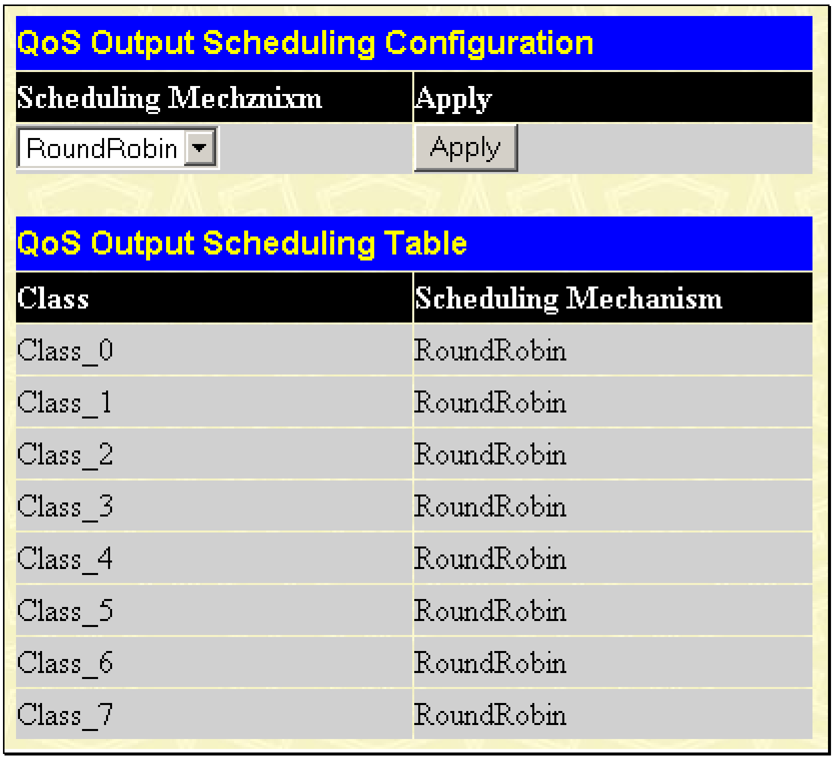
Priority-0	Class-2
Priority-1	Class-0
Priority-2	Class-1
Priority-3	Class-3
Priority-4	Class-4
Priority-5	Class-5
Priority-6	Class-6
Priority-7	Class-7

Figure 4- 59. User Priority Configuration window

Once you have assigned a priority to the port groups on the Switch, you can then assign this Class to each of the eight levels of 802.1p priorities.

QoS Output Scheduling Configuration

QoS can be customized by changing the output scheduling used for the hardware queues in the Switch. As with any changes to QoS implementation, careful consideration should be given to how network traffic in lower priority queues are affected. Changes in scheduling may result in unacceptable levels of packet loss or significant transmission delay. If you choose to customize this setting, it is important to monitor network performance, especially during peak demand as bottlenecks can quickly develop if the QoS settings are not suitable.



QoS Output Scheduling Configuration

Scheduling Mechznixm	Apply
RoundRobin ▾	Apply

QoS Output Scheduling Table

Class	Scheduling Mechanism
Class_0	RoundRobin
Class_1	RoundRobin
Class_2	RoundRobin
Class_3	RoundRobin
Class_4	RoundRobin
Class_5	RoundRobin
Class_6	RoundRobin
Class_7	RoundRobin

Figure 4- 60. QoS Output Scheduling Configuration window

Use the Scheduling Mechanism drop-down menu to select between a *RoundRobin* and a *Strict* mechanism for empting the priority queues.

Click **Apply** to let your changes take effect.

Traffic Segmentation

Traffic segmentation is used to limit traffic flow from a single port to a group of ports on either a single Switch (in standalone mode) or a group of ports on another Switch in a Switch stack. This method of segmenting the flow of traffic is similar to using VLANs to limit traffic, but is more restrictive. It provides a method of directing traffic that does not increase the overhead of the Master Switch CPU.

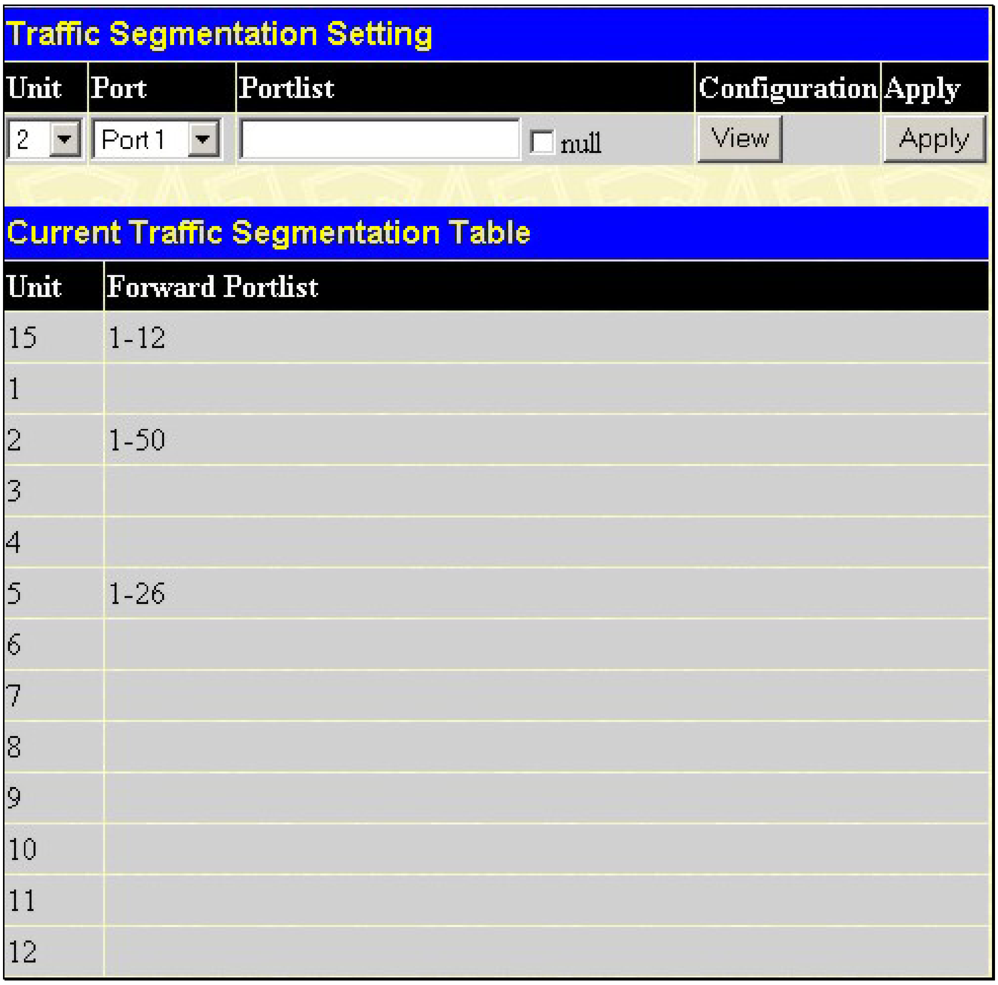
This page allows you to determine which port on the master switch in a switch stack will be allowed to forward packets to other ports on that switch.

Configuring traffic segmentation on the DGS-33121SR is accomplished in two parts. First, you specify a switch from a switch stack by using the **Unit** pull-down menu, and then a port from that switch, using the **Port** pull-down menu. Then specify which ports on the Switch that you want to be able to receive packets from the Switch and port you specified in the first part.

Clicking the **Apply** button will enter the combination of transmitting port and allowed receiving ports into the Switch's **Traffic Segmentation** table.

The **Unit** drop-down menu at the top of the page allows you to select a switch from a switch stack using that switch's Unit ID. The **Port** drop-down menu allows you to select a port from that switch. This is the port that will be transmitting packets. The **Portlist** field will allow the user to set a port or series of ports to which traffic will be forwarded, on the same switch. These ports will be configured for the same switch in the Switch stack that has been selected. For the master switch of a switch stack, the traffic segmentation can be done per stacking port so the Switch can forward traffic to all the ports on a specific switch in the Switch stack. Clicking the **null** click box will instruct the Switch not to forward traffic to any ports on the selected switch.

Clicking the **Apply** button will enter the combination of transmitting port and allowed receiving ports into the Switch's **Traffic Segmentation Table**.



Traffic Segmentation Setting

Unit	Port	Portlist	Configuration	Apply
2	Port 1	□ null	View	Apply

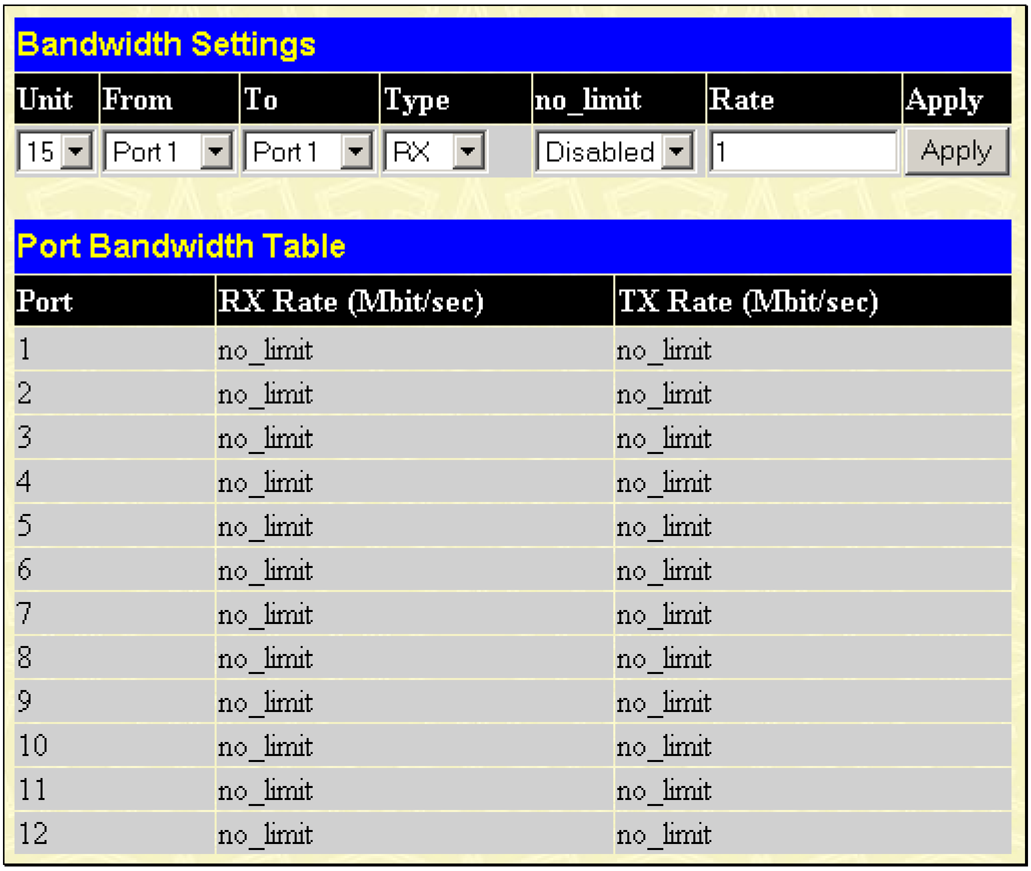
Current Traffic Segmentation Table

Unit	Forward Portlist
15	1-12
1	
2	1-50
3	
4	
5	1-26
6	
7	
8	
9	
10	
11	
12	

Figure 4- 61. Traffic Segmentation Setting and Current Traffic Segmentation Table window

Port Bandwidth

The bandwidth control settings are used to place a ceiling on the transmitting and receiving data rates for any selected port.



Bandwidth Settings

Unit	From	To	Type	no_limit	Rate	Apply
15	Port 1	Port 1	RX	Disabled	1	Apply

Port Bandwidth Table

Port	RX Rate (Mbit/sec)	TX Rate (Mbit/sec)
1	no_limit	no_limit
2	no_limit	no_limit
3	no_limit	no_limit
4	no_limit	no_limit
5	no_limit	no_limit
6	no_limit	no_limit
7	no_limit	no_limit
8	no_limit	no_limit
9	no_limit	no_limit
10	no_limit	no_limit
11	no_limit	no_limit
12	no_limit	no_limit

Figure 4- 62. Bandwidth Settings window

The following parameters can be set or are displayed:

Parameter	Description
Unit	Allows you to specify a Switch in a Switch stack using that Switch's Unit ID. 15 indicates a Switch in standalone mode.
From/To	A consecutive group of ports may be configured starting with the selected port.
Type	This drop-down menu allows you to select between *RX* (receive,) *TX* (transmit,) and *Both*. This setting will determine whether the bandwidth ceiling is applied to receiving, transmitting, or both receiving and transmitting packets.
no_limit	This drop-down menu allows you to specify that the selected port will have no bandwidth limit. *Enabled* disables the limit.
Rate	This field allows you to enter the data rate, in Mb/s, that will be the limit for the selected port.

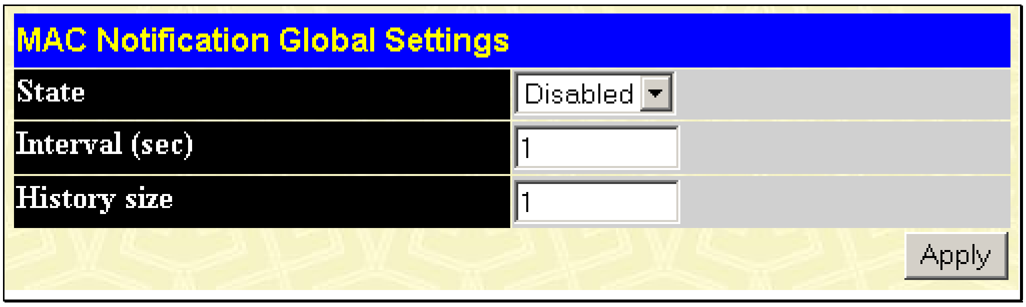
Click **Apply** to implement changes made.

MAC Notification

MAC address notification is used to monitor MAC addresses as they are learned and entered into the Switch's MAC forwarding database.

MAC Notification Global Settings

The following window will allow the user to globally enable MAC Notification on the Switch. To view this window, click **Configuration > MAC Notification > MAC Notification Global Settings**.



MAC Notification Global Settings

State	Disabled
Interval (sec)	1
History size	1

Figure 4- 63. MAC Notification Global Settings window

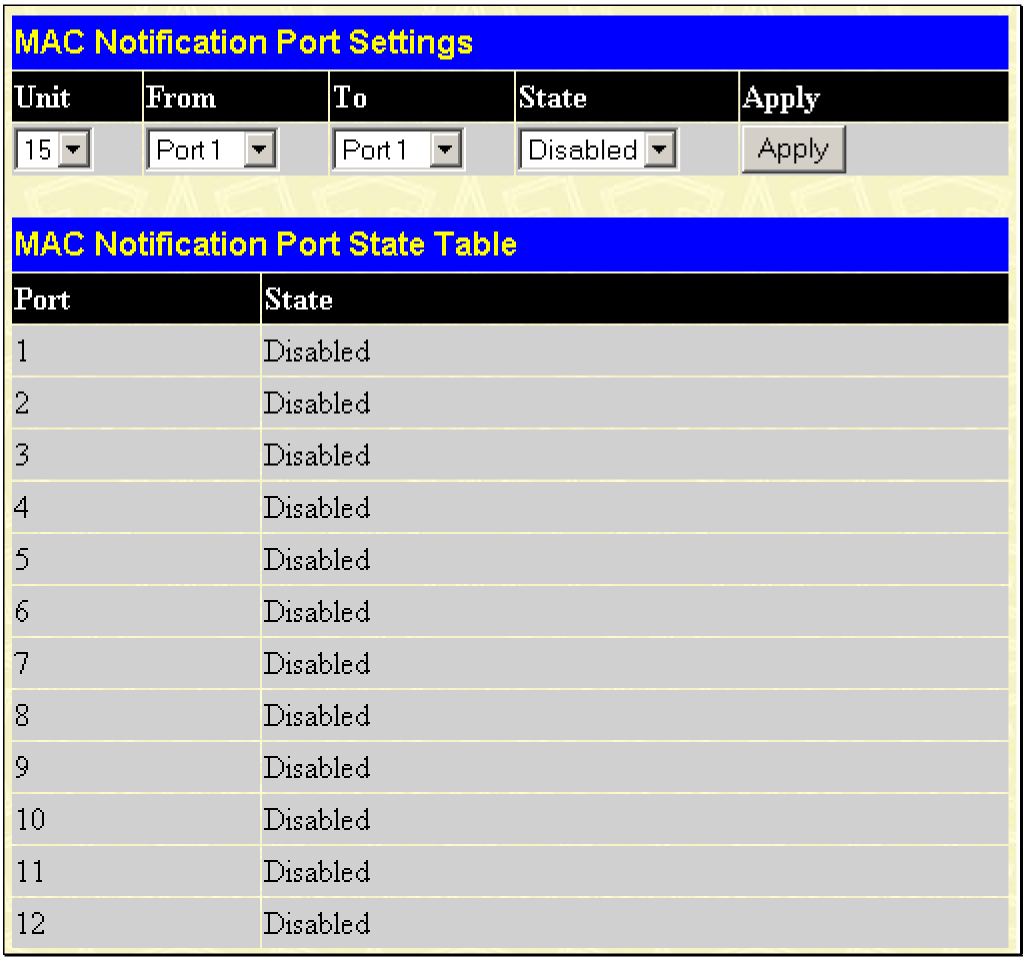
The following parameters can be set:

Parameter	Description
State	This drop-down menu is used to enable or disable MAC notification on the selected Switch.
Interval (sec)	The time in seconds between notifications.
History size	The maximum number of entries that will be listed in the History log. Up to *500* entries can be specified.

Click **Apply** to implement changes made.

MAC Notification Port Settings

Enable or disable MAC notification for ports with the window below.



MAC Notification Port Settings

Unit	From	To	State	Apply
15	Port 1	Port 1	Disabled	Apply

MAC Notification Port State Table

Port	State
1	Disabled
2	Disabled
3	Disabled
4	Disabled
5	Disabled
6	Disabled
7	Disabled
8	Disabled
9	Disabled
10	Disabled
11	Disabled
12	Disabled

Figure 4- 64. MAC Notification Port Settings window

The following parameters can be set:

Parameter	Description
Unit	Allows you to specify a Switch in a Switch stack using that Switch’s Unit ID. 15 indicates the DGS-3312SR.
From/To	A consecutive group of ports may be configured starting with the selected port.
State	This pull-down menu allows you to enable or disable MAC notification for the specified Switch and group of ports.

Click **Apply** to implement changes made.

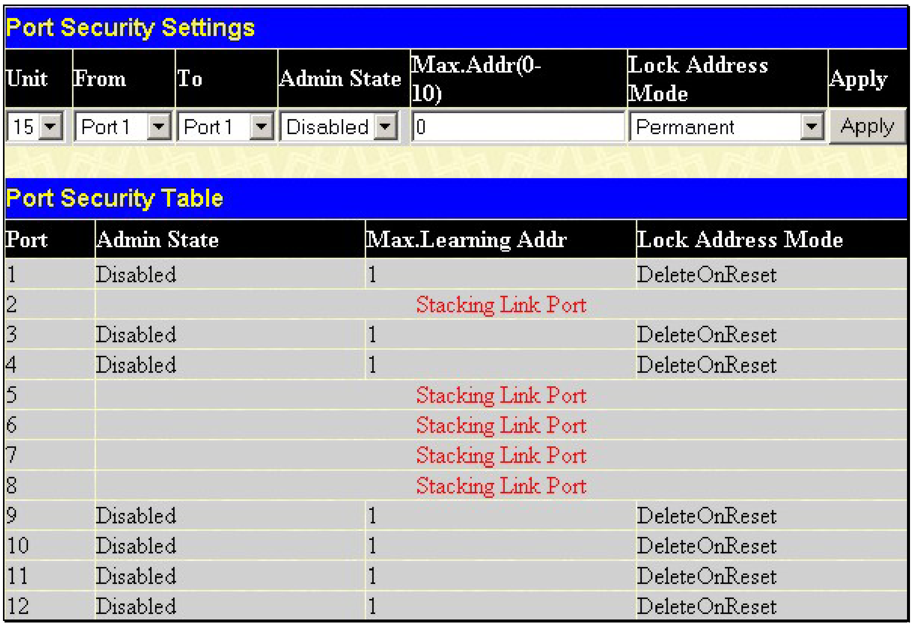
Port Security Configuration

The following three windows will allow the user to implement security functions on a per port basis on the Switch or a switch in a switch stack. To access the following windows, open the **Port Security Configuration** folder in the **Configuration** folder.

Port Security

A given port's (or a range of port's) dynamic MAC address learning can be locked such that the current source MAC addresses entered into the MAC address forwarding table can not be changed once the port lock is enabled. The port can be locked by using the Admin State pull-down menu to *Enabled*, and clicking **Apply**.

This is a security feature that prevents unauthorized computers (with source MAC addresses unknown to the Switch prior to locking the port (or ports) from connecting to the Switch's locked ports and gaining access to the network.



Port Security Settings

Unit	From	To	Admin State	Max.Addr(0-10)	Lock Address Mode	Apply
15	Port 1	Port 1	Disabled	0	Permanent	Apply

Port Security Table

Port	Admin State	Max.Learning Addr	Lock Address Mode
1	Disabled	1	DeleteOnReset
2	Stacking Link Port		
3	Disabled	1	DeleteOnReset
4	Disabled	1	DeleteOnReset
5	Stacking Link Port		
6	Stacking Link Port		
7	Stacking Link Port		
8	Stacking Link Port		
9	Disabled	1	DeleteOnReset
10	Disabled	1	DeleteOnReset
11	Disabled	1	DeleteOnReset
12	Disabled	1	DeleteOnReset

Figure 4- 65. Port Security Settings window

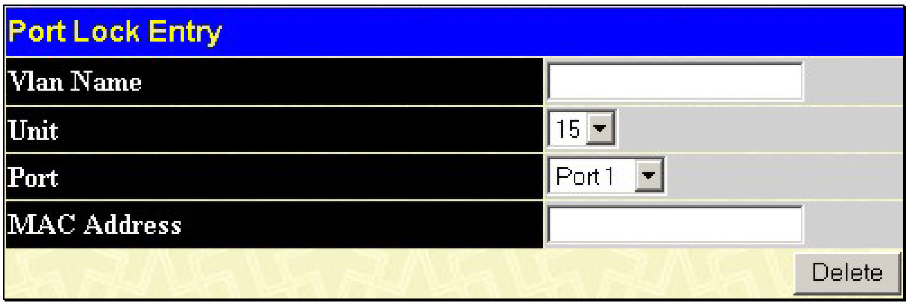
The following parameters can be set:

Parameter	Description
Unit	Allows you to specify a Switch in a Switch stack using that Switch's Unit ID. The number 15 indicates a Switch in standalone mode.
From/To	A consecutive group of ports may be configured starting with the selected port.
Admin State	This pull-down menu allows you to enable or disable Port Security (locked MAC address table for the selected ports.)
Max.Addr (0-10)	The number of MAC addresses that will be in the MAC address forwarding table for the selected Switch and group of ports.
Lock Address Mode	This pull-down menu allows you to select how the MAC address table locking will be implemented on the Switch, for the selected group of ports. The options are: • *Permanent* – The locked addresses will not age out after the aging timer expires. • *DeleteOnTimeout* – The locked addresses will age out after the aging timer expires.

	DeleteOnReset – The locked addresses will not age out until the Switch has been reset.

Port Lock Entry Delete

The **Port Lock Entry Delete** window is used to remove an entry from the port security entries learned by the Switch and entered into the forwarding database. To view the following window, click **Configuration > Port Security Configuration > Port Lock Entry Delete**:



Port Lock Entry

Vlan Name:

Unit: 15

Port: Port 1

MAC Address:

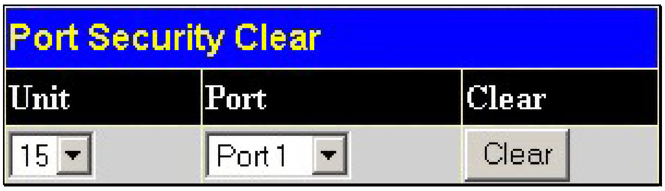
Figure 4- 66. Port Lock Entry window

This function is only operable if the **Mode** in the **Port Security** window is selected as **Permanent** or **DeleteOnReset,** or in other words, only addresses that are permanently learned by the Switch can be deleted. Once the entry has been defined by entering the correct information into the window above, click **Delete**.

Parameter	Description
VLAN Name	The VLAN Name of the entry in the forwarding database table that has been permanently learned by the Switch.
Unit	The ID number of the Switch in the Switch stack that has permanently learned the MAC address.
Port	Enter the port on which the MAC address resides.
MAC Address	The MAC address of the entry in the forwarding database table that has been permanently learned by the Switch.

Port Security Clear

This window is used to clear the security settings implemented on the Switch on a per port basis. To view this window, click **Configuration > Port Security Configuration > Port Security Clear**:



Port Security Clear

Unit	Port	Clear
15	Port 1	Clear

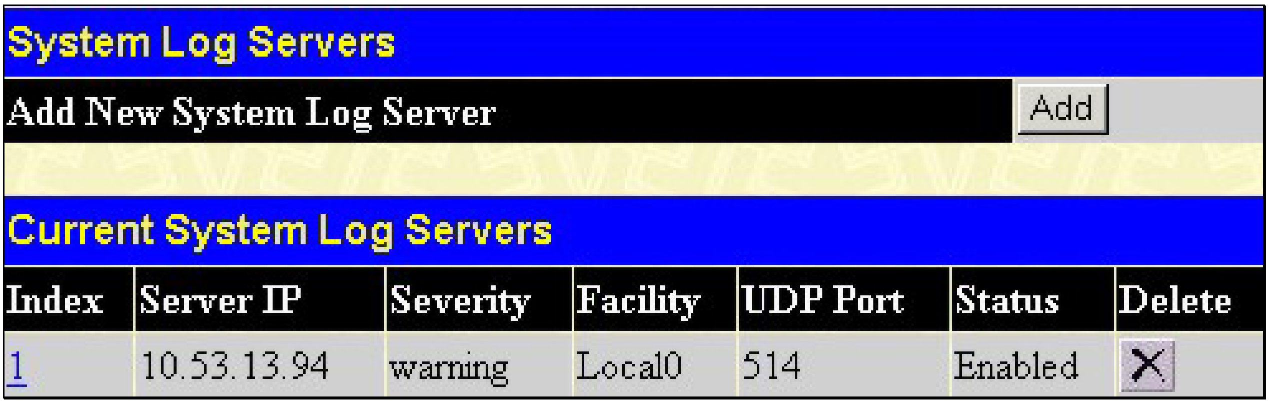
Figure 4- 67. Port Security Clear window

To clear the security configurations on a port, use the pull-down menus to select a switch within the Switch stack and then a port on that switch and click the clear button. A **Success!** message will appear in a pop-up window when the port has been cleared of security restrictions.

System Log Server

Use the System Log to keep a record of warning and other pertinent system information.

The Switch can send system log (SysLog) messages to up to four designated servers, which can be set on the Switch utilizing the **System Log Servers** window. To view the following window, click **Configuration > System Log Server**:



System Log Servers

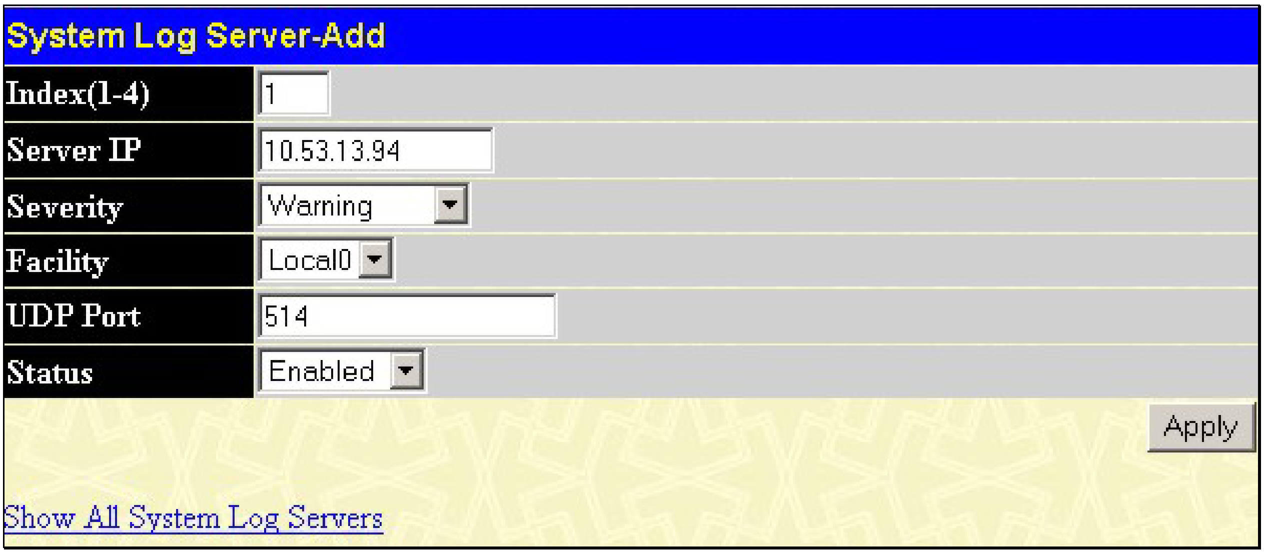
Add New System Log Server

Current System Log Servers

Index	Server IP	Severity	Facility	UDP Port	Status	Delete
1	10.53.13.94	warning	Local0	514	Enabled	☒

Figure 4- 68. System Log Servers window

Click the **Add** or the hyperlinked number under the **Index** heading will bring up the window pictured below. The parameters configured for adding System Log are described in the table below. To eliminate a System Log Server configuration, click the ***X*** in the **Delete** column for the configuration being removed.



System Log Server-Add

Index(1-4)	1
Server IP	10.53.13.94
Severity	Warning
Facility	Local0
UDP Port	514
Status	Enabled

Figure 4- 69. System Log Server – Modify window

Configure these parameters for the system log:

Parameter	Description
Index	Syslog server settings index (1-4).
Server IP	The IP address of the Syslog server.
Severity	This drop-down menu allows you to select the level of messages that will be sent. The options are *Warning*, *Informational*, and *ALL*.

Facility	Some of the operating system daemons and processes have been assigned Facility values. Processes and daemons that have not been explicitly assigned a Facility may use any of the "local use" facilities or they may use the "user-level" Facility. Those Facilities that have been designated are shown in the following: **Bold** font means the facility values that the Switch currently supports. Numerical Code Facility 0 kernel messages 1 user-level messages 2 mail system 3 system daemons 4 security/authorization messages 5 messages generated internally by syslog line printer subsystem 7 network news subsystem 8 UUCP subsystem 9 clock daemon 10 security/authorization messages 11 FTP daemon 12 NTP subsystem 13 log audit 14 log alert 15 clock daemon **16 local use 0 (local0)** **17 local use 1 (local1)** **18 local use 2 (local2)** **19 local use 3 (local3)** **20 local use 4 (local4)** **21 local use 5 (local5)** **22 local use 6 (local6)** **23 local use 7 (local7)**
UDP Port	Type the UDP port number used for sending Syslog messages. The default is 514.
Status	Choose *Enabled* or *Disabled* to activate or deactivate this

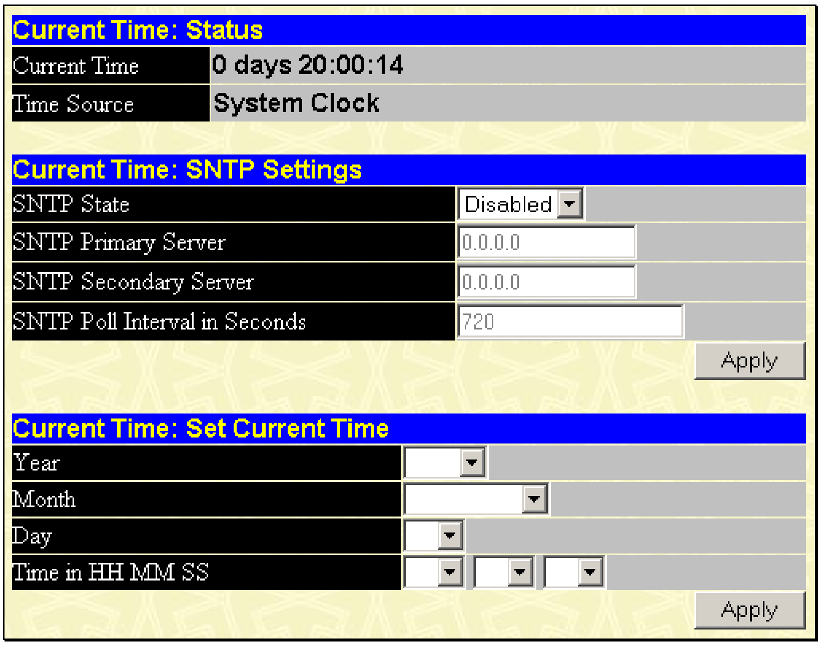
Click **Apply** to implement changes made.

SNTP Settings

The Simple Network Time Protocol (SNTP) (an adaptation of the Network Time Protocol (NTP)) is configured on the Switch using the following windows.

Time Setting

The following window will allow the user to configure the time settings for the Switch and can be accessed by clicking **Configuration > SNTP Settings > Time Setting**. Click **Apply** to implement changes made.



Current Time: Status

Current Time: 0 days 20:00:14
Time Source: System Clock

Current Time: SNTP Settings

SNTP State: Disabled
SNTP Primary Server: 0.0.0.0
SNTP Secondary Server: 0.0.0.0
SNTP Poll Interval in Seconds: 720

Current Time: Set Current Time

Year
Month
Day
Time in HH MM SS

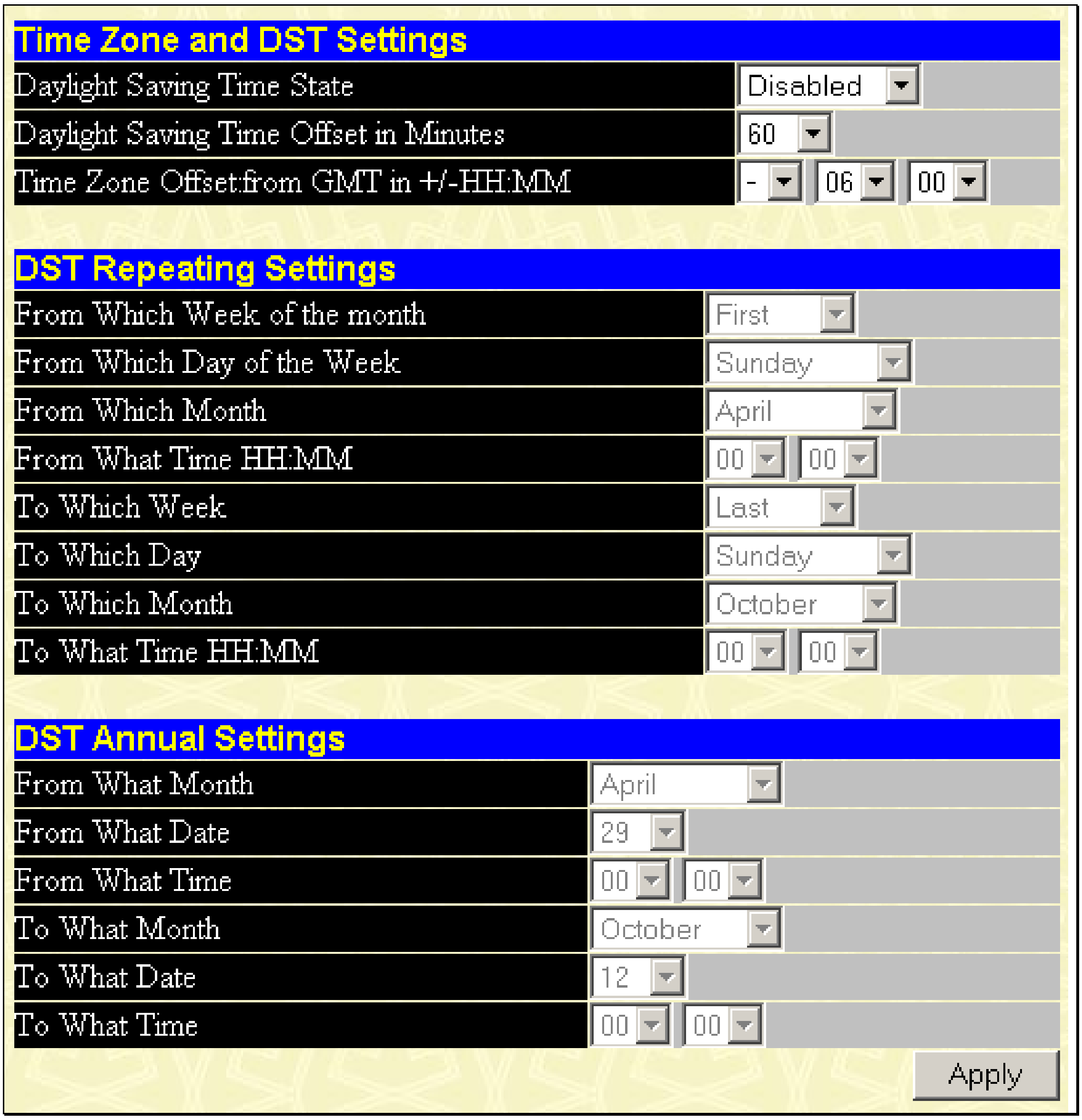
Figure 4- 70. Current Time: Status window

The following parameters can be set or are displayed:

Parameter	Description
Current Time	Displays the current system time.
Time Source	Displays the time source for the system.
SNTP State	Use this pull-down menu to enable or disable SNTP.
SNTP Primary Server	This is the primary server from which SNTP information will be taken.
SNTP Secondary Server	This is the secondary server from which the SNTP information will be taken, if the primary server fails.
SNTP Poll Interval in Seconds	This is the interval between requests for updated SNTP information.
Year	Enter the current year, to update the system clock.
Month	Enter the current month, to update the system clock.
Day	Enter the current day, to update the system clock.
Time in HH MM SS	Enter the current time in hours, minutes, and seconds, to update the system clock.

Time Zone and DST Settings

The following window is used to set up Time Zone and Daylight Savings configurations for the Switch and can be accessed by clicking **Configuration** > **SNTP Settings** > **Time Zone and DST.**



Time Zone and DST Settings

Daylight Saving Time State: Disabled
Daylight Saving Time Offset in Minutes: 60
Time Zone Offset:from GMT in +/-HH:MM: - 06 00

DST Repeating Settings

From Which Week of the month: First
From Which Day of the Week: Sunday
From Which Month: April
From What Time HH:MM: 00 00
To Which Week: Last
To Which Day: Sunday
To Which Month: October
To What Time HH:MM: 00 00

DST Annual Settings

From What Month: April
From What Date: 29
From What Time: 00 00
To What Month: October
To What Date: 12
To What Time: 00 00

Figure 4- 71. Time Zone and DST Settings window

The following parameters can set:

Parameter	Description
Daylight Saving Time State	Use this pull-down menu to enable or disable the DST Settings.
Daylight Saving Time Offset in Minutes	Use this pull-down menu to specify the amount of time that will constitute your local DST offset – *30*, *60*, *90*, or *120* minutes.
Time Zone Offset from GMT in +/- HH:MM	Use these pull-down menus to specify your local time zone's offset from Greenwich Mean Time (GMT.)

DST Repeating Settings	Repeating - Using repeating mode will enable DST seasonal time adjustment. Repeating mode requires that the DST beginning and ending date be specified using a formula. For example, specify to begin DST on Saturday during the second week of April and end DST on Sunday during the last week of October.
From: Which Week of the month	Enter the week of the month that DST will start.
From: Which Day of Week	Enter the day of the week that DST will start on.
From: Which Month	Enter the month DST will start on.
From: What Time HH:MM	Enter the time of day that DST will start on.
To: Which Week	Enter the week of the month the DST will end.
To: Which Day	Enter the day of the week that DST will end.
To: Which Month	Enter the month that DST will end.
To: What Time HH:MM	Enter the time DST will end.
DST Annual Settings	Annual - Using annual mode will enable DST seasonal time adjustment. Annual mode requires that the DST beginning and ending date be specified concisely. For example, specify to begin DST on April 3 and end DST on October 14.
From: What Month	Enter the month DST will start on, each year.
From: What Date	Enter the day of the week DST will start on, each year.
From: What Time	Enter the time of day DST will start on, each year.
To: What Month	Enter the month DST will end on, each year.
To: What Date	Enter the day of the week DST will end on, each year.
To: What Time	Enter the time of day that DST will end on, each year.

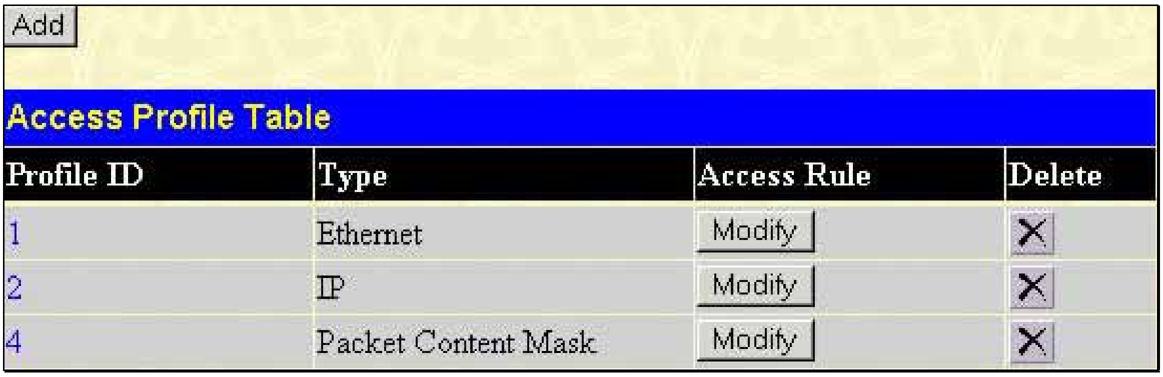
Click **Apply** to implement changes made.

Access Profile Table

Access profiles allow you to establish criteria to determine whether or not the Switch will forward packets based on the information contained in each packet's header. These criteria can be specified on a basis of VLAN, MAC address or IP address.

Creating an access profile is divided into two basic parts. The first is to specify which part or parts of a frame the Switch will examine, such as the MAC source address or the IP destination address. The second part is entering the criteria the Switch will use to determine what to do with the frame. The entire process is described below in two parts.

To display the currently configured Access Profiles on the Switch, open the **Configuration** folder and click on the **Access Profile Table** link. This will open the **Access Profile Table** window, as shown below.

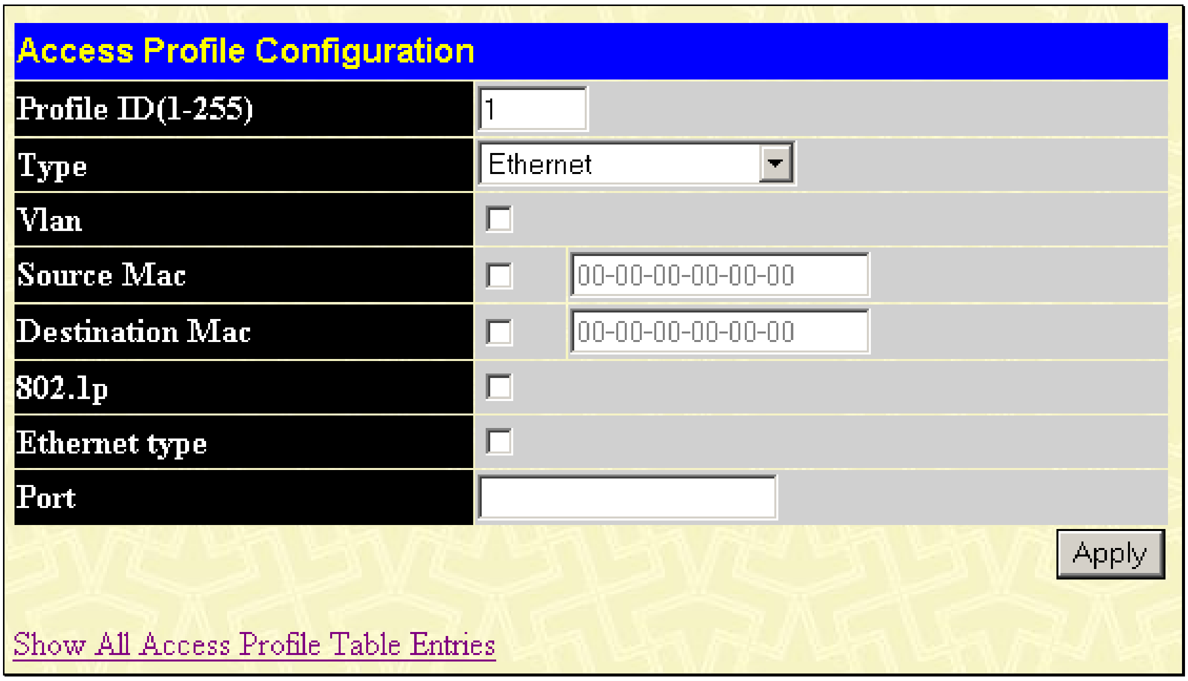


Access Profile Table

Profile ID	Type	Access Rule	Delete
1	Ethernet	Modify	☒
2	IP	Modify	☒
4	Packet Content Mask	Modify	☒

Figure 4- 72. Access Profile Table window

To add an entry to the **Access Profile Table** window, click the **Add** button. This will open the **Access Profile Configuration** window, as shown below. There are three **Access Profile Configuration** windows – one for Ethernet (or MAC address-based) profile configuration, one for IP address-based profile configuration, and one for Packet Content Mask-based profile configuration. You can Switch among the three **Access Profile Configuration** windows by using the Type drop-down menu, and clicking on the **Apply** button. The **Access Profile Configuration** window for Ethernet is shown below.



Access Profile Configuration

Profile ID(1-255)	1
Type	Ethernet
Vlan	□
Source Mac	□ 00-00-00-00-00-00
Destination Mac	□ 00-00-00-00-00-00
802.1p	□
Ethernet type	□
Port	

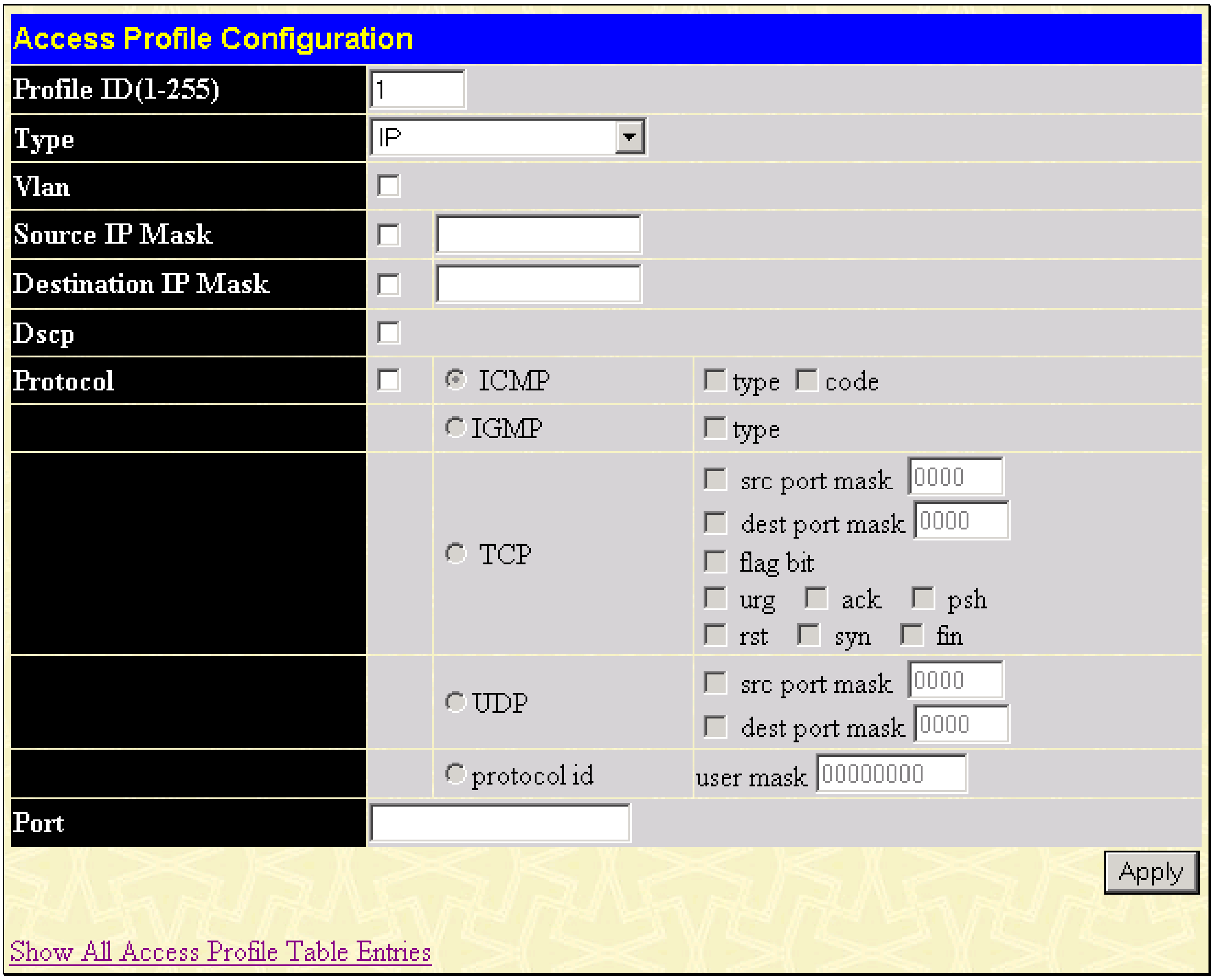
Figure 4- 73. Access Profile Configuration (Ethernet) window

The following parameters can be set:

Parameter	Description
Profile ID (1-255)	Type in a unique identifier number for this profile set. This value can be set from *1* to *255*.
Type	Select profile based on Ethernet (MAC Address), IP address or packet content mask. This will change the menu according to the requirements for the type of profile. • Select *Ethernet* to instruct the Switch to examine the layer 2 part of each packet header. • Select *IP* to instruct the Switch to examine the IP address in each frame's header. • Select *Packet Content Mask* to specify a mask to hide the content of the packet header.
VLAN	Selecting this option instructs the Switch to examine the VLAN part of each packet header and use this as the, or part of the criterion for forwarding.
Source MAC	Source MAC Mask - Enter a MAC address mask for the source MAC address.
Destination MAC	Destination MAC Mask - Enter a MAC address mask for the destination MAC address.
802.1p	Selecting this option instructs the Switch to examine the 802.1p priority value of each packet header and use this as the, or part of the criterion for forwarding.
Ethernet type	Selecting this option instructs the Switch to examine the Ethernet type value of each packet header and use this as the, or part of the criterion for forwarding.
Port	The user may set the **Access Profile Table** window on a per-port basis by entering a port number in this field. Entering “all” will denote all ports on the Switch.

Click **Apply** to set the parameters for Ethernet.

The page shown below is the **Access Profile Configuration** window for IP:



Access Profile Configuration

Profile ID(1-255)	1	
Type	IP	
Vlan	□	
Source IP Mask	□	
Destination IP Mask	□	
Dscp	□	
Protocol	□ ● ICMP	□ type □ code
	○ IGMP	□ type
	○ TCP	□ src port mask 0000 □ dest port mask 0000 □ flag bit □ urg □ ack □ psh □ rst □ syn □ fin
	○ UDP	□ src port mask 0000 □ dest port mask 0000
	○ protocol id	user mask 00000000
Port		

Figure 4- 74. Access Profile Configuration (IP) window

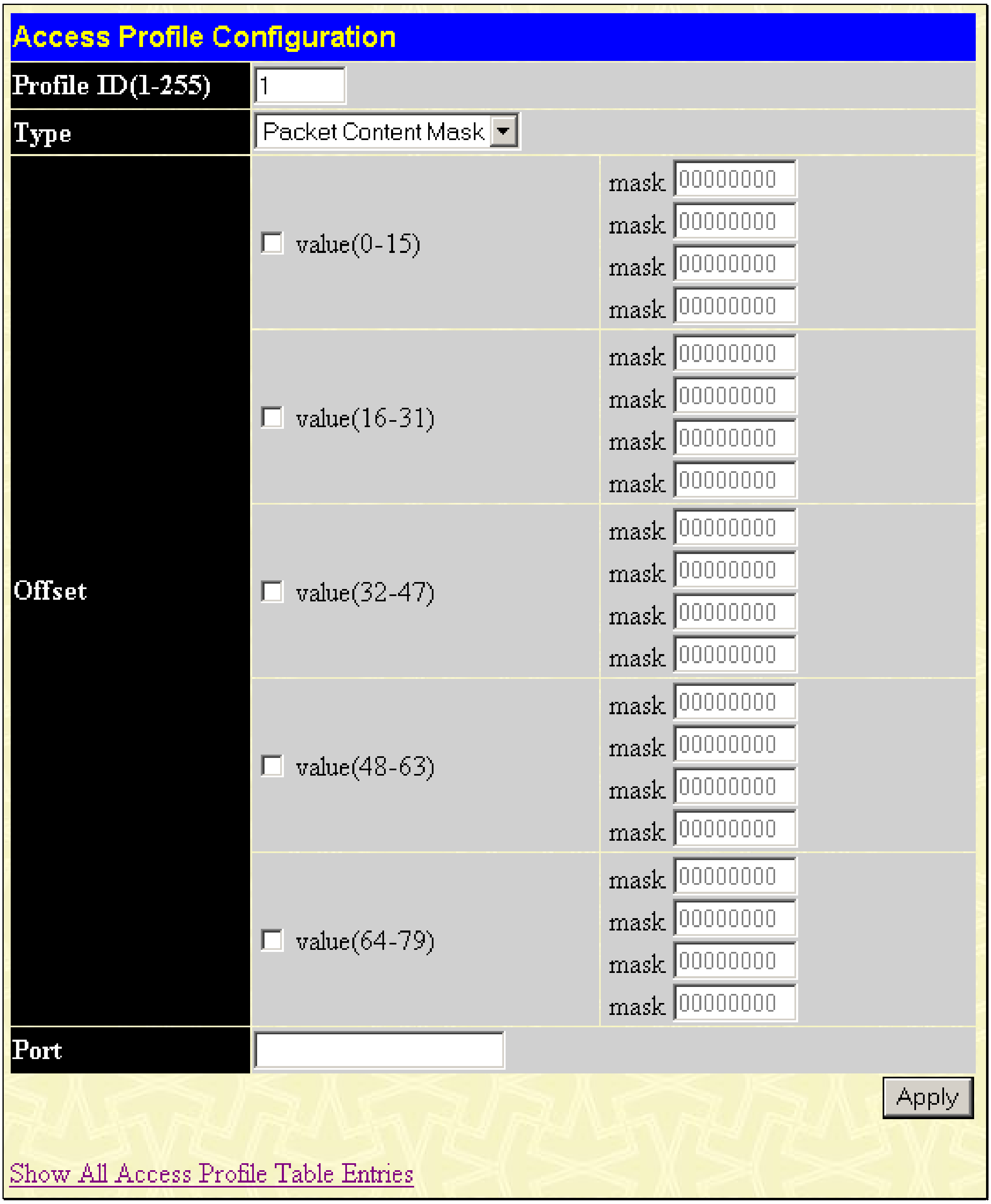
The following parameters can be set:

Parameter	**Description**
Profile ID (1-255)	Type in a unique identifier number for this profile set. This value can be set from *1* to *255*.
Type	Select profile based on Ethernet (MAC Address), IP address, packet content mask or IPv6. This will change the menu according to the requirements for the type of profile. • Select *Ethernet* to instruct the Switch to examine the layer 2 part of each packet header. • Select *IP* to instruct the Switch to examine the IP address in each frame's header. • Select *Packet Content Mask* to specify a mask to hide the content of the packet header.
VLAN	Selecting this option instructs the Switch to examine the VLAN part of each packet header and use this as the, or part of the criterion for forwarding.

Source IP Mask	Source IP Mask - Enter an IP address mask for the source IP address.
Destination IP Mask	Destination IP Mask - Enter an IP address mask for the destination MAC address.
DSCP	Selecting this option instructs the Switch to examine the DiffServ Code part of each packet header and use this as the, or part of the criterion for forwarding.
Protocol	Selecting this option instructs the Switch to examine the protocol type value in each frame's header. You must then specify what protocol(s) to include according to the following guidelines: Select *ICMP* to instruct the Switch to examine the Internet Control Message Protocol (ICMP) field in each frame's header. • Select *type* to further specify that the access profile will apply an ICMP type value, or specify code to further specify that the access profile will apply an ICMP code value. Select *IGMP* to instruct the Switch to examine the Internet Group Management Protocol (ICMP) field in each frame's header. • Select *type* to further specify that the access profile will apply an IGMP type value. Select *TCP* to use the TCP port number contained in an incoming packet as the forwarding criterion. Selecting TCP requires that you specify a source port mask, a destination port mask or a flag bite. • *src port mask* – Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff). • *dest port mask* – Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff). • *flag bit* – Specify a flag bite in the TCP header. Select *UDP* to use the UDP port number contained in an incoming packet as the forwarding criterion. Selecting UDP requires that you specify a source port mask and/or a destination port mask. • *src port mask* – Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff). • *dest port mask* – Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff). *protocol id* – Enter a value defining the protocol ID in the packet header to mask. Specify the protocol ID mask in hex form (hex 0x0-0xffffffff).
Port	The user may set the Access Profile Table window on a per-port basis by entering a port number in this field. Entering "all" will denote all ports on the Switch.

Click **Apply** to set the parameters for IP.

The window shown below is the **Access Profile Configuration** window for *Packet Content Mask*.



Access Profile Configuration

Profile ID(1-255): 1

Type: Packet Content Mask

Offset:

- □ value(0-15) — mask 00000000, mask 00000000, mask 00000000, mask 00000000
- □ value(16-31) — mask 00000000, mask 00000000, mask 00000000, mask 00000000
- □ value(32-47) — mask 00000000, mask 00000000, mask 00000000, mask 00000000
- □ value(48-63) — mask 00000000, mask 00000000, mask 00000000, mask 00000000
- □ value(64-79) — mask 00000000, mask 00000000, mask 00000000, mask 00000000

Port:

Figure 4- 75. Access Profile Configuration (Packet Content Mask) window

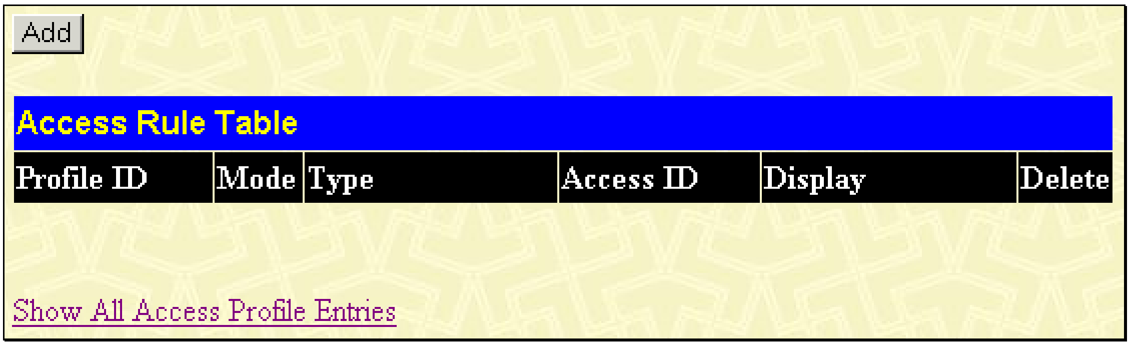
This window will aid the user in configuring the Switch to mask packet headers beginning with the offset value specified. The following fields are used to configure the **Packet Content Mask** window:

The following parameters can be set:

Parameter	Description
Profile ID(1-255)	Type in a unique identifier number for this profile set or allow an ID to be automatically assigned by checking the Auto Assign option. This value can be set from 1 to 255.

Type	Select profile based on *Ethernet* (MAC Address), *IP* address or *packet content mask*. This will change the menu according to the requirements for the type of profile. • Select *Ethernet* to instruct the Switch to examine the layer 2 part of each packet header. • Select *IP* to instruct the Switch to examine the IP address in each frame's header. • Select *Packet Content Mask* to specify a mask to hide the content of the packet header.
Offset	This field will instruct the Switch to mask the packet header beginning with the offset value specified: • *value (0-15)* - Enter a value in hex form to mask the packet from the beginning of the packet to the 15th byte. • *value (16-31)* - Enter a value in hex form to mask the packet from byte 16 to byte 31. • *value (32-47)* - Enter a value in hex form to mask the packet from byte 32 to byte 47. • *value (48-63)* - Enter a value in hex form to mask the packet from byte 48 to byte 63. • *value (64-79)* - Enter a value in hex form to mask the packet from byte 64 to byte 79.
Port	The user may set the Access Profile Table window on a per-port basis by entering a port number in this field. Entering "all" will denote all ports on the Switch.

To establish the rule for a previously created Access Profile, select the Access Profile entry from the **Access Profile Table** window and then click the **Modify** button for that individual entry.



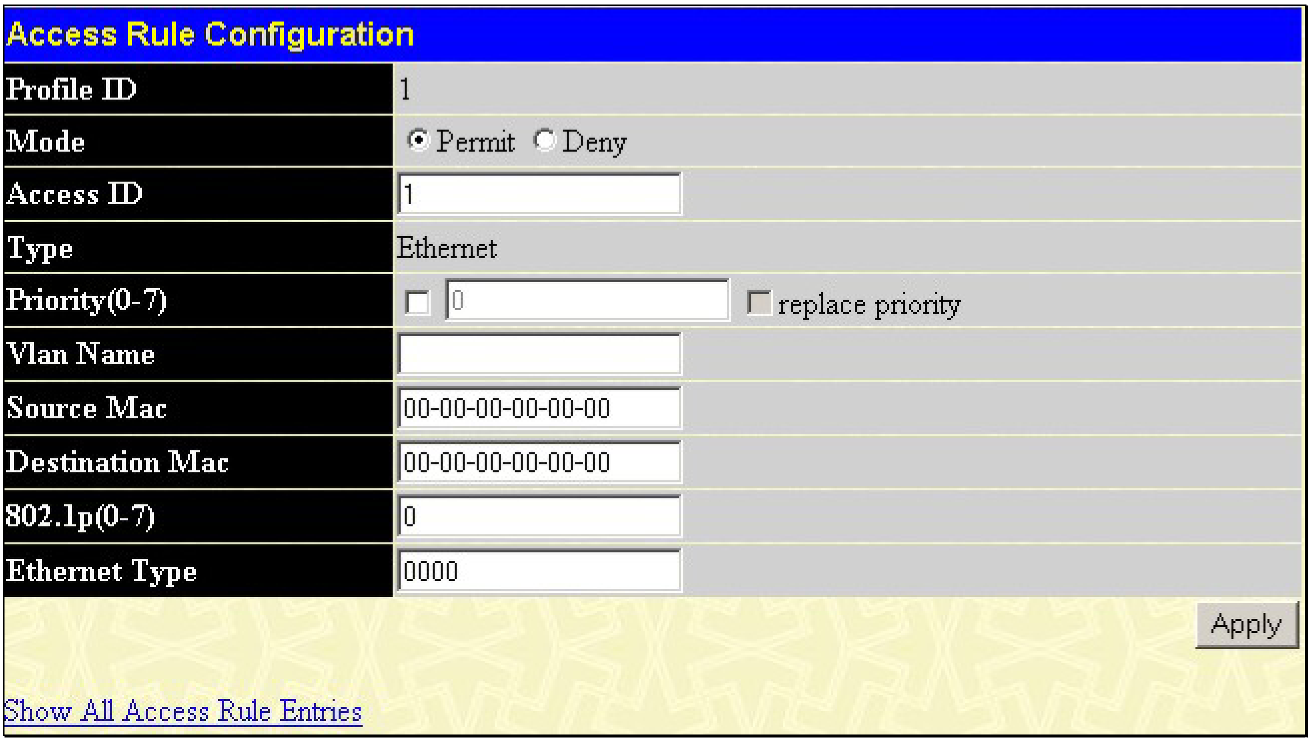
Access Rule Table

Profile ID	Mode	Type	Access ID	Display	Delete

Figure 4- 76. Access Rule Table window

To create a new rule set for the access profile, click the **Add** button. A new window is displayed. To remove a previously created rule, select it and click the **Delete** button.

Configure the **Access Rule Configuration** settings for Ethernet on the window below.



Access Rule Configuration

Profile ID	1
Mode	● Permit ○ Deny
Access ID	1
Type	Ethernet
Priority(0-7)	□ 0 □ replace priority
Vlan Name	
Source Mac	00-00-00-00-00-00
Destination Mac	00-00-00-00-00-00
802.1p(0-7)	0
Ethernet Type	0000

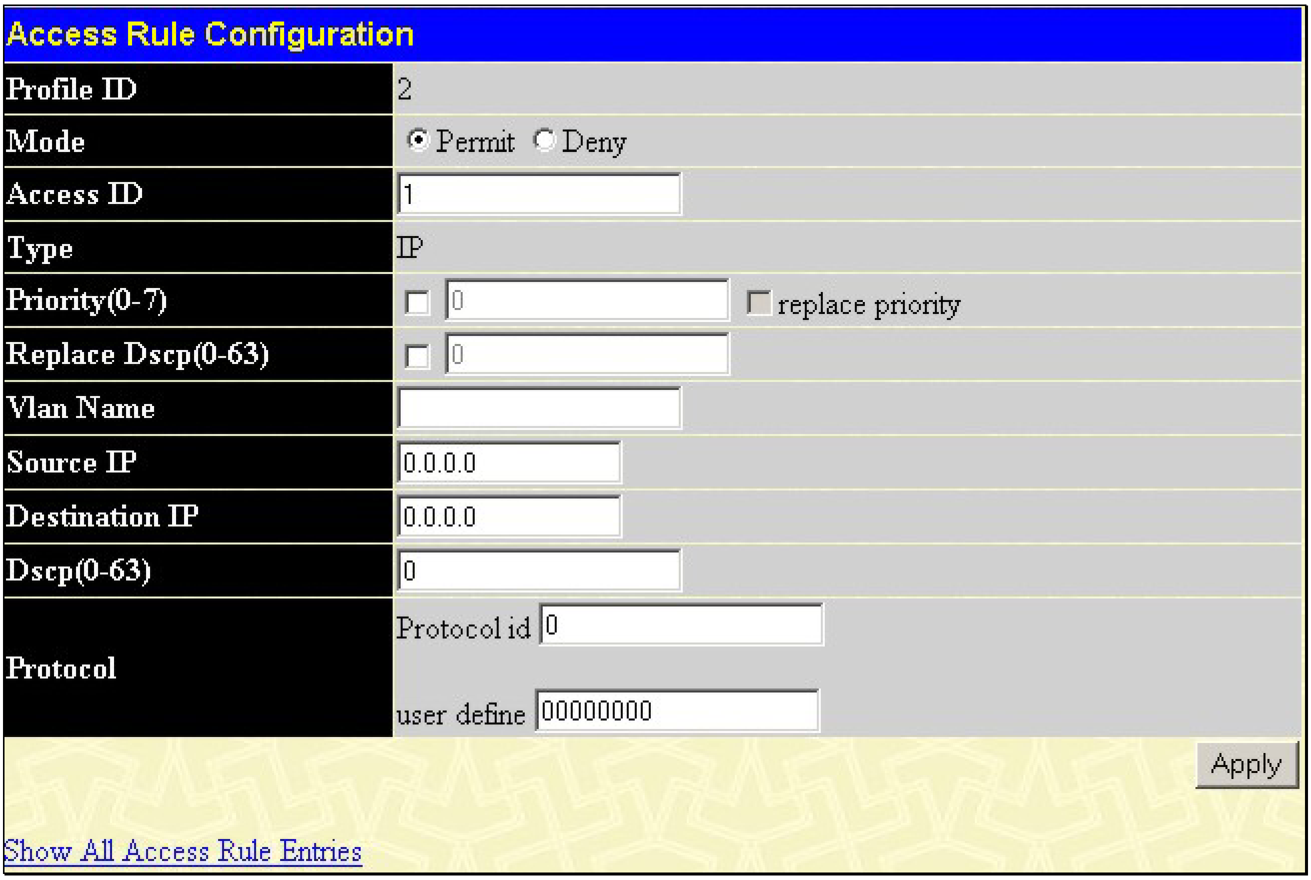
Figure 4- 77. Access Rule Configuration (Ethernet) window

The following parameters can be set:

Parameter	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
Access ID	Type in a unique identifier number for this access. This value can be set from *1* to *255*.
Type	Selected profile based on Ethernet (MAC Address), IP address or packet content mask. This will change the menu according to the requirements for the type of profile. • *Ethernet* instructs the Switch to examine the layer 2 part of each packet header. • *IP* instructs the Switch to examine the IP address in each frame's header. • *Packet Content Mask* specifies a mask to hide the content of the packet header.
Priority (0-7)	Specify the priority tag, located in the packet header that will be identified by the Switch.
Replace Priority (0-7)	This parameter is specified if you want to re-write the 802.1p default priority previously set in the Switch, which is used to determine the CoS queue to which packets are forwarded to. Once this field is specified, packets accepted by the Switch that match this priority are forwarded to the CoS queue specified previously by the user.

	Replace priority – Click the corresponding box if you want to re-write the 802.1p default priority of a packet to the value entered in the **Priority** field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the **QoS** section of this manual.
VLAN Name	Allows the entry of a name for a previously configured VLAN.
Source MAC	Source MAC Address - Enter a MAC Address for the source MAC address.
Destination MAC	Destination MAC Address - Enter a MAC Address mask for the destination MAC address.
802.1p (0-7)	Enter a value from 0 to 7 to specify that the access profile will apply only to packets with this 802.1p priority value.
Ethernet Type	Specifies that the access profile will apply only to packets with this hexadecimal 802.1Q Ethernet type value (hex 0x0-0xffff) in the packet header. The Ethernet type value may be set in the form: hex 0x0-0xffff, which means the user may choose any combination of letters and numbers ranging from a-f and from 0-9999.

Configure the **Access Rule Configuration** settings for IP on the window below.



Access Rule Configuration

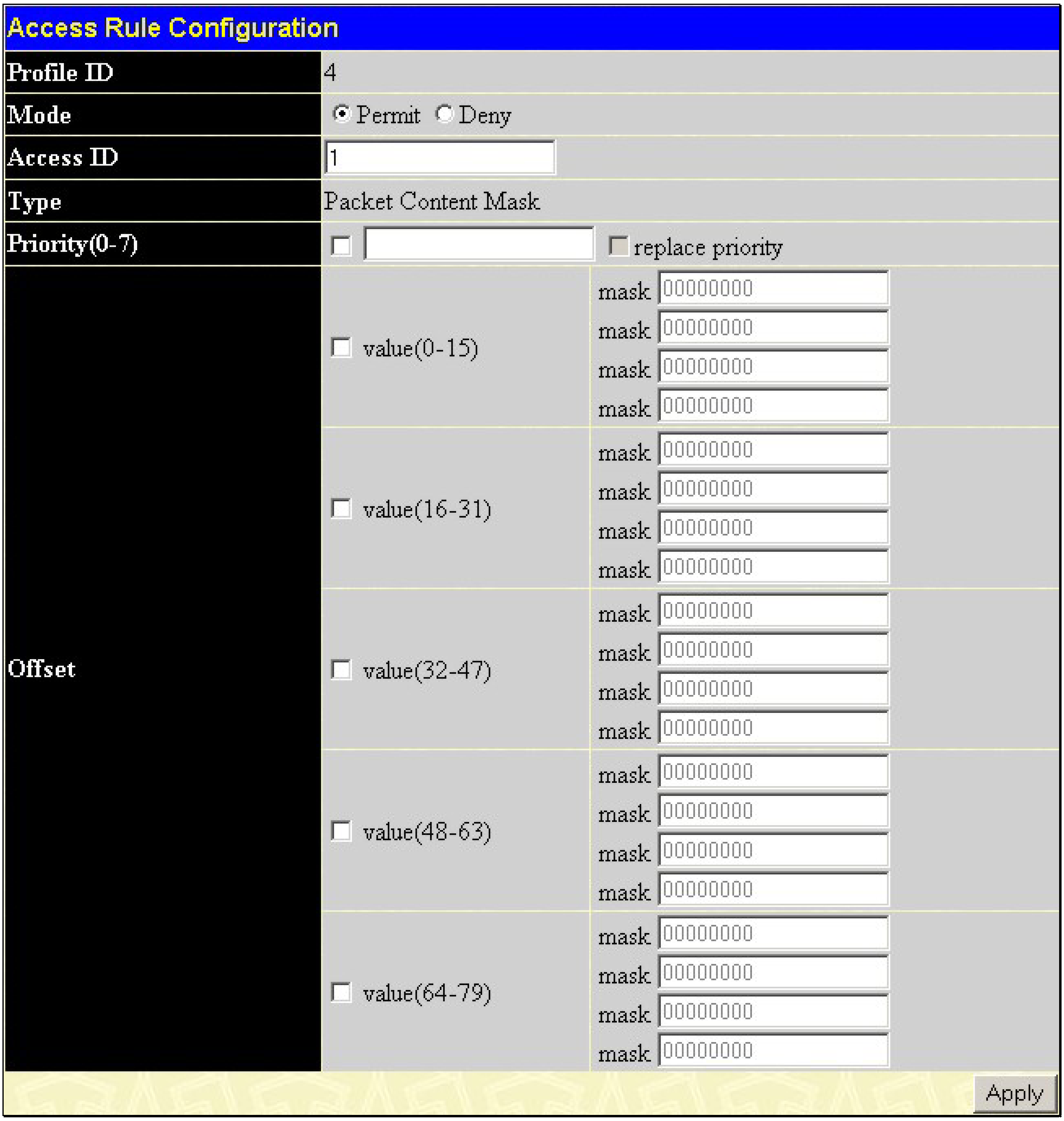
Profile ID	2
Mode	● Permit ○ Deny
Access ID	1
Type	IP
Priority(0-7)	□ 0 □ replace priority
Replace Dscp(0-63)	□ 0
Vlan Name	
Source IP	0.0.0.0
Destination IP	0.0.0.0
Dscp(0-63)	0
Protocol	Protocol id 0 user define 00000000

Figure 4- 78. Access Rule Configuration (IP) window

The following parameters can be set:

Parameter	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.
Access ID	Type in a unique identifier number for this access. This value can be set from *1* to *255*.
Type	Selected profile based on Ethernet (MAC Address), IP address or packet content mask. This will change the menu according to the requirements for the type of profile. • *Ethernet* instructs the Switch to examine the layer 2 part of each packet header. • *IP* instructs the Switch to examine the IP address in each frame’s header. • *Packet Content Mask* specifies a mask to hide the content of the packet header.
Priority (0-7)	This parameter is specified if you want to re-write the 802.1p default priority previously set in the Switch, which is used to determine the CoS queue to which packets are forwarded to. Once this field is specified, packets accepted by the Switch that match this priority are forwarded to the CoS queue specified previously by the user. *Replace priority* – Click the corresponding box if you want to re-write the 802.1p default priority of a packet to the value entered in the **Priority** field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the **QoS** section of this manual.
Replace DSCP (0-63)	Select this option to instruct the Switch to replace the DSCP value (in a packet that meets the selected criteria) with the value entered in the adjacent field.
VLAN Name	Allows the entry of a name for a previously configured VLAN.
Source IP	Source IP Address - Enter an IP Address mask for the source IP address.
Destination IP	Destination IP Address- Enter an IP Address mask for the destination IP address.
Dscp (0-63)	This field allows the user to enter a DSCP value in the space provided, which will instruct the Switch to examine the DiffServ Code part of each packet header and use this as the, or part of the criterion for forwarding. The user may choose a value between *0* and *63*.
Protocol	This field allows the user to modify the protocol ID used in configuring the Access Rule Table window; depending on which protocol the user has chosen in the Access Profile Table window.

Configure the **Access Rule Configuration** settings for the Packet Content Mask on the window below.



Access Rule Configuration

Profile ID	4	
Mode	● Permit ○ Deny	
Access ID	1	
Type	Packet Content Mask	
Priority(0-7)	□	□ replace priority
Offset	□ value(0-15)	mask 00000000 mask 00000000 mask 00000000 mask 00000000
	□ value(16-31)	mask 00000000 mask 00000000 mask 00000000 mask 00000000
	□ value(32-47)	mask 00000000 mask 00000000 mask 00000000 mask 00000000
	□ value(48-63)	mask 00000000 mask 00000000 mask 00000000 mask 00000000
	□ value(64-79)	mask 00000000 mask 00000000 mask 00000000 mask 00000000

Figure 4- 79. Access Rule Configuration (Package Content Mask) window

The following parameters can be set:

Parameter	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the packets that match the access profile are forwarded by the Switch, according to any additional rule added (see below). Select *Deny* to specify that packets that do not match the access profile are not forwarded by the Switch and will be filtered.

Access ID	Type in a unique identifier number for this access. This value can be set from *1* to *255*.
Type	Selected profile based on Ethernet (MAC Address), IP address or packet content mask. This will change the menu according to the requirements for the type of profile. • *Ethernet* instructs the Switch to examine the layer 2 part of each packet header. • *IP* instructs the Switch to examine the IP address in each frame's header. • *Packet Content Mask* specifies a mask to hide the content of the packet header.
Priority (0-7)	This parameter is specified if you want to re-write the 802.1p default priority previously set in the Switch, which is used to determine the CoS queue to which packets are forwarded to. Once this field is specified, packets accepted by the Switch that match this priority are forwarded to the CoS queue specified previously by the user. *Replace priority* – Click the corresponding box if you want to re-write the 802.1p default priority of a packet to the value entered in the **Priority** field, which meets the criteria specified previously in this command, before forwarding it on to the specified CoS queue. Otherwise, a packet will have its incoming 802.1p user priority re-written to its original value before being forwarded by the Switch. For more information on priority queues, CoS queues and mapping for 802.1p, see the **QoS** section of this manual.
Offset	This field will instruct the Switch to match the packet header beginning with the offset value specified: • *value (0-15)* - Enter a value in hex form to mask the packet from the beginning of the packet to the 15th byte. • *value (16-31)* - Enter a value in hex form to mask the packet from byte 16 to byte 31. • *value (32-47)* - Enter a value in hex form to mask the packet from byte 32 to byte 47. • *value (48-63)* - Enter a value in hex form to mask the packet from byte 48 to byte 63. • *value (64-79)* - Enter a value in hex form to mask the packet from byte 64 to byte 79.

Click **Apply** to implement changes made.

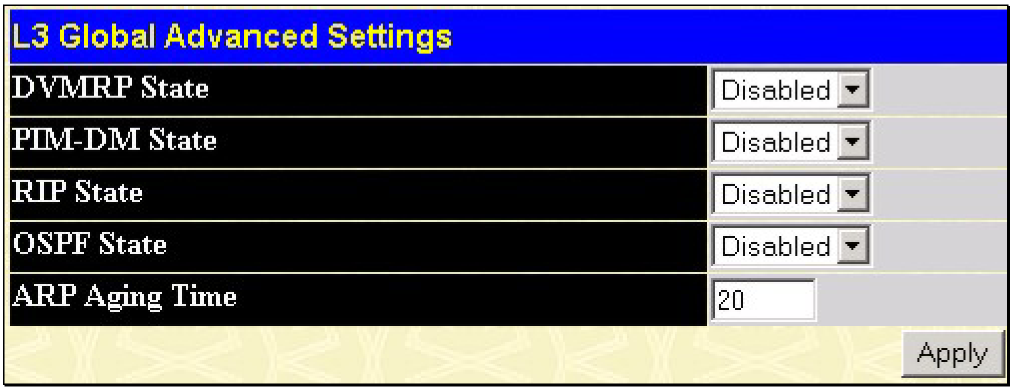
Section 5

Layer 3 IP Networking

L3 Global Advanced Settings

In order to use DVMRP, PIM-DM, RIP, or OSPF, the Switch must first be globally enabled for Layer 3 IP Networking. To enable or disable these Layer 3 protocols as well as configure ARP Aging Time, access the **L3 Global Advanced Settings** window by clicking **Configuration > Layer 3 IP Networking > L3 Global Advanced Settings**.

To enable DVMRP, PIM-DM, RIP or OSPF for the Switch, select *Enabled* using the pull-down menu for the global setting and click the **Apply** button. You may later select *Disabled* for any of these to disable the protocol without changing any of the settings that may have been configured for them.



L3 Global Advanced Settings

DVMRP State	Disabled
PIM-DM State	Disabled
RIP State	Disabled
OSPF State	Disabled
ARP Aging Time	20

Figure 5- 1. L3 Global Advanced Settings window

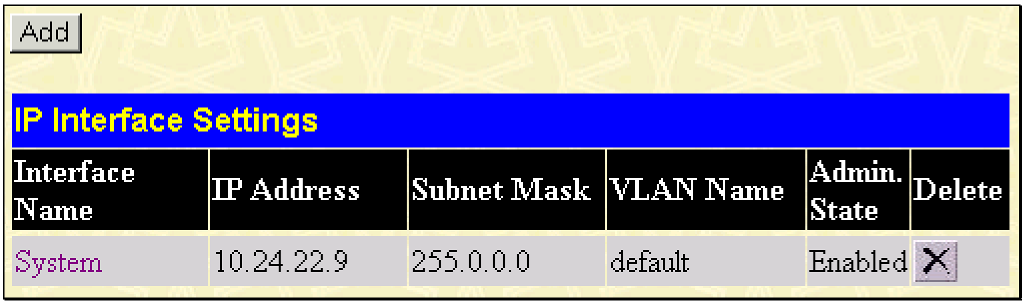
The user may globally set the maximum amount of time, in minutes, which an Address Resolution Protocol (ARP) entry can remain in the Switch's ARP table, without being accessed, before it is dropped from the table. The value may be set in the range of 0-65535 minutes with a default setting of 20 minutes.

NOTE: PIM, RIP, OSPF, and DVMRP may also be globally enabled or disabled using a separate global settings window for each protocol. The links for the individual global settings windows are located in their respective subfolders.

IP Interface Settings

Each VLAN must be configured prior to setting up the VLAN's corresponding IP interface.

To set up IP interfaces, open the **Layer 3 IP Networking** sub-folder in the **Configuration** folder and then click **IP Interfaces Settings** to open the following window:

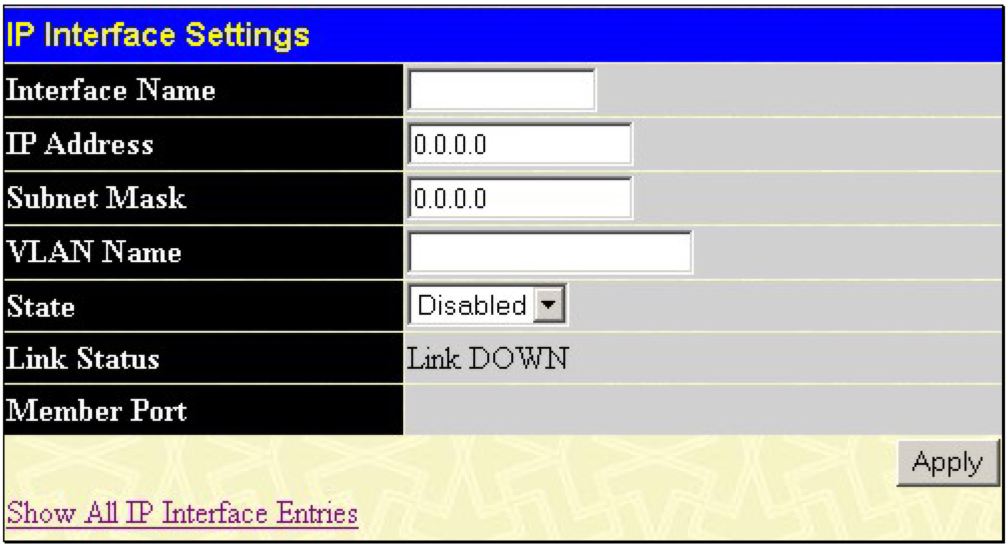


IP Interface Settings

Interface Name	IP Address	Subnet Mask	VLAN Name	Admin. State	Delete
System	10.24.22.9	255.0.0.0	default	Enabled	☒

Figure 5- 2. IP Interface Settings window

Click the **Add** button to configure settings for a new IP interface. If you want to change an existing IP interface, click on the hyperlinked **Interface Name** in the list.

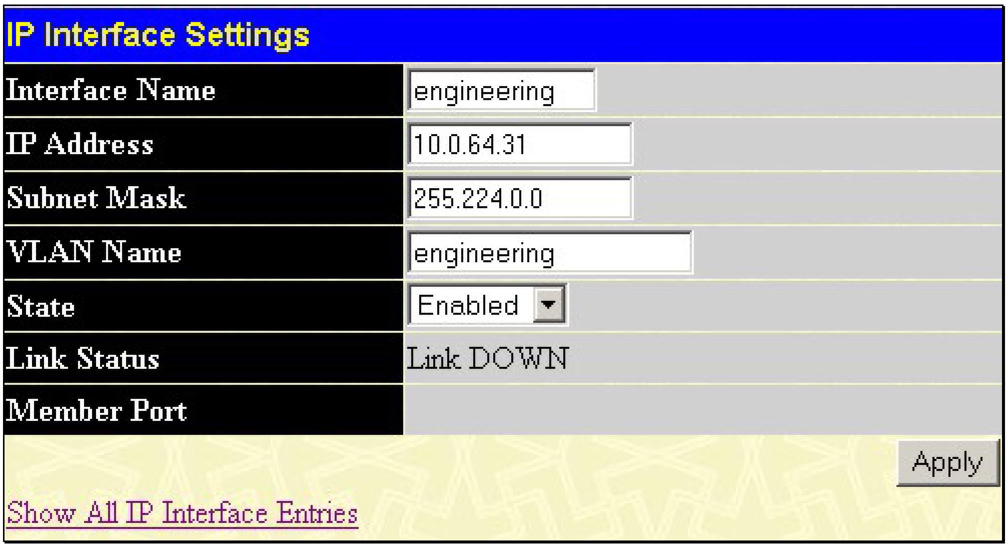


IP Interface Settings

Interface Name	
IP Address	0.0.0.0
Subnet Mask	0.0.0.0
VLAN Name	
State	Disabled
Link Status	Link DOWN
Member Port	

Figure 5- 3. IP Interface Settings window - Add

Enter the desired IP interface settings and click the **Apply** button. A message should appear informing you if the settings have been successfully applied. For convenience, you may want to use the same name for the IP interface and the VLAN. To return to the first **IP Interface Settings** window, click the Show ALL IP Interface Entries link. The example pictured below follows the example IP interface setup discussed on the previous window.



IP Interface Settings

Interface Name	engineering
IP Address	10.0.64.31
Subnet Mask	255.224.0.0
VLAN Name	engineering
State	Enabled
Link Status	Link DOWN
Member Port	

Figure 5- 4. Example IP Interface Settings window

Choose a name for the interface to add and enter it in the **Interface Name** field (if you are editing an IP Interface, the **Interface Name** will already be in the top field as seen in the window above). Enter the interface's IP address and subnet mask in the corresponding fields. Pull the State pull-down menu to *Enabled* and click **Apply** to enter to make the IP interface effective. Use **Save Changes** in the **Maintenance** folder to enter the changes into NV-RAM.

The following fields can be set:

Parameter	Description
Interface Name	This field displays the name for the IP interface. The default IP interface is named "System".
IP Address	Enter an IP address to be assigned to this IP interface.
Subnet Mask	Enter a subnet mask to be applied to this IP interface.
VLAN Name	Enter the VLAN Name for the VLAN to which the IP interface belongs. The VLAN name must match the existing VLAN name previously configured.
State	Select *Enabled* or *Disabled* to activate or deactivate the interface.
Link Status	This read only field states the current status of the IP Interface on the Switch. *Link Up* denotes that the IP interface is up and running on the Switch. *Link Down* will denote that the IP interface is not currently set and/or enabled on the Switch.
Member Port	Specifies which ports on the Switch are a member of this VLAN.

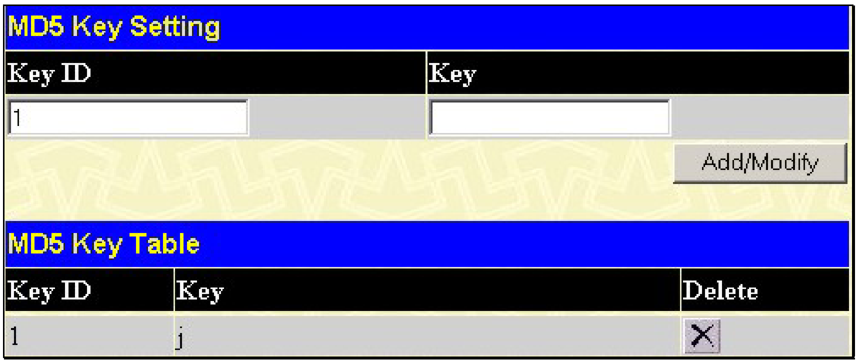
MD5 Key Settings

MD5 authentication is used to identify trusted routers sending OSPF packets. By default, no authentication is used for OSPF so it is not necessary to configure any MD5 keys to use OSPF. MD5 authentication can be set up at any time, before or after you have configured OSPF settings.

The **MD5 Key Setting** window allows the entry of a 16-character Message Digest – version 5 (MD5) key that can be used to authenticate every packet exchanged between OSPF routers. It is used as a security mechanism to limit the exchange of network topology information to the OSPF routing domain.

MD5 Keys created here are entered in when setting up OSPF interfaces. Please read the description in the section below about OSPF Interface Settings.

To configure an MD5 Key, click the **MD5 Key Settings** link in the **Layer 3 IP Networking** folder to open the following window:



MD5 Key Setting

Key ID	Key
1	

MD5 Key Table

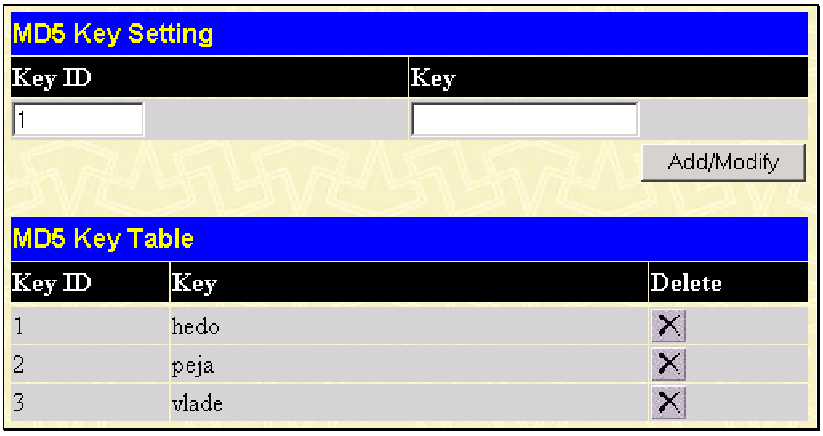
Key ID	Key	Delete
1	j	✕

Figure 5- 5. MD5 Key Setting window

To add an MD5 key to the table, type a unique Key ID (Key Identifier) and provide a Key in the fields provided. Click the **Add/Modify** button to add the key to the MD5 Key Table.

To remove a key, simply click the ***X*** in the **Delete** column for the Key you wish to remove.

To change an existing key in the list, type the Key ID for that key in the **Key ID** field, change the **Key** as desired and click the **Add/Modify** button. The modified key will appear in the new list.



MD5 Key Setting

Key ID	Key
1	

MD5 Key Table

Key ID	Key	Delete
1	hedo	✕
2	peja	✕
3	vlade	✕

Figure 5- 6. Newly Created MD5 Key List window

The MD5 key settings must satisfy the requirements listed here:

Parameter	Description
Key ID	A number from *1* to *255* used to identify the MD5 Key.
Key	A alphanumeric string of between *1* and *16* case-sensitive characters used to generate the Message Digest which is in turn, used to authenticate OSPF packets within the OSPF routing domain.

Route Redistribution Settings

Route redistribution allows routers on the network, which are running different routing protocols to exchange routing information. This is accomplished by comparing the routes stored in the various routers routing tables and assigning appropriate metrics. This information is then exchanged among the various routers according to the individual routers current routing protocol. The Switch can redistribute routing information between the OSPF and RIP routing protocols to all routers on the network that are running OSPF or RIP. Routing information entered into the **Static Routing Table** on the local Switch is also redistributed.

Routing information source – OSPF and the Static Route table. Routing information will be redistributed to RIP. The following table lists the allowed values for the routing metrics and the types (or forms) of the routing information that will be redistributed.

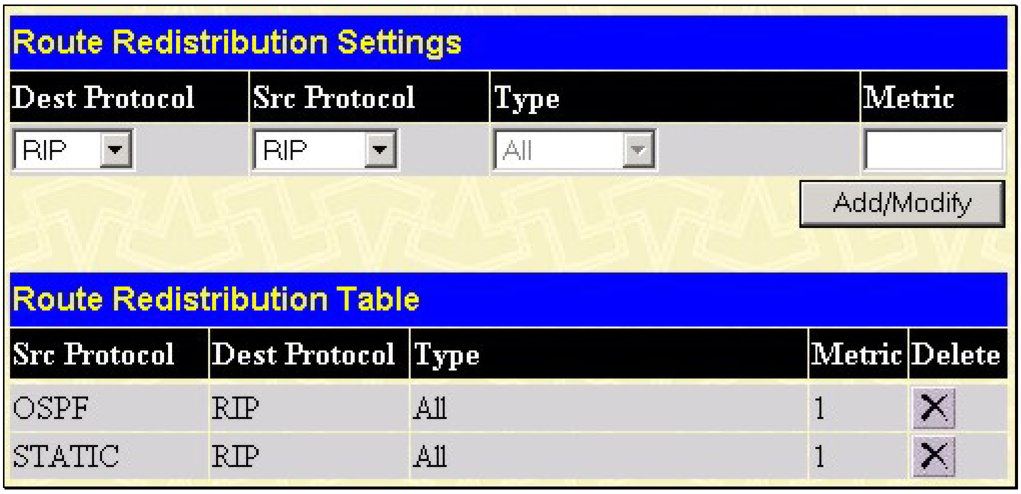
Route Source	Metric	Type
OSPF	0 to 16	All Internal External ExtType1 ExtType2 Inter-E1 Inter-E2
RIP	0 to 16777214	Type 1 Type 2
Static	0 to 16777214	Type 1 Type 2
Local	0 to 16777214	Type 1 Type 2

Table 5- 1. Route Redistribution Source table

Entering the Type combination – internal type_1 type_2 is functionally equivalent to all. Entering the combination type_1 type_2 is functionally equivalent to external. Entering the combination internal external is functionally equivalent to all.

Entering the metric 0 specifies transparency.

This window will redistribute routing information between the OSPF and RIP routing protocols to all routers on the network that are running OSPF or RIP. To access the **Route Redistribution Settings** window, go to **Configuration > Layer 3 IP Networking > Route Redistribution Settings**:



Route Redistribution Settings

Dest Protocol	Src Protocol	Type	Metric
RIP	RIP	All	

Route Redistribution Table

Src Protocol	Dest Protocol	Type	Metric	Delete
OSPF	RIP	All	1	☒
STATIC	RIP	All	1	☒

Figure 5- 7. Route Redistribution Settings window

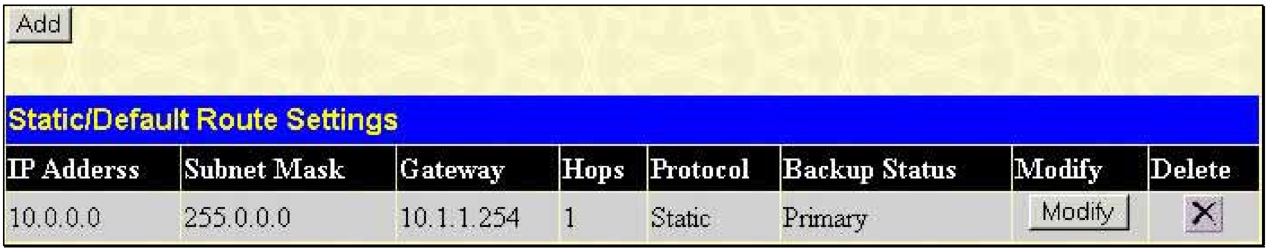
To create a new route redistribution criteria, select the Dest Protocol (destination protocol) and Src Protocol (source protocol) from the drop-down menus, choose the metric Type and enter a Metric value. Click on the **Add/Modify** button and the new redistribution setting appears listed in the table. To eliminate an existing redistribution configuration, click the ***X*** in the Delete column for the configuration being removed.

Refer to the table below for descriptions of the **Router Redistribution Settings** window settings:

Parameter	Description
Dest Protocol	Allows the selection of the protocol of the destination device. Available choices are *RIP* and *OSPF*.
Src Protocol	Allows the selection of the protocol of the source device. Available choices are *RIP*, *OSPF*, *STATIC*, or *LOCAL.*
Type	Allows for the selection of one of six methods of calculating the metric value. The user may choose between *All*, *Internal*, *External*, *ExtType1*, *ExtType2*, *Inter-E1*, *Inter-E2*. See the table above for available metric value types for each source protocol.
Metric	Allows the entry of an interface cost. This is analogous to a Hop Count in the RIP routing protocol. The user may specify a cost between 0 and 16.

Static/Default Route Settings

Static routes that have been previously configured appear in the Static/Default Route Settings table. To add a new route, click on the **Add** button, a new window appears. To remove an existing route, click the ***X*** button in the Delete column for the route you want to eliminate. To modify an existing entry, click the **Modify** button in the **Static/Default Route Settings** window, which will bring up the identical window as the **Add** window.

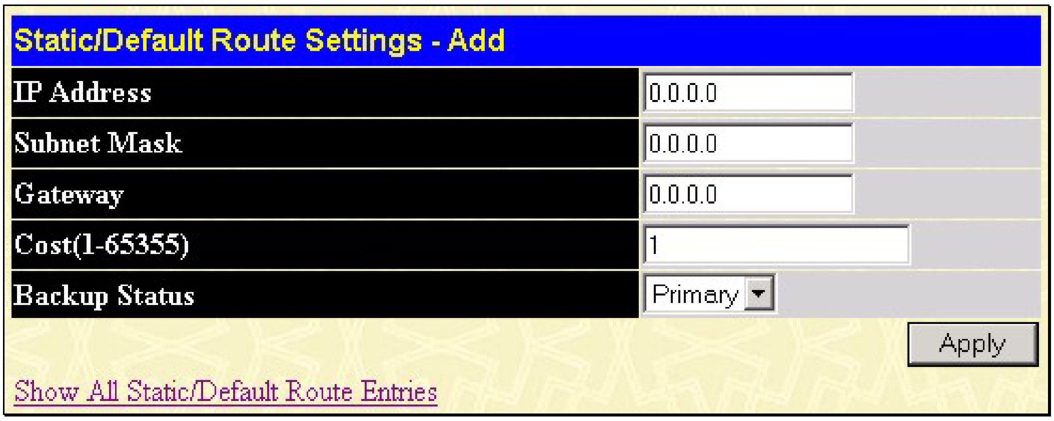


Static/Default Route Settings

IP Adderss	Subnet Mask	Gateway	Hops	Protocol	Backup Status	Modify	Delete
10.0.0.0	255.0.0.0	10.1.1.254	1	Static	Primary	Modify	☒

Figure 5- 8. Static/Default Route Settings window

Use the **Static/Default Route Settings – Add** window to configure IP settings and Metric cost for the new route.



Static/Default Route Settings - Add

IP Address	0.0.0.0
Subnet Mask	0.0.0.0
Gateway	0.0.0.0
Cost(1-65355)	1
Backup Status	Primary ▾

Figure 5- 9. Static/Default Route Settings – Add window

Configure the IP settings for the new static route and click the **Apply** button to create the static route. The new route will appear in the previous window. To view the new route and any other static routes configured for the Switch click the Show All Static/Default Route Entries link.

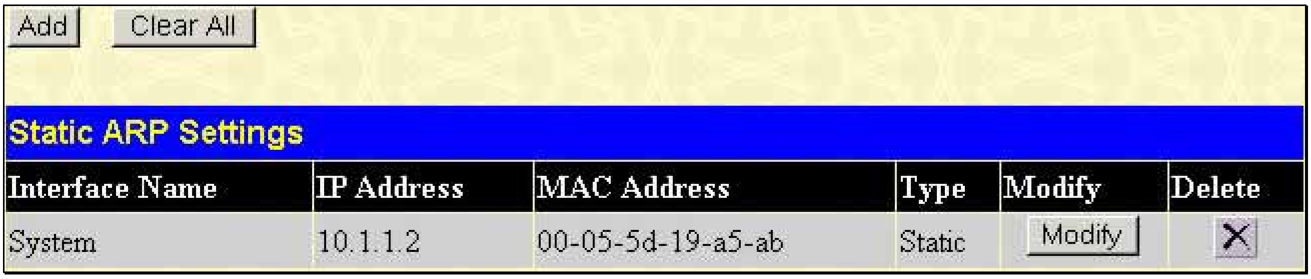
The following fields can be set or viewed for windows of the Static/Default route Settings section:

Parameter	Description
IP Address	The IP address of the Static/Default Route.
Subnet Mask	The corresponding Subnet Mask of the IP address entered into the table.
Gateway	The corresponding Gateway of the IP address entered into the table.
Hops/Cost	Represents the metric value of the IP interface entered into the table. This field may read a number between 1-65535 for an OSPF setting, and 1-16 for a RIP setting.
Protocol	Represents the protocol used for the Routing Table entry of the IP interface. This field may read OSPF, RIP, Static or Local.
Backup State	Represents the Backup state that this IP interface is configured for. This field may read Primary or Backup.
Delete	Click the ***X*** if you would like to delete this entry from the Static/Default Route Settings table.

Static ARP Settings

The *Address Resolution Protocol* (**ARP**) is a TCP/IP protocol that converts IP addresses into physical addresses. This table allows network managers to view, define, modify and delete ARP information for specific devices. Use the **Static ARP Settings** window to create permanent entries in the ARP table for different IP interfaces. Static ARP entries that have been configured appear in the Static ARP Settings table in this window. To add a new static ARP entry, click on the **Add** button, a new window appears (see below). To remove an existing entry, click the ***X*** button in the Delete column for the entry you want to eliminate. To delete all static ARP entries, click the **Clear All** button.

To open the **Static ARP Table** open the **Configuration** folder, and then open the **Layer 3 IP Networking** folder and click on the **Static ARP Settings** link.

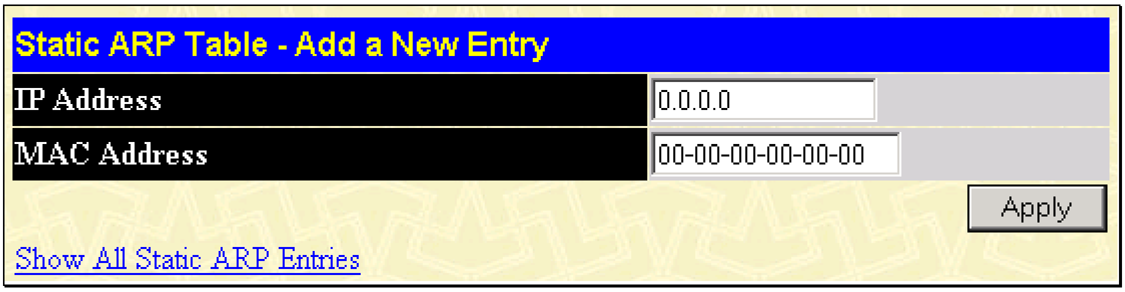


Static ARP Settings

Interface Name	IP Address	MAC Address	Type	Modify	Delete
System	10.1.1.2	00-05-5d-19-a5-ab	Static	Modify	☒

Figure 5- 10. Static ARP Settings window

Clicking the **Add** button allows you to add a new entry using the window below.

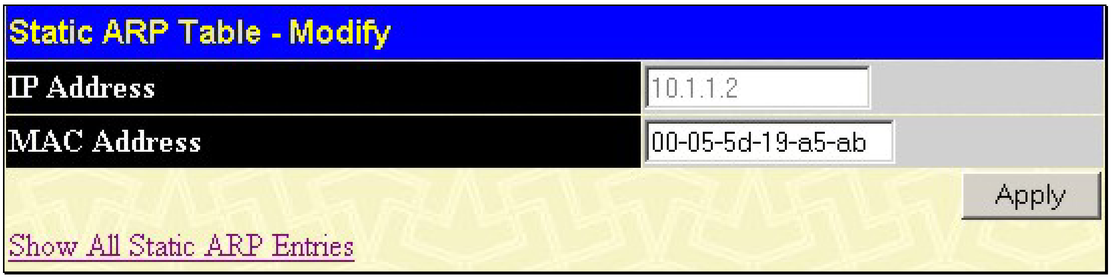


Static ARP Table - Add a New Entry

IP Address	0.0.0.0
MAC Address	00-00-00-00-00-00

Figure 5- 11. Static ARP Table – Add a New Entry window

Clicking the **Modify** button allows you to add a new entry using the window below.



Static ARP Table - Modify

IP Address	10.1.1.2
MAC Address	00-05-5d-19-a5-ab

Figure 5- 12. Static ARP Table – Modify window

Enter the IP address and the MAC address of the device you want to map with ARP and click the **Apply** button. The new entry will appear in the **Static ARP Settings** window. Click the Show All Static ARP Entries link to see the **Static ARP Settings** window.

RIP

The Routing Information Protocol is a distance-vector routing protocol. There are two types of network devices running RIP - active and passive. Active devices advertise their routes to others through RIP messages, while passive devices listen to these messages. Both active and passive routers update their routing tables based upon RIP messages that active routers exchange. Only routers can run RIP in the active mode.

Every 30 seconds, a router running RIP broadcasts a routing update containing a set of pairs of network addresses and a distance (represented by the number of hops or routers between the advertising router and the remote network). So, the vector is the network address and the distance is measured by the number of routers between the local router and the remote network.

RIP measures distance by an integer count of the number of hops from one network to another. A router is one hop from a directly connected network, two hops from a network that can be reached through a router, etc. The more routers between a source and a destination, the greater the RIP distance (or hop count).

There are a few rules to the routing table update process that help to improve performance and stability. A router will not replace a route with a newly learned one if the new route has the same hop count (sometimes referred to as ‘cost’). So learned routes are retained until a new route with a lower hop count is learned.

When learned routes are entered into the routing table, a timer is started. This timer is restarted every time this route is advertised. If the route is not advertised for a period of time (usually 180 seconds), the route is removed from the routing table.

RIP does not have an explicit method to detect routing loops. Many RIP implementations include an authorization mechanism (a password) to prevent a router from learning erroneous routes from unauthorized routers.

To maximize stability, the hop count RIP uses to measure distance must have a low maximum value. Infinity (that is, the network is unreachable) is defined as 16 hops. In other words, if a network is more than 16 routers from the source, the local router will consider the network unreachable.

RIP can also be slow to converge (to remove inconsistent, unreachable or looped routes from the routing table) because RIP messages propagate relatively slowly through a network.

Slow convergence can be solved by using split horizon update, where a router does not propagate information about a route back to the interface on which it was received. This reduces the probability of forming transient routing loops.

Hold down can be used to force a router to ignore new route updates for a period of time (usually 60 seconds) after a new route update has been received. This allows all routers on the network to receive the message.

A router can ‘poison reverse’ a route by adding an infinite (16) hop count to a route’s advertisement. This is usually used in conjunction with triggered updates, which force a router to send an immediate broadcast when an update of an unreachable network is received.

RIP Version 1 Message Format

There are two types of RIP messages: routing information messages and information requests. Both types use the same format.

The Command field specifies an operation according the following table:

Command	Meaning
1	Request for partial or full routing information
2	Response containing network-distance pairs from sender’s routing table
3	Turn on trace mode (obsolete)
4	Turn off trace mode (obsolete)
5	Reserved for Sun Microsystem’s internal use

9	Update Request
10	Update Response
11	Update Acknowledgement

RIP Command Codes

The field VERSION contains the protocol version number (1 in this case), and is used by the receiver to verify which version of RIP the packet was sent.

RIP 1 Message

RIP is not limited to TCP/IP. Its address format can support up to 14 octets (when using IP, the remaining 10 octets must be zeros). Other network protocol suites can be specified in the Family of Source Network field (IP has a value of 2). This will determine how the address field is interpreted.

RIP specifies that the IP address, 0.0.0.0, denotes a default route.

The distances, measured in router hops are entered in the Distance to Source Network, and Distance to Destination Network fields.

RIP 1 Route Interpretation

RIP was designed to be used with classed address schemes, and does not include an explicit subnet mask. An extension to version 1 does allow routers to exchange subnetted addresses, but only if the subnet mask used by the network is the same as the subnet mask used by the address. This means the RIP version 1 cannot be used to propagate classless addresses.

Routers running RIP version 1 must send different update messages for each IP interface to which it is connected. Interfaces that use the same subnet mask as the router's network can contain subnetted routes, other interfaces cannot. The router will then advertise only a single route to the network.

RIP Version 2 Extensions

RIP version 2 includes an explicit subnet mask entry, so RIP version 2 can be used to propagate variable length subnet addresses or CIDR classless addresses. RIP version 2 also adds an explicit next hop entry, which speeds convergence and helps prevent the formation of routing loops.

RIP2 Message Format

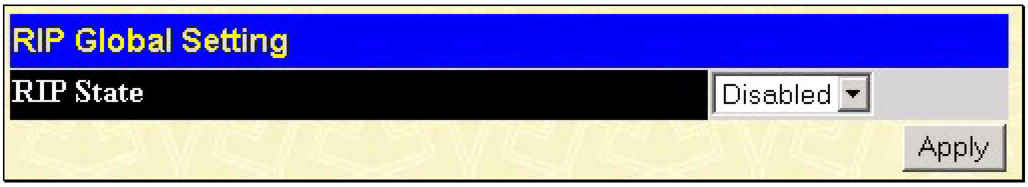
The message format used with RIP2 is an extension of the RIP1 format:

RIP version 2 also adds a 16-bit route tag that is retained and sent with router updates. It can be used to identify the origin of the route.

Because the version number in RIP2 occupies the same octet as in RIP1, both versions of the protocols can be used on a given router simultaneously without interference.

RIP Global Setting

To setup Routing Information Protocol (RIP) for the IP interfaces configured in the Switch, click **Configuration > Layer 3 IP Networking > RIP > RIP Global Setting**. Use the **RIP Global Setting** window to first enable RIP and then configure RIP settings for the individual IP interfaces. To enable RIP, select *Enabled* from the drop-down RIP State menu and click the **Apply** button. RIP can be disabled or enabled without changing any of the RIP IP interfaces settings using this window.



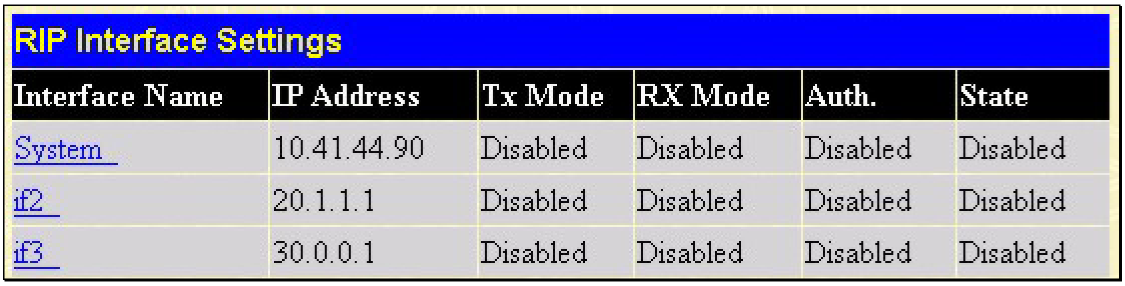
RIP Global Setting

RIP State	Disabled

Figure 5- 13. RIP Global Setting window

RIP Interface Settings

RIP settings are configured for each IP interface on the Switch. Click the **RIP Interface Settings** link in the **RIP** sub-folder. The window appears in table form listing settings for IP interfaces currently on the Switch. To configure RIP settings for an individual interface, click on the hyperlinked name of the interface.

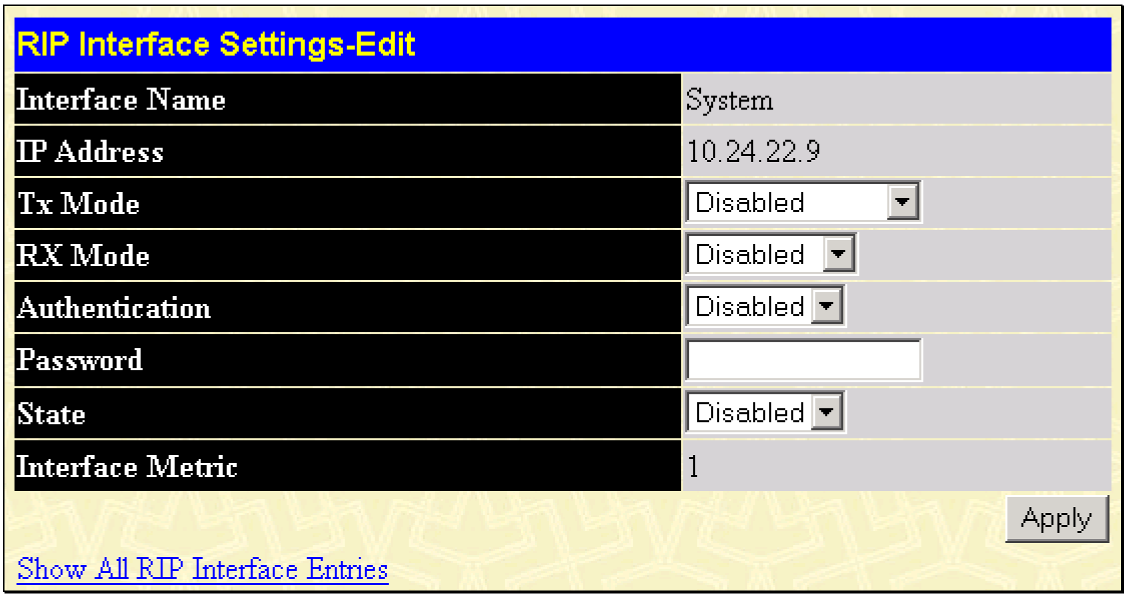


RIP Interface Settings

Interface Name	IP Address	Tx Mode	RX Mode	Auth.	State
System	10.41.44.90	Disabled	Disabled	Disabled	Disabled
if2	20.1.1.1	Disabled	Disabled	Disabled	Disabled
if3	30.0.0.1	Disabled	Disabled	Disabled	Disabled

Figure 5- 14. RIP Interface Settings window

Click the name of the interface for which to setup RIP. This will open the following window:



RIP Interface Settings-Edit

Interface Name	System
IP Address	10.24.22.9
Tx Mode	Disabled
RX Mode	Disabled
Authentication	Disabled
Password	
State	Disabled
Interface Metric	1

Figure 5- 15. RIP Interface Settings – Edit window

Refer to the table below for a description of the available parameters for RIP interface settings. To return to the **RIP Interface Settings** table, click the Show All RIP Interface Settings link.

The following RIP settings can be applied to each IP interface:

Parameter	Description
Interface Name	The name of the IP interface on which RIP is to be setup. This interface must be previously configured on the Switch.
IP Address	The IP address corresponding to the **Interface Name** showing in the field above.
TX Mode	Toggle among *Disabled*, *V1 Only*, *V1 Compatible*, and *V2 Only*. This entry specifies which version of the RIP protocol will be used to transmit RIP packets. *Disabled* prevents the transmission of RIP packets.
RX Mode	Toggle among *Disabled*, *V1 Only*, *V2 Only*, and *V1 or V2*. This entry specifies which version of the RIP protocol will be used to interpret received RIP packets. *Disabled* prevents the reception of RIP packets.
Authentication	Toggle between *Disabled* and *Enabled* to specify that routers on the network should us the Password above to authenticate router table exchanges.
Password	A password to be used to authenticate communication between routers on the network.
State	Toggle between *Disabled* and *Enabled* to disable or enable this RIP interface on the Switch.
Interface Metric	A read only field that denotes the Metric value of the current IP Interface setting.

Click **Apply** to implement changes made.

OSPF

Introduction to OSPF

The Open Shortest Path First (OSPF) routing protocol that uses a *link-state* algorithm to determine routes to network destinations. A "link" is an interface on a router and the "state" is a description of that interface and its relationship to neighboring routers. The state contains information such as the IP address, subnet mask, type of network the interface is attached to, other routers attached to the network, etc. The collection of link-states are then collected in a link-state database that is maintained by routers running OSPF.

OSPF specifies how routers will communicate to maintain their link-state database and defines several concepts about the topology of networks that use OSPF.

To limit the extent of link-state update traffic between routers, OSPF defines the concept of *Area.* All routers within an area share the exact same link-state database, and a change to this database on one router triggers an update to the link-state database of all other routers in that area. Routers that have interfaces connected to more than one area are called *Border Routers* and take the responsibility of distributing routing information between areas.

One area is defined as *Area 0* or the *Backbone.* This area is central to the rest of the network in that all other areas have a connection (through a router) to the backbone. Only routers have connections to the backbone and OSPF is structured such that routing information changes in other areas will be introduced into the backbone, and then propagated to the rest of the network.

When constructing a network to use OSPF, it is generally advisable to begin with the backbone (area 0) and work outward.

Link-State Algorithm

An OSPF router uses a link-state algorithm to build a shortest path tree to all destinations known to the router. The following is a simplified description of the algorithm's steps:

1. When OSPF is started, or when a change in the routing information changes, the router generates a link-state advertisement. This advertisement is a specially formatted packet that contains information about all the link-states on the router.
2. This link-state advertisement is flooded to all router in the area. Each router that receives the link-state advertisement will store the advertisement and then forward a copy to other routers.
3. When the link-state database of each router is updated, the individual routers will calculate a Shortest Path Tree to all destinations – with the individual router as the root. The IP routing table will then be made up of the destination address, associated cost, and the address of the next hop to reach each destination.
4. Once the link-state databases are updated, Shortest Path Trees calculated, and the IP routing tables written – if there are no subsequent changes in the OSPF network (such as a network link going down) there is very little OSPF traffic.

Shortest Path Algorithm

The Shortest Path to a destination is calculated using the Dijkstra algorithm. Each router is places at the root of a tree and then calculates the shortest path to each destination based on the cumulative cost to reach that destination over multiple possible routes. Each router will then have its own Shortest Path Tree (from the perspective of its location in the network area) even though every router in the area will have and use the exact same link-state database.

The following sections describe the information used to build the Shortest Path Tree.

OSPF Cost

Each OSPF interface has an associated cost (also called "metric") that is representative of the overhead required to send packets over that interface. This cost is inversely proportional to the bandwidth of the interface (i.e. a higher bandwidth interface has a lower cost). There is then a higher cost (and longer time delays) in sending packets over a 56 Kbps dial-up connection than over a 10 Mbps Ethernet connection. The formula used to calculate the OSPF cost is as follows:

Cost = 100,000,000 / bandwidth in bps

As an example, the cost of a 10 Mbps Ethernet line will be 10 and the cost to cross a 1.544 Mbps T1 line will be 64.

Shortest Path Tree

To build Router A's shortest path tree for the network diagramed below, Router A is put at the root of the tree and the smallest cost link to each destination network is calculated.

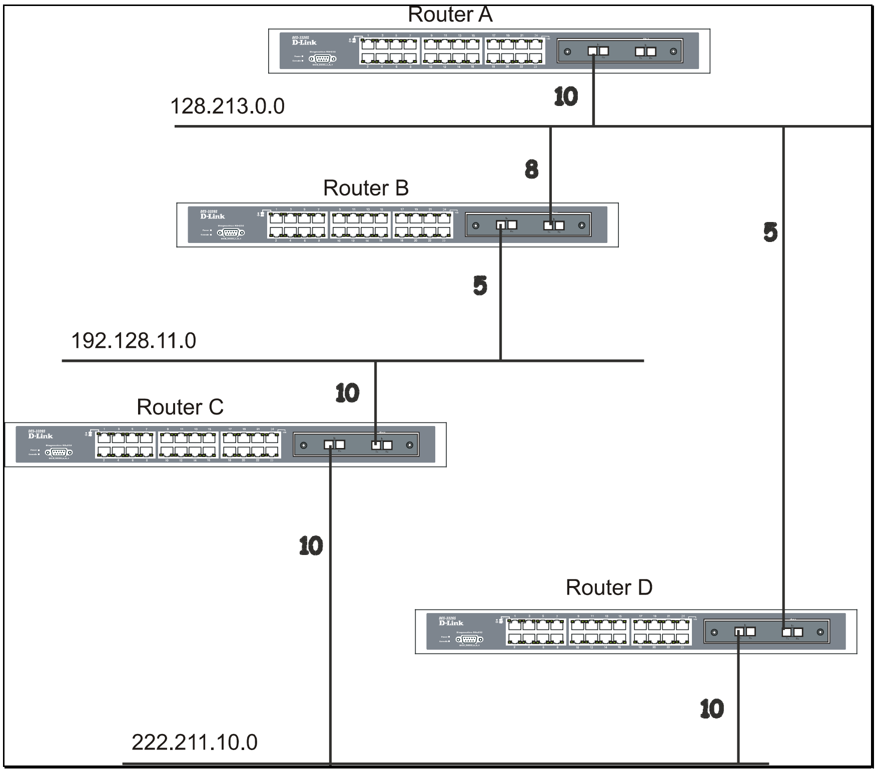


Figure 5- 16. Constructing a Shortest Path Tree

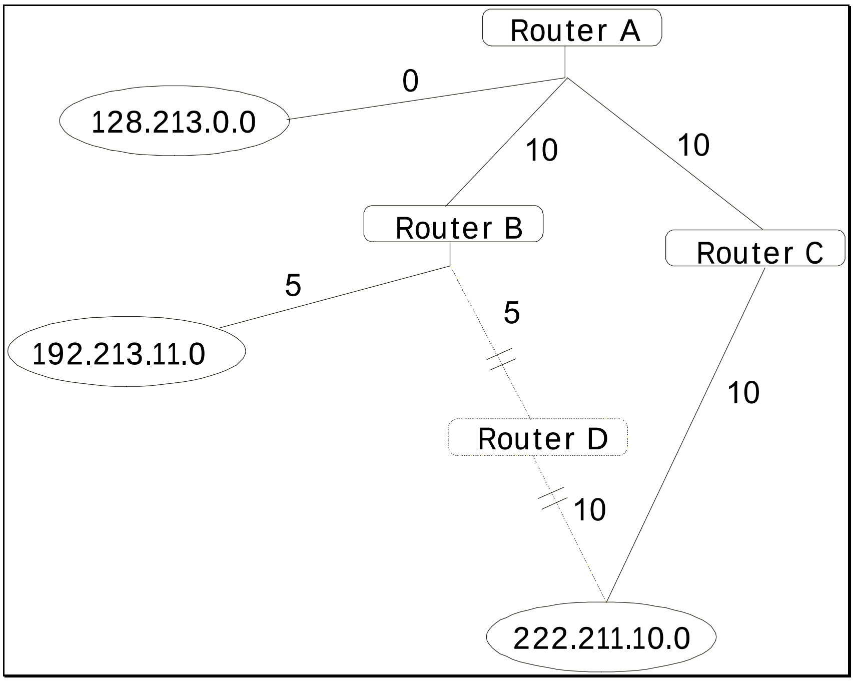


Figure 5- 17. Constructing a Shortest Path Tree

The diagram above shows the network from the viewpoint of Router A. Router A can reach 192.213.11.0 through Router B with a cost of 10+5=15. Router A can reach 222.211.10.0 through Router C with a cost of 10+10=20. Router A can also reach 222.211.10.0 through Router B and Router D with a cost of 10+5+10=25, but the cost is higher than the route through Router C. This higher-cost route will not be included in the Router A's shortest path tree. The resulting tree will look like this:

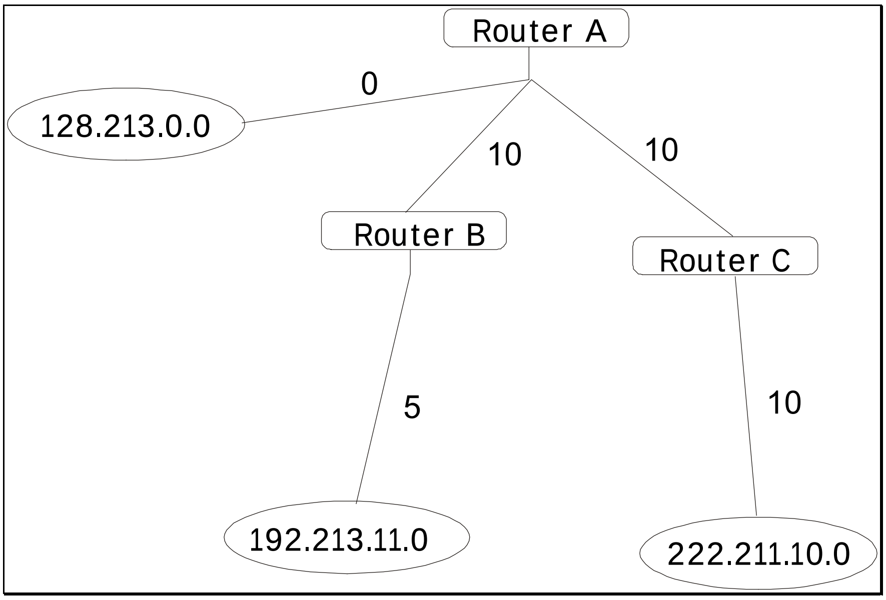


Figure 5- 18. Constructing a Shortest Path Tree - Completed

Note that this shortest path tree is only from the viewpoint of Router A. The cost of the link from Router B to Router A, for instance is not important to constructing Router A’s shortest path tree, but is very important when Router B is constructing its shortest path tree.

Note also that directly connected networks are reached at a cost of 0, while other networks are reached at the cost calculated in the shortest path tree.

Router A can now build its routing table using the network addresses and costs calculated in building the above shortest path tree.

Areas and Border Routers

OSPF link-state updates are forwarded to other routers by flooding to all routers on the network. OSPF uses the concept of areas to define where on the network routers that need to receive particular link-state updates are located. This helps ensure that routing updates are not flooded throughout the entire network and to reduce the amount of bandwidth consumed by updating the various router’s routing tables.

Areas establish boundaries beyond which link-state updates do not need to be flooded. So the exchange of link-state updates and the calculation of the shortest path tree are limited to the area that the router is connected to.

Routers that have connections to more than one area are called Border Routers (BR). The Border Routers have the responsibility of distributing necessary routing information and changes between areas.

Areas are specific to the router interface. A router that has all of its interfaces in the same area is called an Internal Router. A router that has interfaces in multiple areas is called a Border Router. Routers that act as gateways to other networks (possibly using other routing protocols) are called Autonomous System Border Routers (ASBRs).

Link-State Packets

There are different types of link-state packets, four are illustrated below:

- Router Link-State Updates – these describe a router’s links to destinations within an area.
- Summary Link-State Updates – issued by Border Routers and describe links to networks outside the area but within the Autonomous System (AS).
- Network Link-State Updates – issued by multi-access areas that have more than one attached router. One router is elected as the Designated Router (DR) and this router issues the network link-state updates describing every router on the segment.
- External Link-State Updates – issued by an Autonomous System Border Router and describes routes to destinations outside the AS or a default route to the outside AS.

The format of these link-state updates is described in more detail below.

Router link-state updates are flooded to all routers in the current area. These updates describe the destinations reachable through all of the router's interfaces.

Summary link-state updates are generated by Border Routers to distribute routing information about other networks within the AS. Normally, all Summary link-state updates are forwarded to the backbone (area 0) and are then forwarded to all other areas in the network. Border Routers also have the responsibility of distributing routing information from the Autonomous System Border Router in order for routers in the network to get and maintain routes to other Autonomous Systems.

Network link-state updates are generated by a router elected as the Designated Router on a multi-access segment (with more than one attached router). These updates describe all of the routers on the segment and their network connections.

External link-state updates carry routing information to networks outside the Autonomous System. The Autonomous System Border Router is responsible for generating and distributing these updates.

OSPF Authentication

OSPF packets can be authenticated as coming from trusted routers by the use of predefined passwords. The default for routers is to use not authentication.

There are two other authentication methods – simple password authentication (key) and Message Digest authentication (MD-5).

Message Digest Authentication (MD-5)

MD-5 authentication is a cryptographic method. A key and a key-ID are configured on each router. The router then uses an algorithm to generate a mathematical "message digest" that is derived from the OSPF packet, the key and the key-ID. This message digest (a number) is then appended to the packet. The key is not exchanged over the wire and a non-decreasing sequence number is included to prevent replay attacks.

Simple Password Authentication

A password (or key) can be configured on a per-area basis. Routers in the same area that participate in the routing domain must be configured with the same key. This method is possibly vulnerable to passive attacks where a link analyzer is used to obtain the password.

Backbone and Area 0

OSPF limits the number of link-state updates required between routers by defining areas within which a given router operates. When more than one area is configured, one area is designated as area 0 – also called the backbone.

The backbone is at the center of all other areas – all areas of the network have a physical (or virtual) connection to the backbone through a router. OSPF allows routing information to be distributed by forwarding it into area 0, from which the information can be forwarded to all other areas (and all other routers) on the network.

In situations where an area is required, but is not possible to provide a physical connection to the backbone, a virtual link can be configured.

Virtual Links

Virtual links accomplish two purposes:

1. Linking an area that does not have a physical connection to the backbone.
2. Patching the backbone in case there is a discontinuity in area 0.

Areas Not Physically Connected to Area 0

All areas of an OSPF network should have a physical connection to the backbone, but is some cases it is not possible to physically connect a remote area to the backbone. In these cases, a virtual link is configured to connect the remote area to the backbone. A virtual path is a logical path between two border routers that have a common area, with one border router connected to the backbone.

Partitioning the Backbone

OSPF also allows virtual links to be configured to connect the parts of the backbone that are discontinuous. This is the equivalent to linking different area 0s together using a logical path between each area 0. Virtual links can also be added for redundancy to protect against a router failure. A virtual link is configured between two border routers that both have a connection to their respective area 0s.

Neighbors

Routers that are connected to the same area or segment become neighbors in that area. Neighbors are elected via the Hello protocol. IP multicast is used to send out Hello packets to other routers on the segment. Routers become neighbors when they see themselves listed in a Hello packet sent by another router on the same segment. In this way, two-way communication is guaranteed to be possible between any two neighbor routers.

Any two routers must meet the following conditions before the become neighbors:

- **Area ID** – Two routers having a common segment – their interfaces have to belong to the same area on that segment. Of course, the interfaces should belong to the same subnet and have the same subnet mask.
- **Authentication** – OSPF allows for the configuration of a password for a specific area. Two routers on the same segment and belonging to the same area must also have the same OSPF password before they can become neighbors.
- **Hello and Dead Intervals** – The Hello interval specifies the length of time, in seconds, between the hello packets that a router sends on an OSPF interface. The dead interval is the number of seconds that a router's Hello packets have not been seen before its neighbors declare the OSPF router down. OSPF routers exchange Hello packets on each segment in order to acknowledge each other's existence on a segment and to elect a Designated Router on multi-access segments. OSPF requires these intervals to be exactly the same between any two neighbors. If any of these intervals are different, these routers will not become neighbors on a particular segment.
- **Stub Area Flag** – any two routers also have to have the same stub area flag in their Hello packets in order to become neighbors.

Adjacencies

Adjacent routers go beyond the simple Hello exchange and participate in the link-state database exchange process. OSPF elects one router as the Designated Router (DR) and a second router as the Backup Designated Router (BDR) on each multi-access segment (the BDR is a backup in case of a DR failure). All other routers on the segment will then contact the DR for link-state database updates and exchanges. This limits the bandwidth required for link-state database updates.

Designated Router Election

The election of the DR and BDR is accomplished using the Hello protocol. The router with the highest OSPF priority on a given multi-access segment will become the DR for that segment. In case of a tie, the router with the highest Router ID wins. The default OSPF priority is 1. A priority of zero indicates a router that cannot be elected as the DR.

Building Adjacency

Two routers undergo a multi-step process in building the adjacency relationship. The following is a simplified description of the steps required:

- **Down** – No information has been received from any router on the segment.
- **Attempt** – On non-broadcast multi-access networks (such as Frame Relay or X.25), this state indicates that no recent information has been received from the neighbor. An effort should be made to contact the neighbor by sending Hello packets at the reduced rate set by the Poll Interval.
- **Init** – The interface has detected a Hello packet coming from a neighbor but bi-directional communication has not yet been established.
- **Two-way** – Bi-directional communication with a neighbor has been established. The router has seen its address in the Hello packets coming from a neighbor. At the end of this stage the DR and BDR election would have been done. At the end of the Two-way stage, routers will decide whether to proceed in building an adjacency or not. The decision is based on whether one of the routers is a DR or a BDR or the link is a point-to-point or virtual link.
- **Exstart** – (Exchange Start) Routers establish the initial sequence number that is going to be used in the information exchange packets. The sequence number insures that routers always get the most recent information. One router will become the primary and the other will become secondary. The primary router will poll the secondary for information.
- **Exchange** – Routers will describe their entire link-state database by sending database description packets.

- **Loading** – The routers are finalizing the information exchange. Routers have link-state request list and a link-state retransmission list. Any information that looks incomplete or outdated will be put on the request list. Any update that is sent will be put on the retransmission list until it gets acknowledged.
- **Full –** The adjacency is now complete. The neighboring routers are fully adjacent. Adjacent routers will have the same link-state database.

Adjacencies on Point-to-Point Interfaces

OSPF Routers that are linked using point-to-point interfaces (such as serial links) will always form adjacencies. The concepts of DR and BDR are unnecessary.

OSPF Packet Formats

All OSPF packet types begin with a standard 24-byte header and there are five packet types. The header is described first, and each packet type is described in a subsequent section.

All OSPF packets (except for Hello packets) forward link-state advertisements. Link-State Update packets, for example, flood advertisements throughout the OSPF routing domain.

- OSPF packet header
- Hello packet
- Database Description packet
- Link-State Request packet
- The Link-State Update packet
- Link-State Acknowledgment packet

OSPF Packet Header

Every OSPF packet is preceded by a common 24-byte header. This header contains the information necessary for a receiving router to determine if the packet should be accepted for further processing.

The format of the OSPP packet header is shown below:

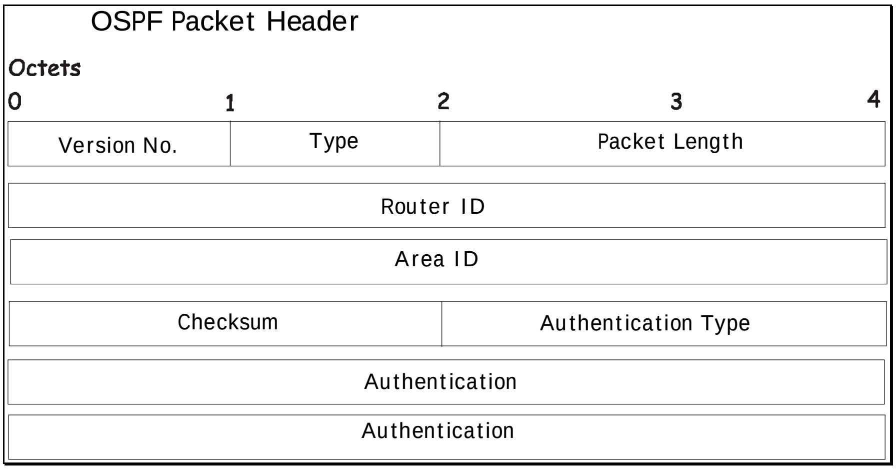


Figure 5- 19. OSPF Packet Header

Field	Description
Version No.	The OSPF version number
Type	The OSPF packet type. The OSPF packet types are as follows: Type Description Hello Database Description

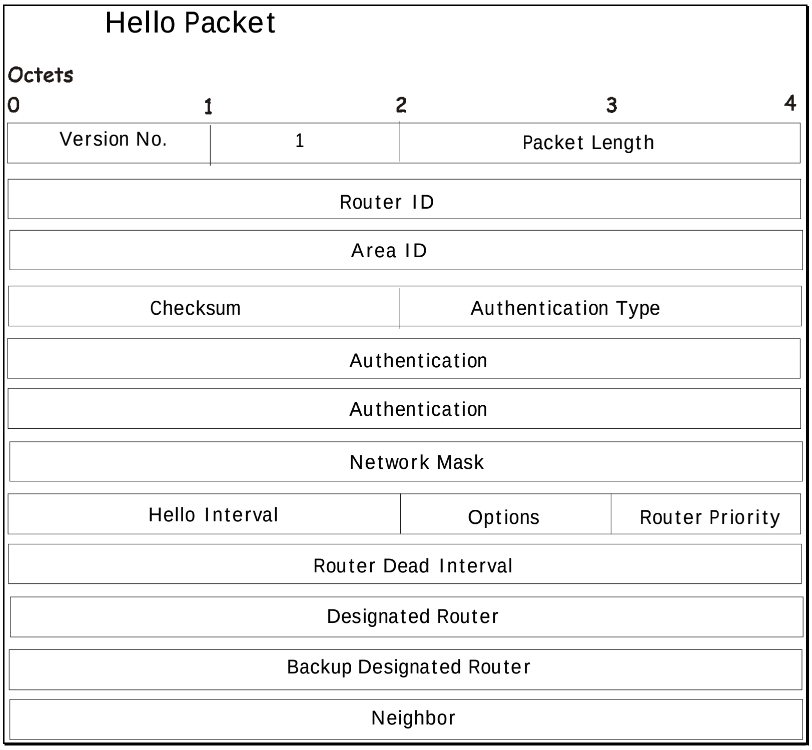
	Link-State Request Link-State Update Link-State Acknowledgment
Packet Length	The length of the packet in bytes. This length includes the 24-byte header.
Router ID	The Router ID of the packet's source.
Area ID	A 32-bit number identifying the area that this packet belongs to. All OSPF packets are associated with a single area. Packets traversing a virtual link are assigned the backbone Area ID of 0.0.0.0
Checksum	A standard IP checksum that includes all of the packet's contents except for the 64-bit authentication field.
Authentication Type	The type of authentication to be used for the packet.
Authentication	A 64-bit field used by the authentication scheme.

Hello Packet

Hello packets are OSPF packet type 1. They are sent periodically on all interfaces, including virtual links, in order to establish and maintain neighbor relationships. In addition, Hello Packets are multicast on those physical networks having a multicast or broadcast capability, enabling dynamic discovery of neighboring routers.

All routers connected to a common network must agree on certain parameters such as the Network Mask, the Hello Interval, and the Router Dead Interval. These parameters are included in hello packets, so that differences can inhibit the forming of neighbor relationships. A detailed explanation of the receive processing for Hello packets, so that differences can inhibit the forming of neighbor relationships.

The format of the Hello packet is shown below:



Hello Packet

Octets

0 1 2 3 4

Version No. | 1 | Packet Length

Router ID

Area ID

Checksum | Authentication Type

Authentication

Authentication

Network Mask

Hello Interval | Options | Router Priority

Router Dead Interval

Designated Router

Backup Designated Router

Neighbor

Figure 5- 20. Hello Packet

Field	Description
Network Mask	The network mask associated with this interface.
Options	The optional capabilities supported by the router.
Hello Interval	The number of seconds between this router's Hello packets.
Router Priority	This router's Router Priority. The Router Priority is used in the election of the DR and BDR. If this field is set to *0*, the router is ineligible become the DR or the BDR.
Router Dead Interval	The number of seconds that must pass before declaring a silent router as down.
Designated Router	The identity of the DR for this network, in the view of the advertising router. The DR is identified here by its IP interface address on the network.
Backup Designated Router	The identity of the Backup Designated Router (BDR) for this network. The BDR is identified here by its IP interface address on the network. This field is set to *0.0.0.0* if there is no BDR.
Field	Description
Neighbor	The Router Ids of each router from whom valid Hello packets have been seen within the Router Dead Interval on the network.

Database Description Packet

Database Description packets are OSPF packet type 2. These packets are exchanged when an adjacency is being initialized. They describe the contents of the topological database. Multiple packets may be used to describe the database. For this purpose a poll-response procedure is used. One of the routers is designated to be master, the other a slave. The master seconds Database Description packets (polls) that are acknowledged by Database Description packets sent by the slave (responses). The responses are linked to the polls via the packets' DD sequence numbers.

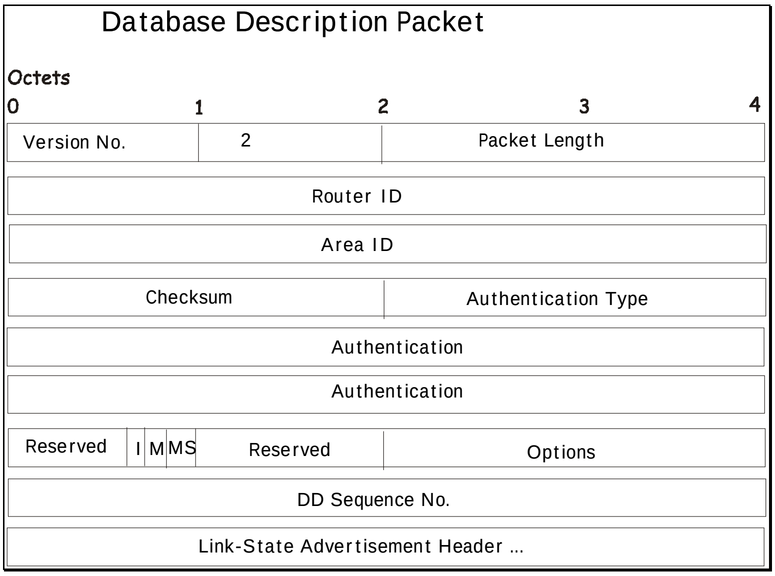


Figure 5- 21. Database Description Packet

Field	Description
Options	The optional capabilities supported by the router.
I – bit	The Initial bit. When set to 1, this packet is the first in the sequence of Database Description packets.
M – bit	The More bit. When set to 1, this indicates that more Database Description packets will follow.
MS – bit	The Master Slave bit. When set to 1, this indicates that the router is the master during the Database Exchange process. A zero indicates the opposite.
DD Sequence Number	User to sequence the collection of Database Description Packets. The initial value (indicated by the Initial bit being set) should be unique. The DD sequence number then increments until the complete database description has been sent.

The rest of the packet consists of a list of the topological database's pieces. Each link state advertisement in the database is described by its link state advertisement header.

Link-State Request Packet

Link-State Request packets are OSPF packet type 3. After exchanging Database Description packets with a neighboring router, a router may find that parts of its topological database are out of date. The Link-State Request packet is used to request the pieces of the neighbor's database that are more up to date. Multiple Link-State Request packets may need to be used. The sending of Link-State Request packets is the last step in bringing up an adjacency.

A router that sends a Link-State Request packet has in mind the precise instance of the database pieces it is requesting, defined by LS sequence number, LS checksum, and LS age, although these fields are not specified in the Link-State Request packet itself. The router may receive even more recent instances in response.

The format of the Link-State Request packet is shown below:

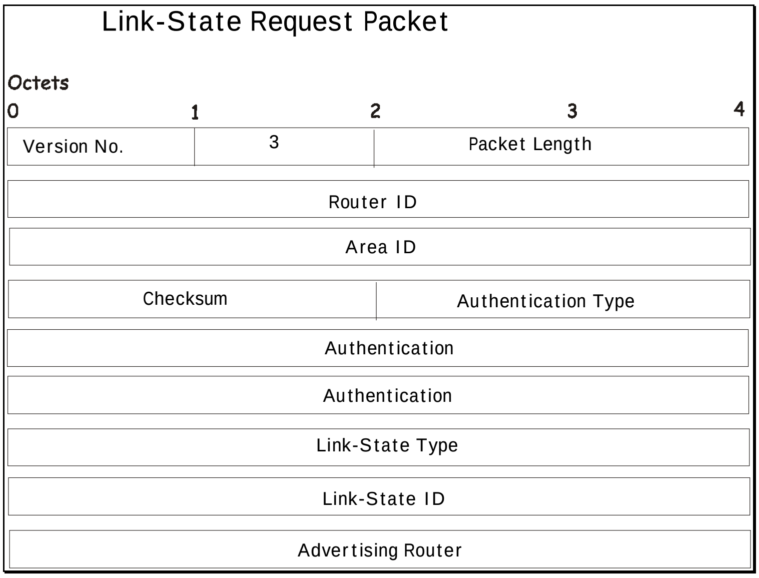


Figure 5- 22. Link-State Request Packet

Each advertisement requested is specified by its Link-State Type, Link-State ID, and Advertising Router. This uniquely identifies the advertisement, but not its instance. Link-State Request packets are understood to be requests for the most recent instance.

Link-State Update Packet

Link-State Update packets are OSPF packet type 4. These packets implement the flooding of link-state advertisements. Each Link-State Update packet carries a collection of link-state advertisements one hop further from its origin. Several link-state advertisements may be included in a single packet.

Link-State Update packets are multicast on those physical networks that support multicast/broadcast. In order to make the flooding procedure reliable, flooded advertisements are acknowledged in Link-State Acknowledgment packets. If retransmission of certain advertisements is necessary, the retransmitted advertisements are always carried by unicast Link-State Update packets.

The format of the Link-State Update packet is shown below:

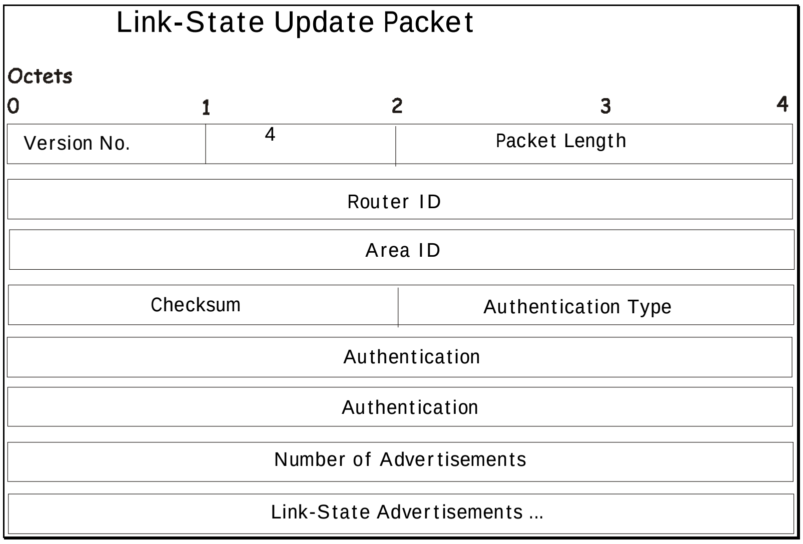


Figure 5- 23. Link-State Update Packet

The body of the Link-State Update packet consists of a list of link-state advertisements. Each advertisement begins with a common 20-byte header, the link-state advertisement header. Otherwise, the format of each of the five types of link-state advertisements is different.

Link-State Acknowledgment Packet

Link-State Acknowledgment packets are OSPF packet type 5. To make the folding of link-state advertisements reliable, flooded advertisements are explicitly acknowledged. This acknowledgment is accomplished through the sending and receiving of Link-State Acknowledgment packets. Multiple link-state advertisements can be acknowledged in a single Link-State Acknowledgment packet.

Depending on the state of the sending interface and the source of the advertisements being acknowledged, a Link-State Acknowledgment packet is sent either to the multicast address AllSPFRouters, to the multicast address AllDRouters, or as a unicast packet.

The format of this packet is similar to that of the Data Description packet. The body of both packets is simply a list of link-state advertisement headers.

The format of the Link-State Acknowledgment packet is shown below:

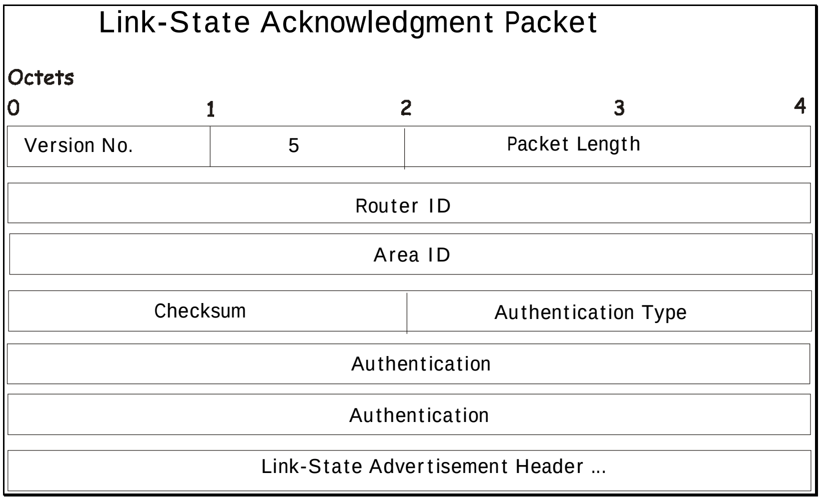


Figure 5- 24. Link-State Acknowledgment Packet

Each acknowledged link-state advertisement is described by its link-state advertisement header. It contains all the information required to uniquely identify both the advertisement and the advertisement's current instance.

Link-State Advertisement Formats

There are five distinct types of link-state advertisements. Each link-state advertisement begins with a standard 20-byte link-state advertisement header. Succeeding sections then diagram the separate link-state advertisement types.

Each link-state advertisement describes a piece of the OSPF routing domain. Every router originates a router links advertisement. In addition, whenever the router is elected as the Designated Router, it originates a network links advertisement. Other types of link-state advertisements may also be originated. The flooding algorithm is reliable, ensuring that all routers have the same collection of link-state advertisements. The collection of advertisements is called the link-state (or topological) database.

From the link-state database, each router constructs a shortest path tree with itself as root. This yields a routing table.

There are four types of link state advertisements, each using a common link state header. These are:

- Router Links Advertisements
- Network Links Advertisements
- Summary Link Advertisements
- Autonomous System Link Advertisements

Link State Advertisement Header

All link state advertisements begin with a common 20-byte header. This header contains enough information to uniquely identify the advertisements (Link State Type, Link State ID, and Advertising Router). Multiple instances of the link state advertisement may exist in the routing domain at the same time. It is then necessary to determine which instance is more recent. This is accomplished by examining the link state age, link state sequence number and link state checksum fields that are also contained in the link state advertisement header.

The format of the Link State Advertisement Header is shown below:

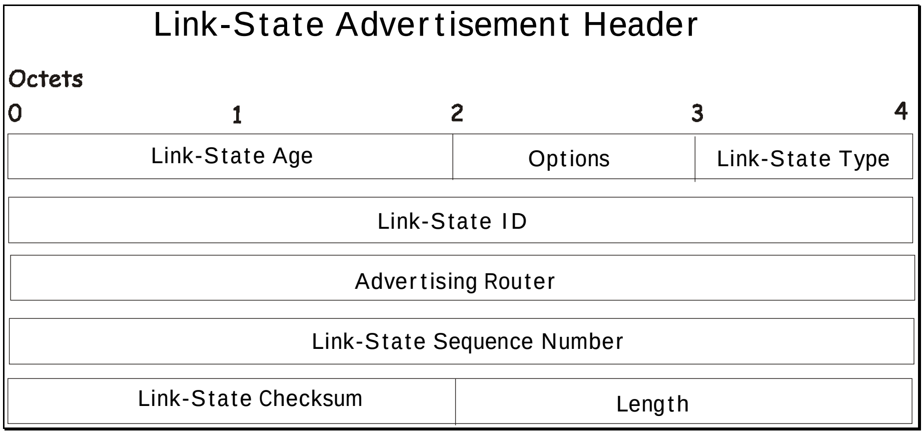


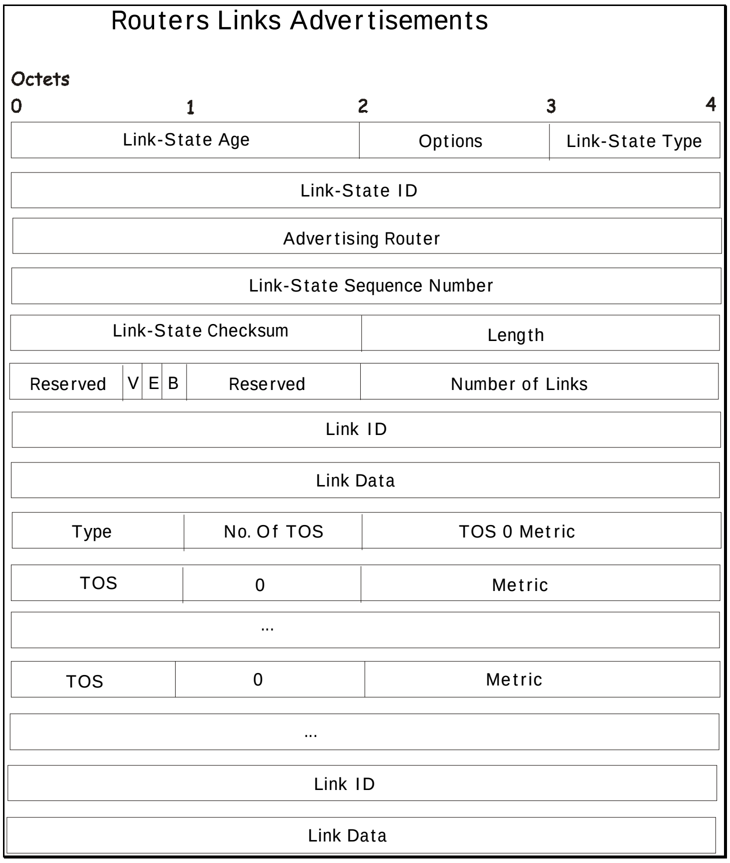
Figure 5- 25. Link-State Advertisement Header

Field	Description
Link State Age	The time is seconds since the link state advertisement was originated.
Options	The optional capabilities supported by the described portion of the routing domain.
Link State Type	The type of the link state advertisement. Each link state type has a separate advertisement format. The link state type are as follows: Type Description 1 Router Links Network Links Summary Link (IP Network) Summary Link (ASBR) AS External Link
Link State ID	This field identifies the portion of the internet environment that is being described by the advertisement. The contents of this field depend on the advertisement's Link State Type.
Advertising Router	The Router ID of the router that originated the Link State Advertisement. For example, in network links advertisements this field is set to the Router ID of the network's Designated Router.
Link State Sequence Number	Detects old or duplicate link state advertisements. Successive instances of a link state advertisement are given successive Link State Sequence numbers.
Link State Checksum	The Fletcher checksum of the complete contents of the link state advertisement, including the link state advertisement header by excepting the Link State Age field.
Length	The length in bytes of the link state advertisement. This includes the 20-byte link state advertisement header.

Router Links Advertisements

Router links advertisements are type 1 link state advertisements. Each router in an area originates a routers links advertisement. The advertisement describes the state and cost of the router's links to the area. All of the router's links to the area must be described in a single router links advertisement.

The format of the Router Links Advertisement is shown below:



Routers Links Advertisements

Octets

0	1	2	3	4

Link-State Age		Options	Link-State Type	
Link-State ID				
Advertising Router				
Link-State Sequence Number				
Link-State Checksum		Length		
Reserved	V E B	Reserved	Number of Links	
Link ID				
Link Data				
Type	No. Of TOS	TOS 0 Metric		
TOS	0	Metric		
...				
TOS	0	Metric		
...				
Link ID				
Link Data				

Figure 5- 26. Routers Links Advertisement

In router links advertisements, the Link State ID field is set to the router's OSPF Router ID. The T – bit is set in the advertisement's Option field if and only if the router is able to calculate a separate set of routes for each IP Type of Service (TOS). Router links advertisements are flooded throughout a single area only.

Field	Description
V – bit	When set, the router is an endpoint of an active virtual link that is using the described area as a Transit area (V is for Virtual link endpoint).
E – bit	When set, the router is an Autonomous System (AS) boundary router (E is for External).
B – bit	When set, the router is an area border router (B is for Border).
Number of Links	The number of router links described by this advertisement. This must be the total collection of router links to the area.

The following fields are used to describe each router link. Each router link is typed. The Type field indicates the kind of link being described. It may be a link to a transit network, to another router or to a stub network. The values of all the other fields describing a router link depend on the link's Type. For example, each link has an associated 32-bit data field. For links to stub networks this field specifies the network's IP address mask. For other link types the Link Data specifies the router's associated IP interface address.

Field	Description
Type	A quick classification of the router link. One of the following: Type Description Point-to-point connection to another router. Connection to a transit network. Connection to a stub network. Virtual link.
Link ID	Identifies the object that this router link connects to. Value depends on the link's Type. When connecting to an object that also originates a link state advertisement (i.e. another router or a transit network) the Link ID is equal to the neighboring advertisement's Link State ID. This provides the key for looking up an advertisement in the link state database. Type Link ID Neighboring router's Router ID. IP address of Designated Router. IP network/subnet number. Neighboring router's Router ID
Link Data	Contents again depend on the link's Type field. For connections to stub networks, it specifies the network's IP address mask. For unnumbered point-to-point connection, it specifies the interface's MIB-II ifIndex value. For other link types it specifies the router's associated IP interface address. This latter piece of information is needed during the routing table build process, when calculating the IP address of the next hop.
No. of TOS	The number of different Type of Service (TOS) metrics given for this link, not counting the required metric for TOS 0. If no additional TOS metrics are given, this field should be set to 0.
TOS 0 Metric	The cost of using this router link for TOS 0.
Field	Description
TOS	IP Type of Service that this metric refers to.
Metric	The cost of using this outbound router link, for traffic of the specified TOS.

For each link, separate metrics may be specified for each Type of Service (TOS). The metric for TOS 0 must always be included, and was discussed above. Metrics for non-zero TOS are described below. Note that the cost for non-zero TOS values that are not specified defaults to the TOS 0 cost. Metrics must be listed in order of increasing TOS encoding. For example, the metric for TOS 16 must always follow the metric for TOS 8 when both are specified.

Network Links Advertisements

Network links advertisements are Type 2 link state advertisements. A network links advertisement is originated for each transit network in the area. A transit network is a multi-access network that has more than one attached router. The network links advertisement is originated by the network's Designated router. The advertisement describes all routers attached to the network, including the Designated Router itself. The advertisement's Link State ID field lists the IP interface address of the Designated Router.

The distance form the network to all attached routers is zero, for all TOS. This is why the TOS and metric fields need not be specified in the network links advertisement.

The format of the Network Links Advertisement is shown below:

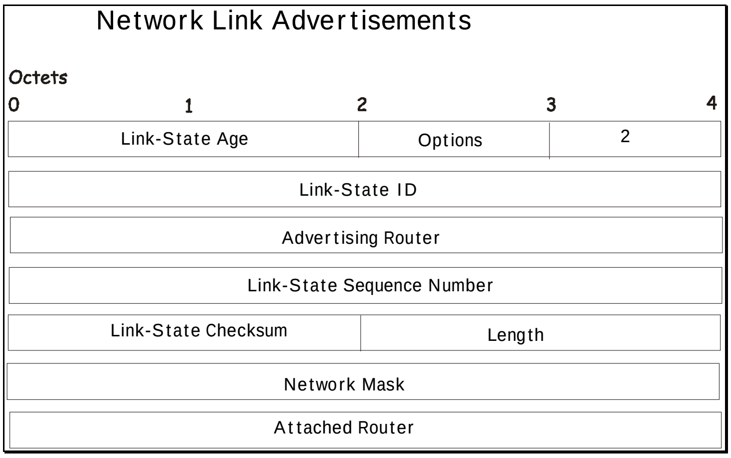


Figure 5- 27. Network Link Advertisements

Field	Description
Network Mask	The IP address mask for the network.
Attached Router	The Router Ids of each of the routers attached to the network. Only those routers that are fully adjacent to the Designated Router (DR) are listed. The DR includes itself in this list.

Summary Link Advertisements

Summary link advertisements are Type 3 and 4 link state advertisements. These advertisements are originated by Area Border routers. A separate summary link advertisement is made for each destination known to the router, that belongs to the Autonomous System (AS), yet is outside the area.

Type 3 link state advertisements are used when the destination is an IP network. In this case the advertisement's Link State ID field is an IP network number. When the destination is an AS boundary router, a Type 4 advertisement is used, and the Link State ID field is the AS boundary router's OSPF Router ID. Other that the difference in the Link State ID field, the format of Type 3 and 4 link state advertisements is identical.

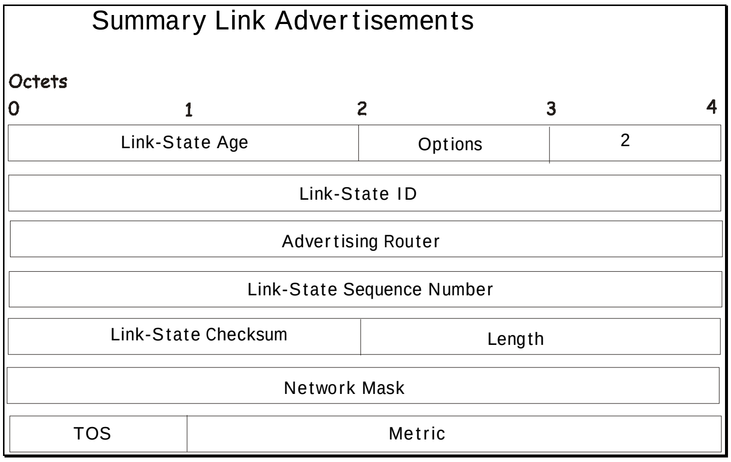


Figure 5- 28. Summary Link Advertisements

For stub area, Type 3 summary link advertisements can also be used to describe a default route on a per-area basis. Default summary routes are used in stub area instead of flooding a complete set of external routes. When describing a default summary route, the advertisement's Link State ID is always set to the Default Destination – 0.0.0.0, and the Network Mask is set to 0.0.0.0.

Separate costs may be advertised for each IP Type of Service. Note that the cost for TOS 0 must be included, and is always listed first. If the T-bit is reset in the advertisement's Option field, only a route for TOS 0 is described by the advertisement. Otherwise, routes for the other TOS values are also described. If a cost for a certain TOS is not included, its cost defaults to that specified for TOS 0.

Field	Description
Network Mask	For Type 3 link state advertisements, this indicates the destination network's IP address mask. For example, when advertising the location of a class A network the value 0xff000000
TOS	The Type of Service that the following cost is relevant to.
Metric	The cost of this route. Expressed in the same units as the interface costs in the router links advertisements.

Autonomous Systems External Link Advertisements

Autonomous Systems (AS) link advertisements are Type 5 link state advertisements. These advertisements are originated by AS boundary routers. A separate advertisement is made for each destination known to the router, that is external to the AS.

AS external link advertisements usually describe a particular external destination. For these advertisements the Link State ID field specifies an IP network number. AS external link advertisements are also used to describe a default route. Default routes are used when no specific route exists to the destination. When describing a default route, the Link Stat ID is always set the Default Destination address (0.0.0.0) and the Network Mask is set to 0.0.0.0.

The format of the AS External Link Advertisement is shown below:

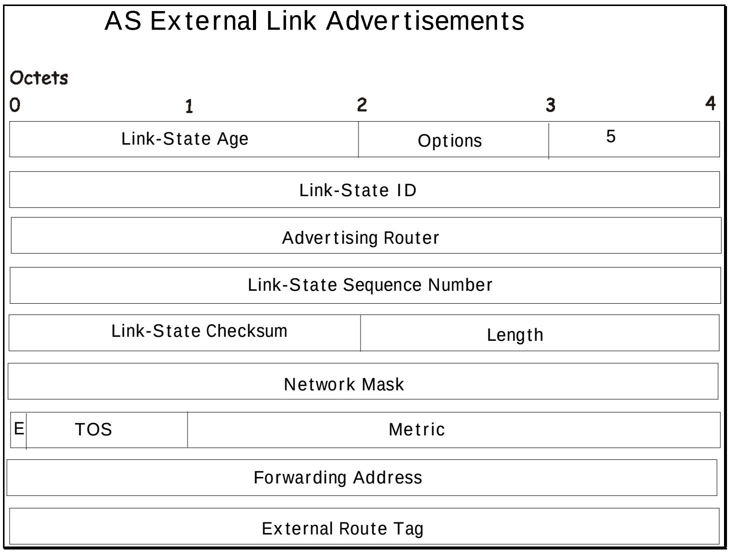


Figure 5- 29. AS External Link Advertisements

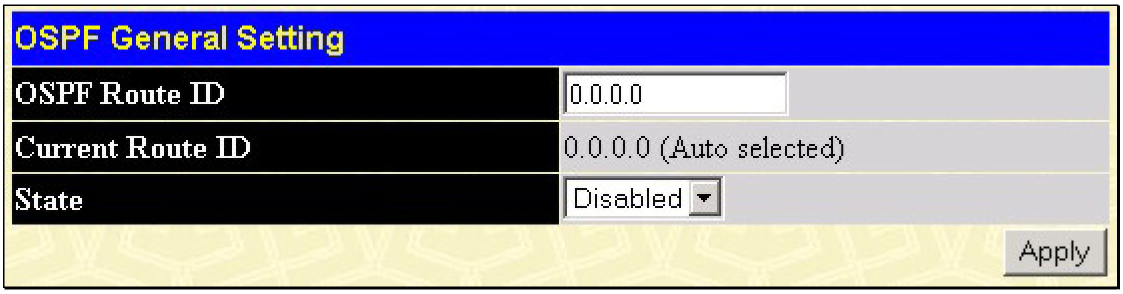
Field	Description
Network Mask	The IP address mask for the advertised destination.
E – bit	The type of external metric. If the E – bit is set, the metric specified is a Type 2 external metric. This means the metric is considered larger than any link state path. If the E – bit is zero, the specified metric is a Type 1 external metric. This means that is comparable directly to the link state metric.
Forwarding Address	Data traffic for the advertised destination will be forwarded to this address. If the Forwarding Address is set to 0.0.0.0, data traffic will be forwarded instead to the advertisement's originator.
TOS	The Type of Service that the following cost is relevant to.
Metric	The cost of this route. The interpretation of this metric depends on the external type indication (the E – bit above).
External Route Tag	A 32-bit field attached to each external route. This is not used by the OSPF protocol itself.

All the links for OSPF configuration windows are contained within the **OSPF** sub-folder of the **Layer 3 IP Networking** folder (located under **Configuration**).

OSPF General Setting

The **OSPF General Setting** window allows OSPF to be enabled or disabled on the Switch – without changing the Switch's OSPF configuration.

From the **Layer 3 IP Networking** folder, open the **OSPF** sub-folder and click on the **OSPF General Setting** link. To enable OSPF, first supply an OSPF Route ID (see below), select *Enabled* from the State drop-down menu and click the **Apply** button.



OSPF General Setting

OSPF Route ID	0.0.0.0
Current Route ID	0.0.0.0 (Auto selected)
State	Disabled

Figure 5- 30. OSPF General Setting window

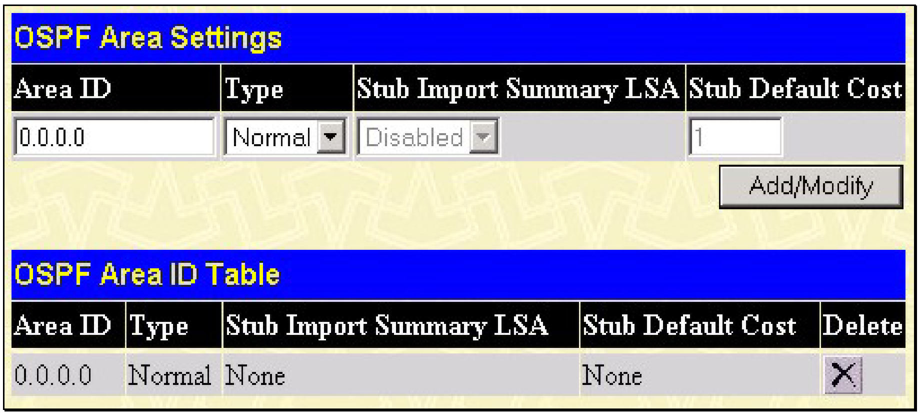
The following parameters are used for general OSPF configuration:

Parameter	Description
OSPF Route ID	A 32-bit number (in the same format as an IP address – xxx.xxx.xxx.xxx) that uniquely identifies the Switch in the OSPF domain. It is common to assign the highest IP address assigned to the Switch (router). In this case, it would be 10.53.13.189, but any unique 32-bit number will do. If 0.0.0.0 is entered, the highest IP address assigned to the Switch will become the OSPF Route ID.
Current Route ID	Displays the OSPF Route ID currently in use by the Switch. This Route ID is displayed as a convenience to the user when changing the Switch's OSPF Route ID.
State	Allows OSPF to be enabled or disabled globally on the Switch without changing the OSPF configuration.

OSPF Area ID Settings

This window allows the configuration of OSPF Area IDs and to designate these areas as either *Normal* or *Stub*. Normal OSPF areas allow Link-State Database (LSDB) advertisements of routes to networks that are external to the area, while stub areas do not allow the LSDB advertisement of external routes. Stub areas use a default summary external route (0.0.0.0 or Area 0) to reach external destinations.

To set up an OSPF Area configuration click the OSPF Area Settings link to open the following window:



OSPF Area Settings

Area ID	Type	Stub Import Summary LSA	Stub Default Cost
0.0.0.0	Normal	Disabled	1

OSPF Area ID Table

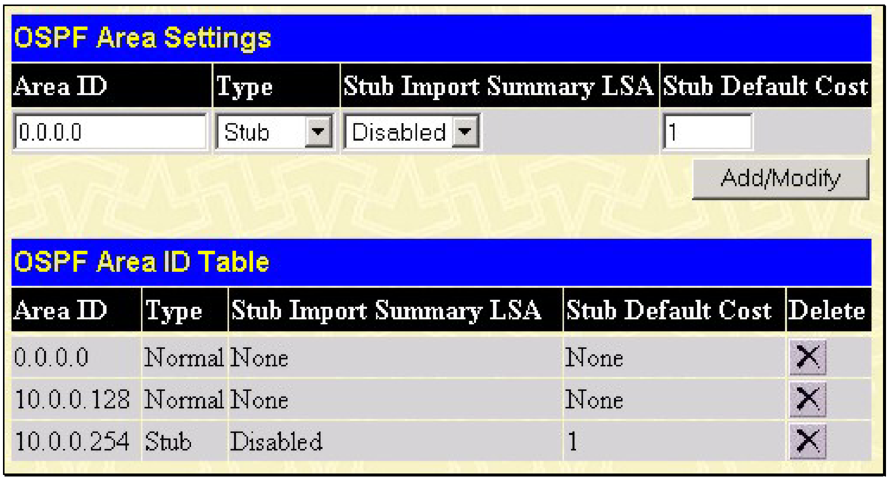
Area ID	Type	Stub Import Summary LSA	Stub Default Cost	Delete
0.0.0.0	Normal	None	None	☒

Figure 5- 31. OSPF Area Settings window

To add an OSPF Area to the table, type a unique Area ID (see below) select the Type from the drop-down menu. For a Stub type, choose *Enabled* or *Disabled* from the Stub Import Summary LSA drop-down menu and determine the Stub Default Cost. Click the **Add/Modify** button to add the Area ID set to the table.

To remove an Area ID configuration set, simply click the ***X*** in the **Delete** column for the configuration.

To change an existing set in the list, type the Area ID of the set you want to change, make the changes and click the **Add/Modify** button. The modified OSPF Area ID will appear in the table.



OSPF Area Settings

Area ID	Type	Stub Import Summary LSA	Stub Default Cost
0.0.0.0	Stub	Disabled	1

OSPF Area ID Table

Area ID	Type	Stub Import Summary LSA	Stub Default Cost	Delete
0.0.0.0	Normal	None	None	☒
10.0.0.128	Normal	None	None	☒
10.0.0.254	Stub	Disabled	1	☒

Figure 5- 32. OSPF Area Settings window

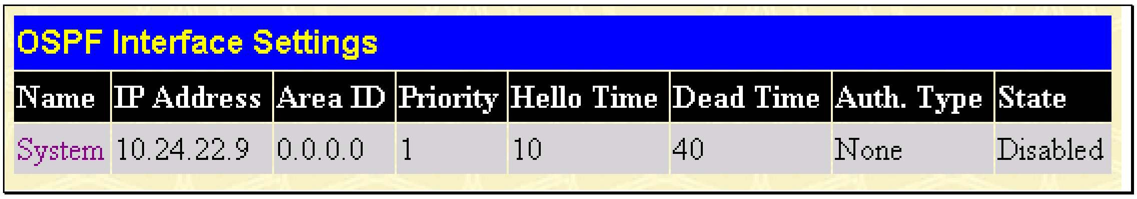
See the parameter descriptions below for information on the OSPF Area ID setting.

The Area ID settings are as follows:

Parameter	Description
Area ID	A 32-bit number in the form of an IP address (xxx.xxx.xxx.xxx) that uniquely identifies the OSPF area in the OSPF domain.
Type	This field can be toggled between *Normal* and *Stub* using the space bar. When it is toggled to *Stub*, additional fields appear – **Stub Import Summary LSA,** and the **Stub Default Cost**.
Stub Import Summary LSA	Displays whether or not the selected Area will allow Summary Link-State Advertisements (Summary LSAs) to be imported into the area from other areas.
Stub Default Cost	Displays the default cost for the route to the stub of between 0 and 65,535. The default is 1.

OSPF Interface Settings

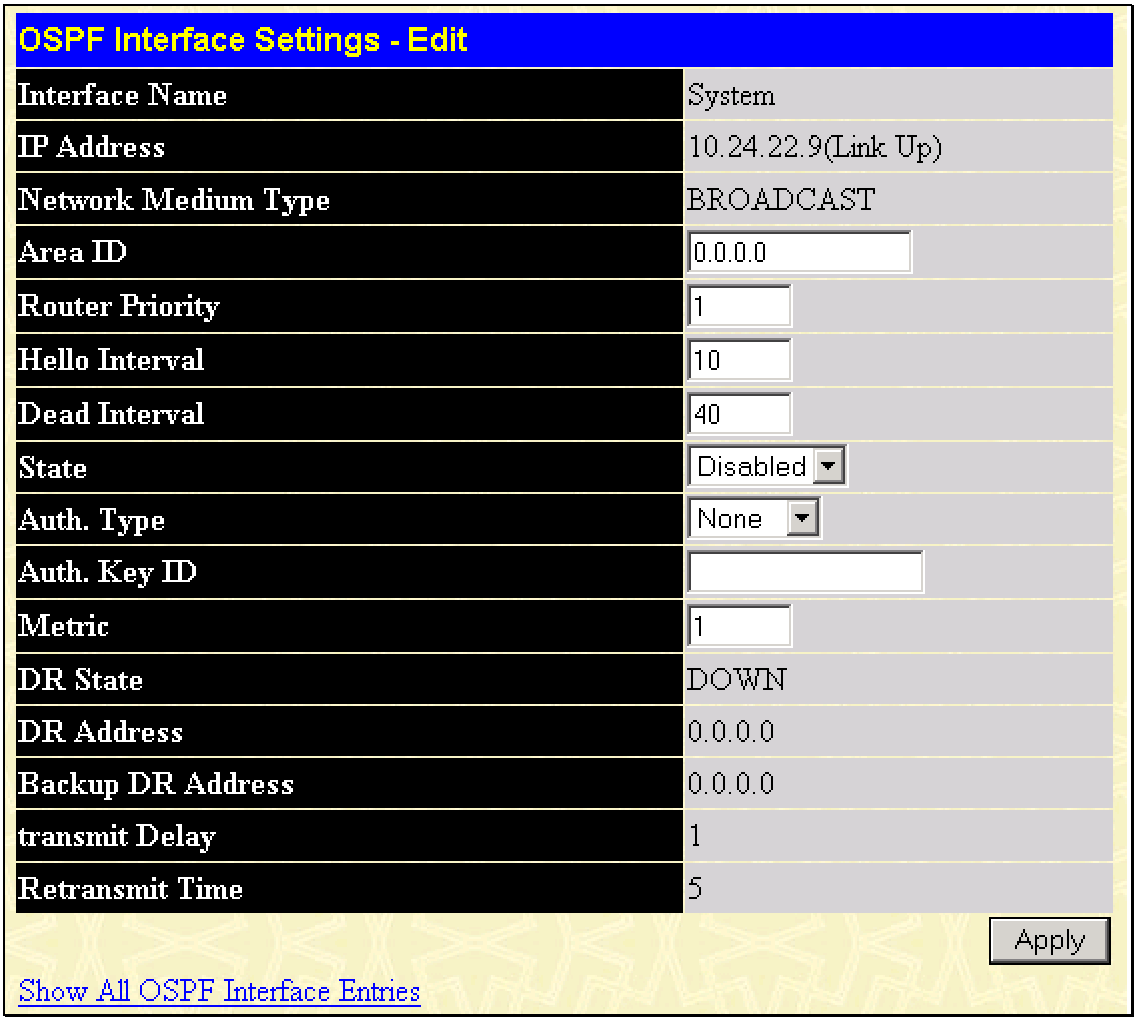
To set up OSPF interfaces, click the **OSPF Interface Settings** link to view OSPF settings for existing IP interfaces. If there are no IP interfaces configured (besides the default System interface), only the System interface settings will appear listed. To change settings for in IP interface, click on the hyperlinked name of the interface to see the configuration menu for that interface.



OSPF Interface Settings

Name	IP Address	Area ID	Priority	Hello Time	Dead Time	Auth. Type	State
System	10.24.22.9	0.0.0.0	1	10	40	None	Disabled

Figure 5- 33. OSPF Interface Settings window



OSPF Interface Settings - Edit

Interface Name	System
IP Address	10.24.22.9(Link Up)
Network Medium Type	BROADCAST
Area ID	0.0.0.0
Router Priority	1
Hello Interval	10
Dead Interval	40
State	Disabled
Auth. Type	None
Auth. Key ID	
Metric	1
DR State	DOWN
DR Address	0.0.0.0
Backup DR Address	0.0.0.0
transmit Delay	1
Retransmit Time	5

Figure 5- 34. OSPF Interface Settings - Edit window

Configure each IP interface individually using the **OSPF Interface Settings – Edit** window. Click the **Apply** button when you have entered the settings. The new configuration appears listed in the OSPF Interface Settings table. To return to the **OSPF Interface Settings** window, click the Show All OSPF Interface Entries link.

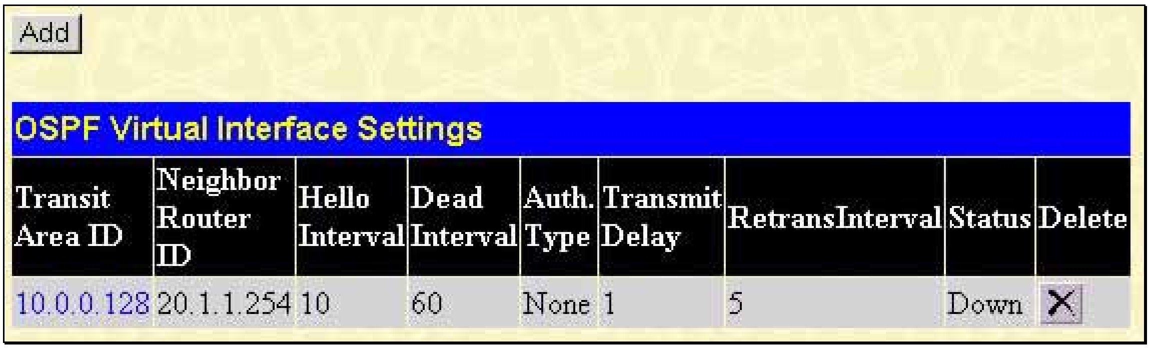
OSPF interface settings are described below.

Some OSPF interface settings require previously configured OSPF settings. Read the descriptions below for details.

Parameter	Description
Interface Name	Displays the of an IP interface previously configured on the Switch.
IP Address	The IP Address of the Interface name stated above.
Area ID	Allows the entry of an OSPF Area ID configured above.
Router Priority	Allows the entry of a number between *0* and *255* representing the OSPF priority of the selected area. If a Router Priority of *0* is selected, the Switch cannot be elected as the Designated Router for the network.
Hello Interval	Allows the specification of the interval between the transmission of OSPF Hello packets, in seconds. Between *1* and *65535* seconds can be specified. The Hello Interval, Dead Interval, Authorization Type, and Authorization Key should be the same for all routers on the same network.
Dead Interval	Allows the specification of the length of time between the receipt of Hello packets from a neighbor router before the selected area declares that router down. An interval between *1* and *65535* seconds can be specified. The Dead Interval must be evenly divisible by the Hello Interval.
State	Allows the OSPF interface to be disabled for the selected area without changing the configuration for that area.
Auth Type	This field can be toggled between *None*, *Simple*, and *MD5* using the space bar. This allows a choice of authorization schemes for OSPF packets that may be exchanged over the OSPF routing domain. *None* specifies no authorization. *Simple* uses a simple password to determine if the packets are from an authorized OSPF router. When *Simple* is selected, the Auth Key field allows the entry of an 8-character password that must be the same as a password configured on a neighbor OSPF router. *MD5* uses a cryptographic key entered in the MD5 Key Setting window. When *MD5* is selected, the Auth Key ID field allows the specification of the Key ID as defined in the MD5 configuration above. This must be the same MD5 Key as used by the neighboring router.
Auth. Key ID	Enter a Key ID of up to 5 characters to set the Auth. Key ID for either the Simple Auth Type or the MD5 Auth Type, as specified in the previous parameter.
Metric	This field allows the entry of a number between *1* and *65,535* that is representative of the OSPF cost of reaching the selected OSPF interface. The default metric is *1*.
DR State	A read only field describing the Designated Router state of the IP interface. This field many read **DR** if the interface is the designated router, or **Backup DR** if the interface is the Backup Designated Router. The highest IP address will be the Designated Router and is determined by the OSPF Hello Protocol of the Switch.
DR Address	The IP address of the aforementioned Designated Router.
Backup DR Address	The IP address of the aforementioned Backup Designated Router.
Transmit Delay	A read only field that denotes the estimated time to transmit a Link State Update Packet over this interface, in seconds.
Retransmit Time	A read only field that denotes the time between LSA retransmissions over this interface, in seconds.

OSPF Virtual Interface Settings

Click the **OSPF Virtual Interface Settings** link to view the current OSPF virtual interface settings. There are not virtual interface settings configured by default, so the first time this table is viewed there will be not interfaces listed. To add a new OSPF virtual interface configuration set to the table, click the **Add** button. A new window appears (see below). To change an existing configuration, click on the hyperlinked Transit Area ID for the set you want to change. The window to modify an existing set is the same as the window used to add a new one. To eliminate an existing configuration, click the ***X*** in the Delete column for the configuration being removed.

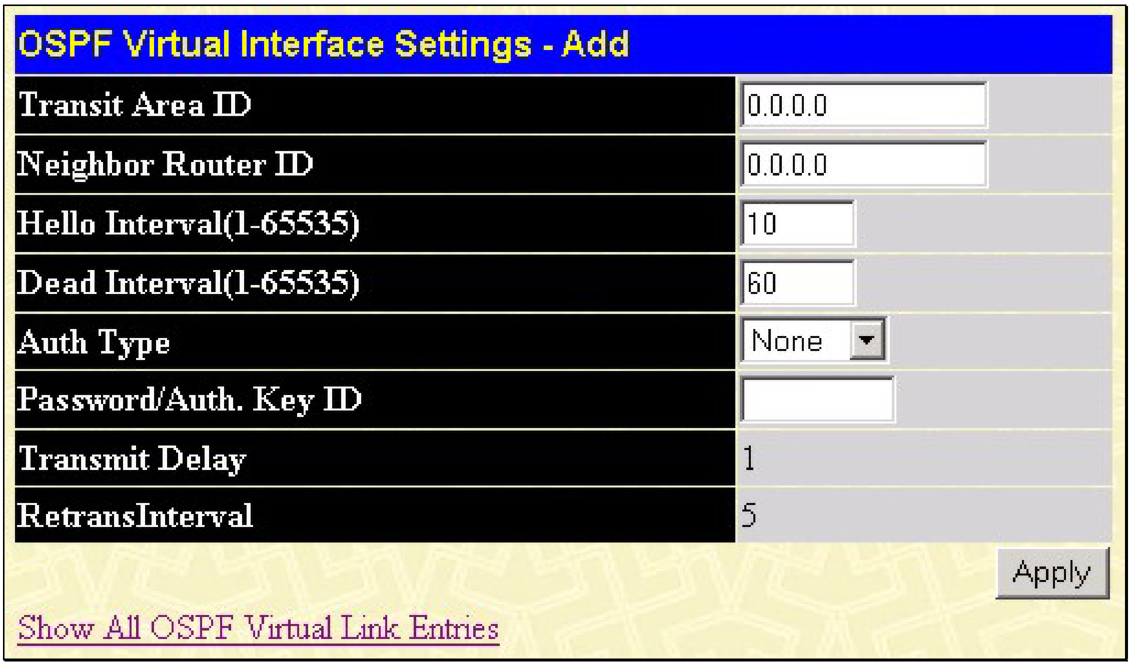


OSPF Virtual Interface Settings

Transit Area ID	Neighbor Router ID	Hello Interval	Dead Interval	Auth. Type	Transmit Delay	RetransInterval	Status	Delete
10.0.0.128	20.1.1.254	10	60	None	1	5	Down	☒

Figure 5- 35. OSPF Virtual Interface Settings window

The status of the virtual interface appears (Up or Down) in the **Status** column.



OSPF Virtual Interface Settings - Add

Transit Area ID	0.0.0.0
Neighbor Router ID	0.0.0.0
Hello Interval(1-65535)	10
Dead Interval(1-65535)	60
Auth Type	None
Password/Auth. Key ID	
Transmit Delay	1
RetransInterval	5

Figure 5- 36. OSPF Virtual Interface Settings – Add window

Configure the following parameters if you are adding or changing an OSPF Virtual Interface:

Parameter	Description
Transit Area ID	Allows the entry of an OSPF Area ID – previously defined on the Switch – that allows a remote area to communicate with the backbone (area 0). A Transit Area cannot be a Stub Area or a Backbone Area.
Neighbor Router	The OSPF router ID for the remote router. This is a 32-bit number in the form of an IP address (xxx.xxx.xxx.xxx) that uniquely identifies the remote area’s Area Border Router.

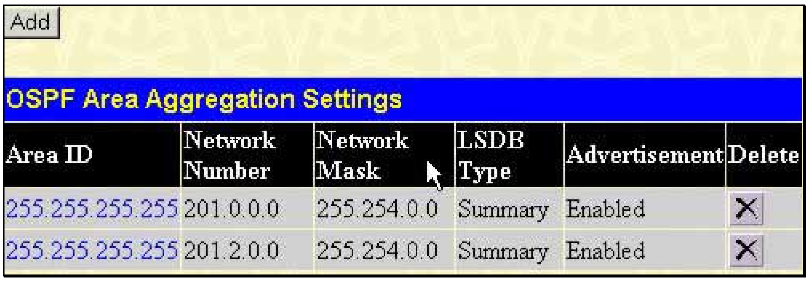
Hello Interval (1-65535)	Specify the interval between the transmission of OSPF Hello packets, in seconds. Enter a value between 1 and 65535 seconds. The **Hello Interval**, **Dead Interval**, **Authorization Type**, and **Authorization Key** should have identical settings for all routers on the same network.
Dead Interval (1-65535)	Specify the length of time between (receiving) Hello packets from a neighbor router before the selected area declares that router down. Again, all routers on the network should use the same setting.
Auth Type	If using authorization for OSPF routers, select the type being used. MD5 key authorization must be set up in the MD5 Key Settings menu.
Password/Auth. Key ID	Enter a case-sensitive password for simple authorization or enter the MD5 key you set in the MD5 Key settings menu.
Transmit Delay	The number of seconds required to transmit a link state update over this virtual link. Transit delay takes into account transmission and propagation delays. This field is fixed at 1 second.
RetransInterval	The number of seconds between link state advertisement retransmissions for adjacencies belonging to this virtual link. This field is fixed at 5 seconds.

NOTE: For OSPF to function properly some settings should be identical on all participating OSPF devices. These settings include the Hello Interval and Dead Interval. For networks using authorization for OSPF devices, they Authorization Type and Password or Key used must likewise be identical.

OSPF Area Aggregation Settings

Area Aggregation allows all of the routing information that may be contained within an area to be aggregated into a summary LSDB advertisement of just the network address and subnet mask. This allows for a reduction in the volume of LSDB advertisement traffic as well as a reduction in the memory overhead in the Switch used to maintain routing tables.

Click the **OSPF Area Aggregation Settings** link to view the current settings. There are no aggregation settings configured by default, so there will not be any listed the first accessing the window. To add a new OSPF Area Aggregation setting, click the **Add** button. A new window (pictured below) appears. To change an existing configuration, click on the hyperlinked Area ID for the set you want to change. The window to modify an existing configuration is the same as the window used to add a new one. To eliminate an existing configuration, click the ***X*** in the Delete column for the configuration being removed.

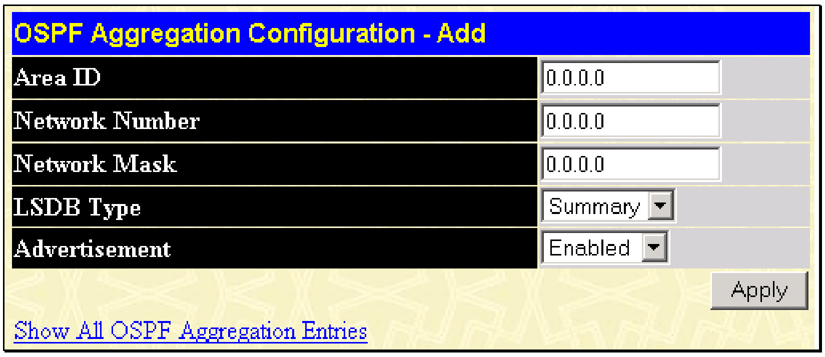


OSPF Area Aggregation Settings

Area ID	Network Number	Network Mask	LSDB Type	Advertisement	Delete
255.255.255.255	201.0.0.0	255.254.0.0	Summary	Enabled	☒
255.255.255.255	201.2.0.0	255.254.0.0	Summary	Enabled	☒

Figure 5- 37. OSPF Area Aggregation Settings window

Use the window below to change settings or add a new Area Aggregation setting.


OSPF Aggregation Configuration - Add

Area ID	0.0.0.0
Network Number	0.0.0.0
Network Mask	0.0.0.0
LSDB Type	Summary
Advertisement	Enabled

Figure 5- 38. OSPF Aggregation Configuration – Add window

Specify the OSPF Aggregation settings and click the **Apply** button to add or change the settings. The new settings will appear listed in the **OSPF Area Aggregation Settings** window. To view the table, click the Show All OSPF Aggregation Entries link to return to the previous window.

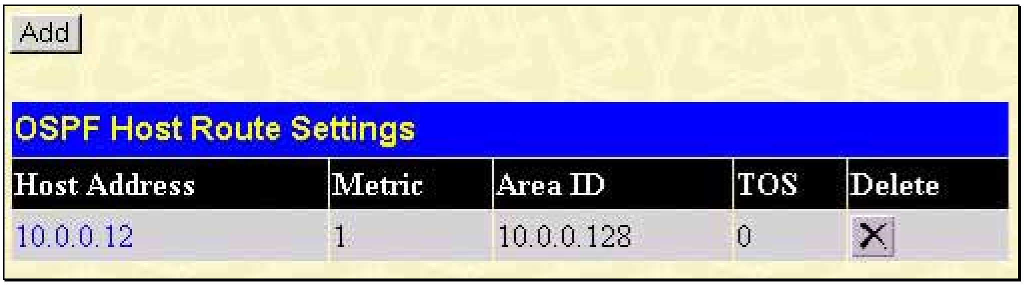
Configure the following settings for **OSPF Area Aggregation**:

Parameter	Description
Area ID	Allows the entry the OSPF Area ID for which the routing information will be aggregated. This Area ID must be previously defined on the Switch.
Network Number	Sometimes called the Network Address. The 32-bit number in the form of an IP address that uniquely identifies the network that corresponds to the OSPF Area above.
Network Mask	The corresponding network mask for the Network Number specified above.
LSDB Type	Specifies the type of address aggregation, which is set at *Summary*.
Advertisement	Select *Enabled* or *Disabled* to determine whether the selected OSPF Area will advertise it's summary LSDB (Network-Number and Network-Mask).

OSPF Host Route Settings

OSPF host routes work in a way analogous to RIP, only this is used to share OSPF information with other OSPF routers. This is used to work around problems that might prevent OSPF information sharing between routers.

To configure OSPF host routes, click the **OSPF Host Route Settings** link. To add a new OSPF Route, click the **Add** button. Configure the setting in the menu that appears. The Add and Modify windows for OSPF host route setting are nearly identical. The difference being that if you are changing an existing configuration you will be unable to change the Host Address. To change an existing configuration, click on the hyperlinked Host Address in the list for the configuration you want to change and proceed to change the metric or area ID. To eliminate an existing configuration, click the ***X*** in the **Delete** column for the configuration being removed.

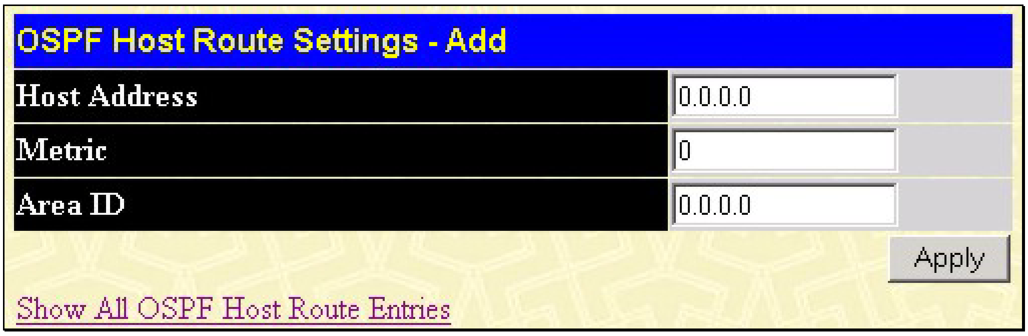


OSPF Host Route Settings

Host Address	Metric	Area ID	TOS	Delete
10.0.0.12	1	10.0.0.128	0	☒

Figure 5- 39. OSPF Host Route Settings window

Use the window below to set up OSPF host routes.



OSPF Host Route Settings - Add

Host Address	0.0.0.0
Metric	0
Area ID	0.0.0.0

Figure 5- 40. OSPF Host Route Settings – Add window

Specify the host route settings and click the **Apply** button to add or change the settings. The new settings will appear listed in the **OSPF Host Route Settings** window. To view the previous window, click the Show All OSPF Host Route Entries link to return to the previous window.

The following fields are configured for OSPF host route:

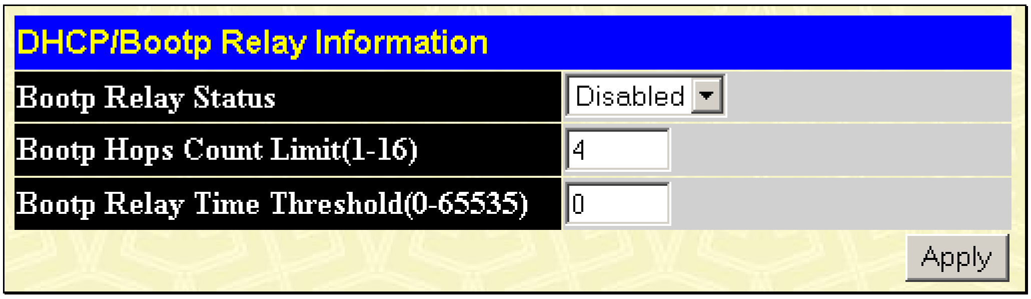
Parameter	Description
Host Address	The IP address of the OSPF host.
Metric	A value between 1 and 65535 that will be advertised for the route.
Area ID	A 32-bit number in the form of an IP address (xxx.xxx.xxx.xxx) that uniquely identifies the OSPF area in the OSPF domain.

DHCP/BOOTP Relay

The BOOTP hops count limit allows the maximum number of hops (routers) that the BOOTP messages can be relayed through to be set. If a packet's hop count is more than the hop count limit, the packet is dropped. The range is between *1* and *16* hops, with a default value of *4*. The relay time threshold sets the minimum time (in seconds) that the Switch will wait before forwarding a BOOTREQUEST packet. If the value in the seconds field of the packet is less than the relay time threshold, the packet will be dropped. The range is between *0* and *65,536* seconds, with a default value of *0* seconds.

DHCP/BOOTP Relay Information

To enable and configure BOOTP or DHCP on the Switch, click **Configuration** > **DHCP/BOOTP Relay** > **DHCP/BOOTP Relay Global Settings**:



DHCP/Bootp Relay Information

Bootp Relay Status	Disabled ▾
Bootp Hops Count Limit(1-16)	4
Bootp Relay Time Threshold(0-65535)	0

Figure 5- 41. DHCP/BOOTP Relay Information window

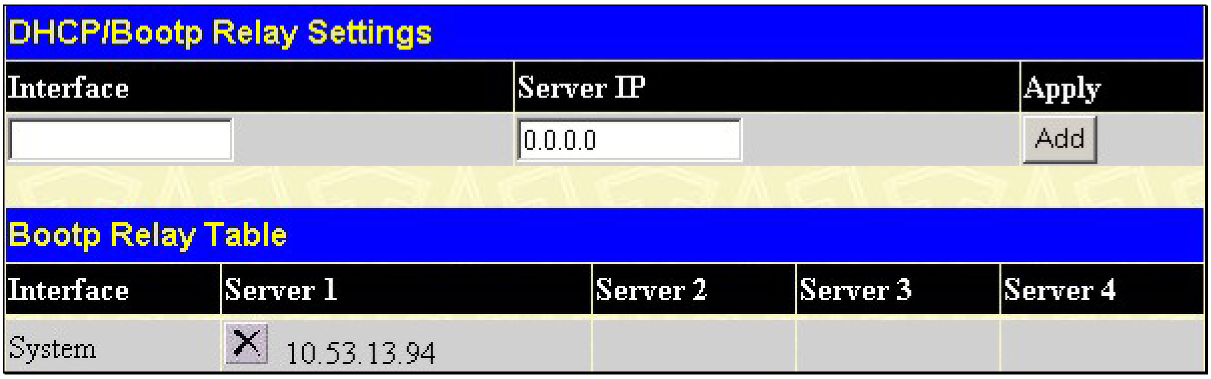
This window is used to enable BOOTP Relay and configure hops and time limit. Set the relay configuration as desired and click on the **Apply** button. These settings will be applied to all BOOTP/DHCP relays regardless of the destination or source.

Parameter	Description
BOOTP Relay State	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the BOOTP/DHCP Relay service on the Switch. The default is *Disabled*
BOOTP Relay Hops Count Limit (1-16)	This field allows an entry between *1* and *16* to define the maximum number of router hops across which BOOTP messages can be forwarded. The default hop count is *4*.
BOOTP Relay Time Threshold (0-65535)	Allows an entry between *0* and *65535* seconds, and defines the maximum time limit for routing a BOOTP/DHCP packet. If a value of 0 is entered, the Switch will not process the value in the seconds field of the BOOTP or DHCP packet. If a non-zero value is entered, the Switch will use that value, along with the hop count to determine whether to forward a given BOOTP or DHCP packet.

To configure BOOTP relay for individual IP interfaces, use the following window.

DHCP/BOOTP Relay Settings

The **DHCP/ BOOTP Relay Interface Settings** allow the user to set up a server, by IP address, for relaying DHCP/ BOOTP information to the Switch. The user may enter a previously configured IP interface on the Switch that will be connected directly to the DHCP/BOOTP server using the following window. Properly configured settings will be displayed in the **BOOTP Relay Table** at the bottom of the following window, once the user clicks the **Add** button under the **Apply** heading. The user may add up to four server IPs per IP interface on the Switch. Entries may be deleted by clicking it's corresponding ***X***.



DHCP/Bootp Relay Settings

Interface	Server IP	Apply
	0.0.0.0	Add

Bootp Relay Table

Interface	Server 1	Server 2	Server 3	Server 4
System	☒ 10.53.13.94			

Figure 5- 42. DHCP/BOOTP Relay Settings window

To create a new relay configuration, enter the IP interface name you want to configure for DHCP relay and the IP address of the server. Click on the **Add** button to enter the relay settings. Up to four servers can be entered for each IP interface. The information listed in the window is described as follows:

Parameter	Description
Interface	The IP interface on the Switch that will be connected directly to the Server.
Server IP	Enter the IP address of the DHCP/BOOTP server. Up to four server IPs can be configured per IP Interface

DNS Relay

Computer users usually prefer to use text names for computers for which they may want to open a connection. Computers themselves, require 32 bit IP addresses. Somewhere, a database of network devices' text names and their corresponding IP addresses must be maintained.

The Domain Name System (DNS) is used to map names to IP addresses throughout the Internet and has been adapted for use within intranets.

For two DNS servers to communicate across different subnets, the **DNS Relay** of the Switch must be used. The DNS servers are identified by IP addresses.

Mapping Domain Names to Addresses

Name-to-address translation is performed by a program called a Name server. The client program is called a Name resolver. A Name resolver may need to contact several Name servers to translate a name to an address.

The Domain Name System (DNS) servers are organized in a somewhat hierarchical fashion. A single server often holds names for a single network, which is connected to a root DNS server - usually maintained by an ISP.

Domain Name Resolution

The domain name system can be used by contacting the name servers one at a time, or by asking the domain name system to do the complete name translation. The client makes a query containing the name, the type of answer required, and a code specifying whether the domain name system should do the entire name translation, or simply return the address of the next DNS server if the server receiving the query cannot resolve the name.

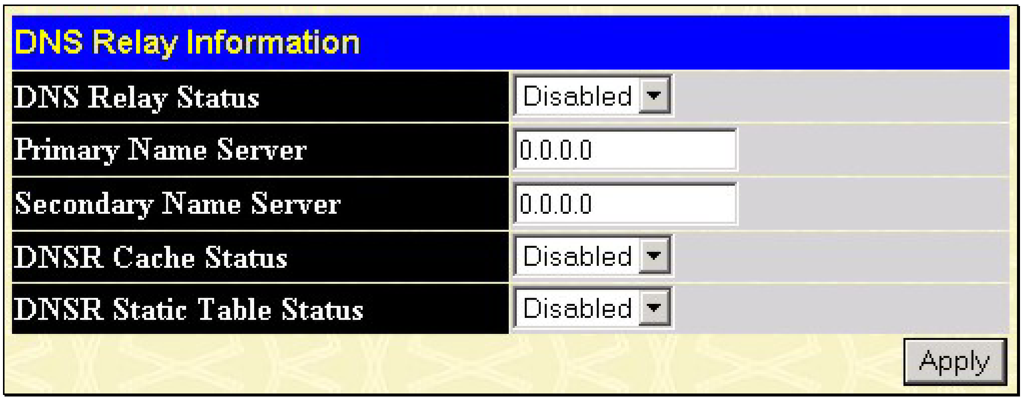
When a DNS server receives a query, it checks to see if the name is in its sub domain. If it is, the server translates the name and appends the answer to the query, and sends it back to the client. If the DNS server cannot translate the name, it determines what type of name resolution the client requested. A complete translation is called recursive resolution and requires the server to contact other DNS servers until the name is resolved. Iterative resolution specifies that if the DNS server cannot supply an answer, it returns the address of the next DNS server the client should contact.

Each client must be able to contact at least one DNS server, and each DNS server must be able to contact at least one root server.

The address of the machine that supplies domain name service is often supplied by a DHCP or BOOTP server, or can be entered manually and configured into the operating system at startup.

DNS Relay Information

To configure the DNS function on the Switch, click **Configuration > Layer 3 IP Networking > DNS Relay > DNS Relay Information**, which will open the **DNS Relay Information** window, as seen below:



DNS Relay Information

DNS Relay Status	Disabled
Primary Name Server	0.0.0.0
Secondary Name Server	0.0.0.0
DNSR Cache Status	Disabled
DNSR Static Table Status	Disabled

Figure 5- 43. DNS Relay Information window

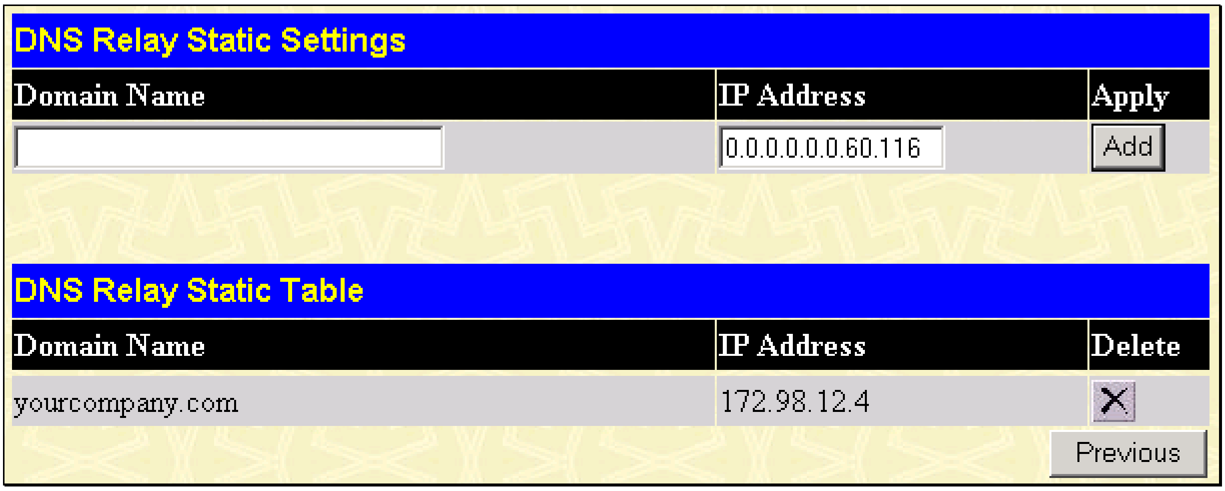
The **DNS Relay Information** window is used to enable DNS Relay and configure IP addresses for available DNS servers. Set the relay configuration as desired and click on the **Apply** button.

Parameter	Description
DNS Relay Status	Enable or disable DNS Relay.
Primary Name Server	Indicates that the IP address below is the address of the primary DNS server.
Secondary Name Server	Indicates that the IP address below is the address of the secondary DNS server.
DNSR Cache Status	Use this to enable the DNS relay cache function. The DNS cache relay can be used to temporarily store DNS relay information for faster recall.
DNSR Static Table Status	Use this to enable the DNS relay static table. This table will permanently store DNS relay information in a static table. Configure the table using the window pictured below.

To configure permanent entries for the **DNS Relay Static Table**, use the following window.

DNS Relay Static Settings

To view the **DNS Relay Static Settings**, click **Configuration** > **Layer 3 IP Networking** > **DNS Relay** > **DNS Relay Static Settings**, which will open the **DNS Relay Static Settings** window, as seen below:



DNS Relay Static Settings

Domain Name	IP Address	Apply
	0.0.0.0.0.0.60.116	Add

DNS Relay Static Table

Domain Name	IP Address	Delete
yourcompany.com	172.98.12.4	☒

Figure 5- 44. DNS Relay Static Settings window

To create a new **DNS Relay Static** entry, enter the **Domain Name** and the associated **IP Address**. Click on the **Add** button to enter the settings into the static table. Click the ***X*** in the Delete column to delete the corresponding entry.

Parameter	Description
Domain Name	The domain name used for the static entry.
IP Address	The IP address associated with the domain name.

VRRP

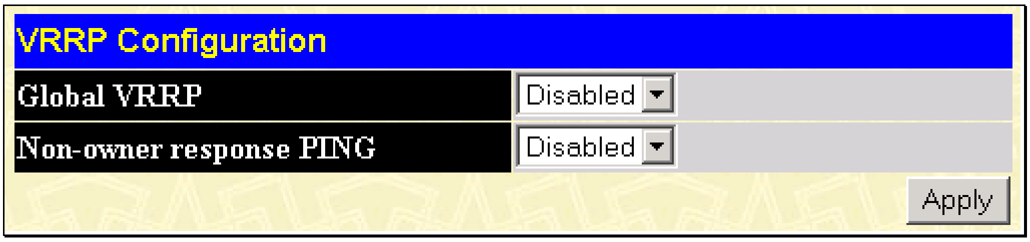
Virtual Routing Redundancy Protocol (VRRP) is a function on the Switch that dynamically assigns responsibility for a virtual router to one of the VRRP routers on a LAN. The VRRP router that controls the IP address associated with a virtual router is called the Master, and will forward packets sent to this IP address. This will allow any Virtual Router IP address on the LAN to be used as the default first hop router by end hosts. Utilizing VRRP, the administrator can achieve a higher available default path cost without needing to configure every end host for dynamic routing or routing discovery protocols.

Statically configured default routes on the LAN are prone to a single point of failure. VRRP is designed to eliminate these failures by setting an election protocol that will assign a responsibility for a virtual router to one of the VRRP routers on the LAN. When a virtual router fails, the election protocol will select a virtual router with the highest priority to be the Master router on the LAN. This retains the link and the connection is kept alive, regardless of the point of failure.

To configure VRRP for virtual routers on the Switch, an IP interface must be present on the system and it must be a part of a VLAN. VRRP IP interfaces may be assigned to every VLAN, and therefore IP interface, on the Switch. VRRP routers within the same VRRP group must be consistent in configuration settings for this protocol to function optimally.

VRRP Configuration

To enable VRRP globally on the Switch, click **Configuration** > **Layer 3 IP Networking** > **VRRP** > **VRRP Configuration**:



VRRP Configuration

Global VRRP: Disabled

Non-owner response PING: Disabled

Figure 5- 45. VRRP Configuration window

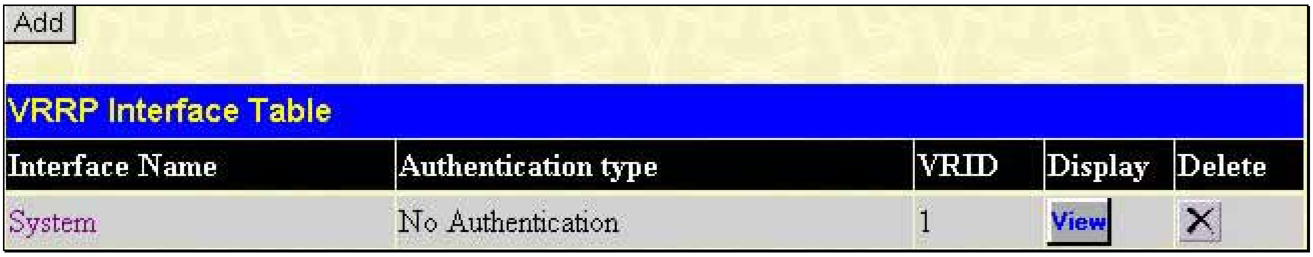
The following fields can be set:

Parameter	Description
Global VRRP	Use the pull-down menu to enable or disable VRRP globally on the Switch. The default is *Disabled*.
Non-owner response PING	Enabling this parameter will allow the virtual IP address to be PINGed from other host end nodes to verify connectivity. This will only enable the PING connectivity check function. This command is *Disabled* by default.

Click **Apply** to implement changes made.

VRRP Interface Settings

The following window will allow the user to set the parameters for the VRRP function on the Switch. To view this window, click **Configuration > Layer 3 IP Networking > VRRP > VRRP Interface Settings**:



VRRP Interface Table

Interface Name	Authentication type	VRID	Display	Delete
System	No Authentication	1	View	☒

Figure 5- 46. VRRP Interface Table window

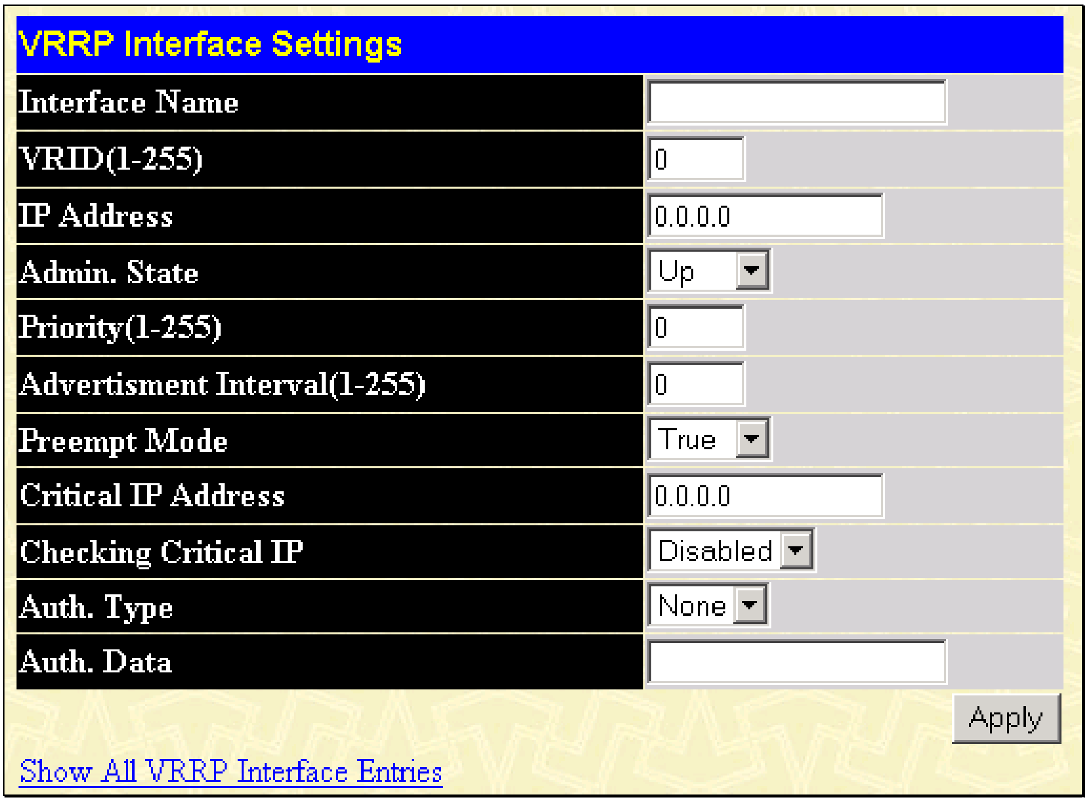
This window displays VRRP entries currently set on the Switch and holds the following information:

Parameter	Description
Interface Name	An IP interface name that has been enabled for VRRP. This entry must have been previously set in the **IP Interface Settings** window.
Authentication type	Displays the type of authentication used to compare VRRP packets received by a virtual router. Possible authentication types include: *No authentication* – No authentication has been selected to compare VRRP packets received by a virtual router. *Simple Text Password* – A Simple password has been selected to compare VRRP packets received by a virtual router, for authentication. *IP Authentication Header* – An MD5 message digest algorithm has been selected to compare VRRP packets received by a virtual router, for authentication.
VRID	Displays the virtual router ID set by the user. This will uniquely identify the VRRP Interface on the network.
Display	Click the View button to display the settings for this particular VRRP entry.
Delete	Click the ☒ to delete this VRRP entry.

Click the **Add** button to display the following window to configure a VRRP interface. Clicking a hyperlinked **Interface Name** will take you to the same window.

VRRP Interface Settings

The following window will allow the user to view the parameters for the VRRP function on the Switch. This window can also be used to set the authentication for each Interface configured for VRRP. This authentication is used to identify incoming message packets received by a router. If the authentication is not consistent with incoming packets, they will be discarded. The **Authentication Type** must be consistent with all routers participating within the VRRP group.



VRRP Interface Settings

Interface Name	
VRID(1-255)	0
IP Address	0.0.0.0
Admin. State	Up
Priority(1-255)	0
Advertisment Interval(1-255)	0
Preempt Mode	True
Critical IP Address	0.0.0.0
Checking Critical IP	Disabled
Auth. Type	None
Auth. Data	

Figure 5- 47. VRRP Interface Settings window

The following parameters may be set to configure an existing or new VRRP interface.

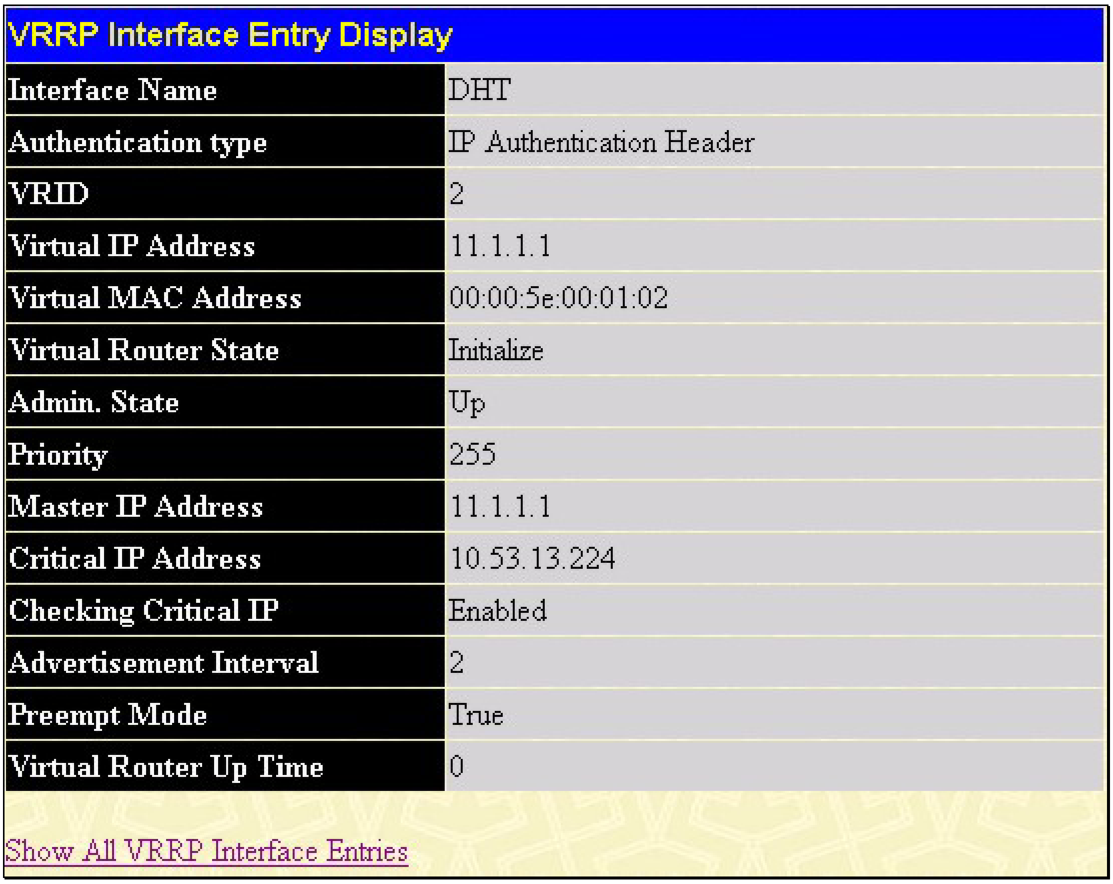
Parameter	Description
Interface Name	Enter the name of a previously configured IP interface to create a VRRP entry for. This IP interface must be assigned to a VLAN on the Switch.
VRID (1-255)	Enter a value between *1* and *255* to uniquely identify this VRRP group on the Switch. All routers participating in this group must be assigned the same *VRID* value. This value MUST be different from other VRRP groups set on the Switch.
IP Address	Enter the virtual IP address that will be assigned to the VRRP entry. This IP address is also the default gateway that will be statically assigned to end hosts and must be set for all routers that participate in this group.
Admin. State	Used to enable (*Up*) and disable (*Down*) the VRRP IP interface on the Switch.
Priority (1-255)	Enter a value between *1* and *255* to indicate the router priority. The VRRP Priority value may determine if a higher priority VRRP router overrides a lower priority VRRP router. A higher priority will increase the probability that this router will become the Master router of the group. A lower priority will increase the probability that this router will become the backup router. VRRP routers that are assigned the same priority value will elect the highest physical IP address as the Master router. The default value is *100*.

Advertisement Interval (1-255)	Enter a time interval value, in seconds, for sending VRRP message packets. This value must be consistent with all routers participating within the same VRRP group and is used to troubleshoot incorrectly configured routers. The default is *1* second.
Preempt Mode	This entry will determine the behavior of backup routers within the VRRP group by controlling whether a higher priority backup router will preempt a lower priority Master router. A *True* entry, along with having the backup router's priority set higher than the masters priority, will set the backup router as the Master router. A *False* entry will disable the backup router from becoming the Master router. This setting must be consistent with all routers participating within the same VRRP group. The default setting is *True*.
Critical IP Address	Enter the IP address of the physical device that will provide the most direct route to the Internet or other critical network connections from this virtual router. This must be a real IP address of a real device on the network. If the connection from the virtual router to this IP address fails, a new Master will be elected from the backup routers participating in the VRRP group. If the connection to the backup fails, this backup router cannot assume the Master router role. Different critical IP addresses may be assigned to different routers participating in the VRRP group, and can therefore define multiple routes to the Internet or other critical network connections.
Checking Critical IP	Use the pull-down menu to enable or disable the Critical IP address entered above.
Auth. Type	Specifies the type of authentication used. The Auth. Type must be consistent with all routers participating within the VRRP group. The choices are: *None* – Selecting this parameter indicates that VRRP protocol exchanges will not be authenticated. *Simple* – Selecting this parameter will require the user to set a simple password in the Auth. Data field for comparing VRRP message packets received by a router. If the two passwords are not exactly the same, the packet will be dropped. *IP* – Selecting this parameter will require the user to set a MD5 message digest for authentication in comparing VRRP messages received by the router. If the two values are inconsistent, the packet will be dropped.
Auth. Data	This field is only valid if the user selects *Simple* or *IP* in the Auth. Type field. *Simple* will require the user to enter an alphanumeric string of no more than eight characters to identify VRRP packets received by a router. *IP* will require the user to enter a MD5 message digest for authentication in comparing VRRP messages received by the router

Click **Apply** to implement changes made.

VRRP Interface Entry Display

To view the settings for a particular VRRP setting, click the corresponding View in the **VRRP Interface Table** window of the entry, which will display the following:



VRRP Interface Entry Display

Interface Name	DHT
Authentication type	IP Authentication Header
VRID	2
Virtual IP Address	11.1.1.1
Virtual MAC Address	00:00:5e:00:01:02
Virtual Router State	Initialize
Admin. State	Up
Priority	255
Master IP Address	11.1.1.1
Critical IP Address	10.53.13.224
Checking Critical IP	Enabled
Advertisement Interval	2
Preempt Mode	True
Virtual Router Up Time	0

Show All VRRP Interface Entries

Figure 5- 48. VRRP Interface Entry Display window

This window displays the following information:

Parameter	Description
Interface Name	An IP interface name that has been enabled for VRRP. This entry must have been previously set in the **IP Interface Settings** window.
Authentication type	Displays the type of authentication used to compare VRRP packets received by a virtual router. Possible authentication types include: *No authentication* – No authentication has been selected to compare VRRP packets received by a virtual router. *Simple Text Password* – A Simple password has been selected to compare VRRP packets received by a virtual router, for authentication. *IP Authentication Header* – An MD5 message digest algorithm has been selected to compare VRRP packets received by a virtual router, for authentication.
VRID	Displays the virtual router ID set by the user. This will uniquely identify the VRRP Interface on the network.
Virtual IP Address	The IP address of the Virtual router configured on the Switch.
Virtual MAC Address	The MAC address of the device that holds the Virtual router.

Virtual Router State	Displays the current status of the virtual router. Possible states include: Initialize, Master and Backup.
Admin. State	Displays the current state of the router. Up will be displayed if the virtual router is enabled and Down if the virtual router is disabled.
Priority	Displays the priority of the virtual router. A higher priority will increase the probability that this router will become the Master router of the group. A lower priority will increase the probability that this router will become the backup router. The lower the number, the higher the priority.
Master IP Address	Displays the IP address of the Master router for the VRRP function.
Critical IP Address	Displays the critical IP address of the VRRP function. This address will judge if a virtual router is qualified to be a master router.
Checking Critical IP	Displays the status of the Critical IP address. May be enabled or disabled.
Advertisement Interval	Displays the time interval, in seconds, that VRRP messages are sent out to the network.
Preempt Mode	Displays the mode for determining the behavior of backup routers set on this VRRP interface. True will denote that this will be the backup router, if the routers priority is set higher than the master router. False will disable the backup router from becoming the master router.
Virtual Router Up Time	Displays the time, in minutes, since the virtual router has been initialized

IP Multicast

Controlling Multicast Routing on the Switch includes setting up IGMP for IP interfaces, PIM and DVMRP. This chapter describes how to set these up. For an explanation of how these protocols function, read Appendix C.

IGMP

Computers and network devices that want to receive multicast transmissions need to inform nearby routers that they will become members of a multicast group. The **Internet Group Management Protocol (IGMP**) is used to communicate this information. IGMP is also used to periodically check the multicast group for members that are no longer active.

In the case where there is more than one multicast router on a subnetwork, one router is elected as the ‘querier’. This router then keeps track of the membership of the multicast groups that have active members. The information received from IGMP is then used to determine if multicast packets should be forwarded to a given subnetwork or not. The router can check, using IGMP, to see if there is at least one member of a multicast group on a given subnetwork. If there are no members on a subnetwork, packets will not be forwarded to that subnetwork.

IGMP Versions 1 and 2

Multicast groups allow members to join or leave at any time. IGMP provides the method for members and multicast routers to communicate when joining or leaving a multicast group.

IGMP version 1 is defined in RFC 1112. It has a fixed packet size and no optional data.

The format of an IGMP packet is shown below:

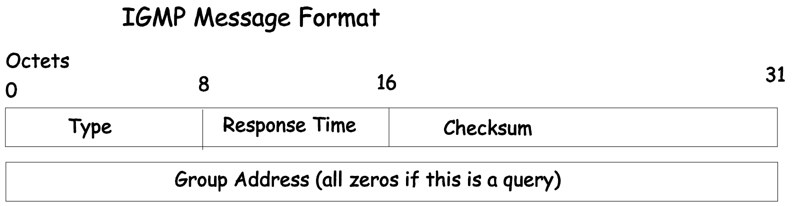


Figure 4- 80. IGMP Message Format

The IGMP Type codes are shown below:

Type	Meaning
0x11	Membership Query (if Group Address is 0.0.0.0)
0x11	Specific Group Membership Query (if Group Address is Present)
0x16	Membership Report (version 2)
0x17	Leave a Group (version 2)
0x12	Membership Report (version 1)

Table 6- 1. IGMP Type Codes

IGMP packets enable multicast routers to keep track of the membership of multicast groups, on their respective subnetworks. The following outlines what is communicated between a multicast router and a multicast group member using IGMP.

A host sends an IGMP “report” to join a group

A host will never send a report when it wants to leave a group (for version 1).

A host will send a “leave” report when it wants to leave a group (for version 2).

Multicast routers send IGMP queries (to the all-hosts group address: 224.0.0.1) periodically to see whether any group members exist on their subnetworks. If there is no response from a particular group, the router assumes that there are no group members on the network.

The Time-to-Live (TTL) field of query messages is set to 1 so that the queries will not be forwarded to other subnetworks.

IGMP version 2 introduces some enhancements such as a method to elect a multicast querier for each LAN, an explicit leave message, and query messages that are specific to a given group.

The states a computer will go through to join or to leave a multicast group are shown below:

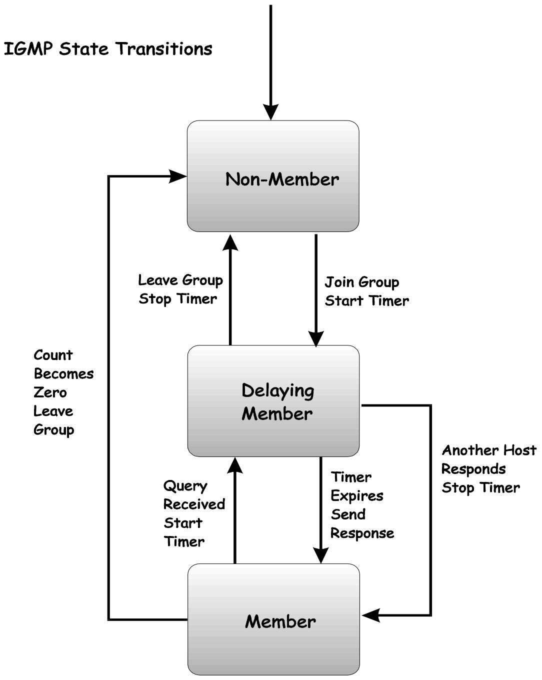
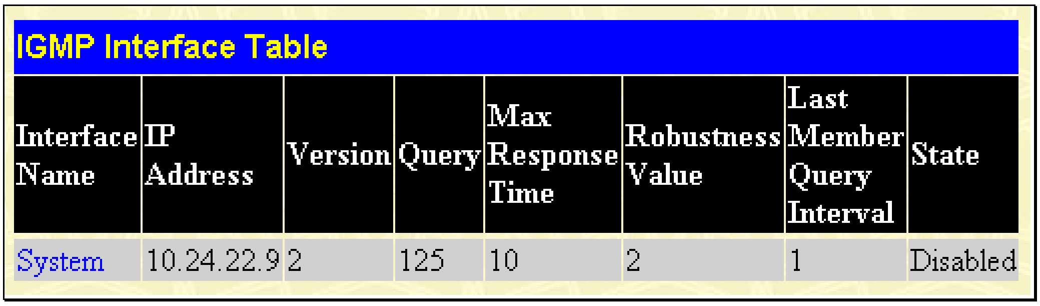

IGMP State Transitions
Non-Member
Leave Group Stop Timer
Join Group Start Timer
Count Becomes Zero Leave Group
Delaying Member
Another Host Responds Stop Timer
Query Received Start Timer
Timer Expires Send Response
Member

Figure 4- 81. IGMP State Transitions

IGMP for IP interfaces function the same way they do for individual ports or VLANs in Layer 2. Most of the parameters are the same as well, except instead of configuring for VLANs you are setting up IGMP for different subnets (IP interfaces).

IGMP Interface Settings

The IGMP interface links are located in the **IP Multicast** subfolder in the **Layer 3 IP Networking** configuration folder. Click **IGMP Interface Settings**:



IGMP Interface Table

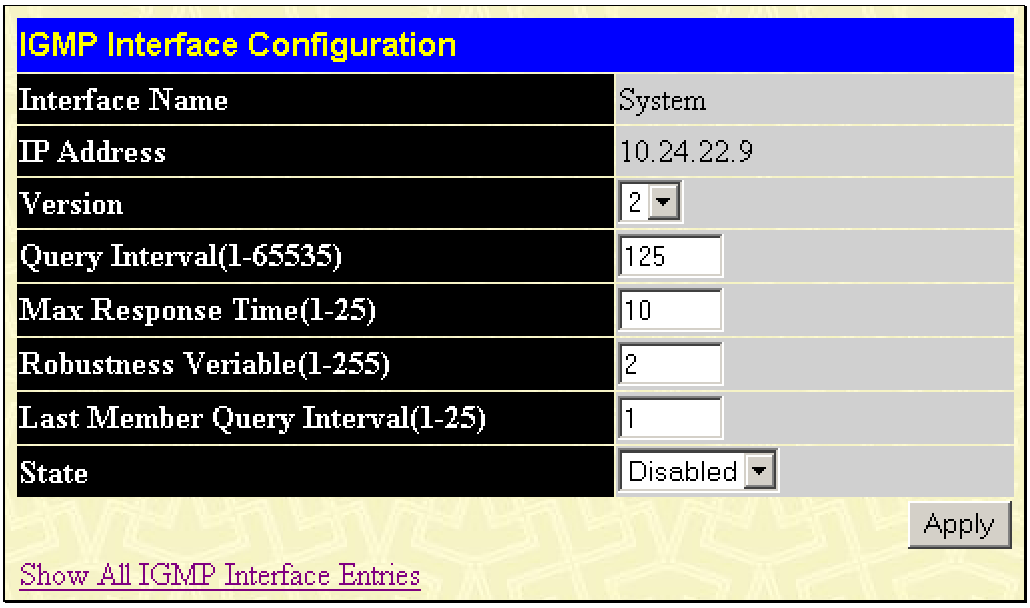
Interface Name	IP Address	Version	Query	Max Response Time	Robustness Value	Last Member Query Interval	State
System	10.24.22.9	2	125	10	2	1	Disabled

Figure 5- 49. IGMP Interface Table window

The Internet Group Multicasting Protocol (IGMP) can be configured on the Switch on a per-IP interface basis. Each IP interface configured on the Switch is displayed in the IGMP Interface Table. To configure an IP interface click on the hyperlinked **Interface Name**:

IGMP Interface Configuration

The Internet Group Multicasting Protocol (IGMP) can be configured on the Switch on a per-IP interface basis. To view the **IGMP Interface Table**, open the **IP Multicast Routing Protocol** folder under **Configuration** and click **IGMP Interface Settings.** Each IP interface configured on the Switch is displayed in the below **IGMP Interface Table** dialog box. To configure IGMP for a particular interface, click the corresponding hyperlink for that IP interface. This will open another **IGMP Interface Configuration** window:



IGMP Interface Configuration

Interface Name	System
IP Address	10.24.22.9
Version	2
Query Interval(1-65535)	125
Max Response Time(1-25)	10
Robustness Veriable(1-255)	2
Last Member Query Interval(1-25)	1
State	Disabled

Figure 5- 50. IGMP Interface Configuration window

Configure IGMP settings for each IP interface and click on the **Apply** button to apply the new or changed settings. The new values will appear in the IGMP Interface Table. To view the table click Show All IGMP Interface Entries.

The following IGMP interface parameters may be configured per interface:

Parameter	Description
Interface Name	Displays the name of the IP interface that is to be configured for IGMP. This must be a previously configured IP interface.

	previously configured IP interface.
IP Address	Displays the IP address corresponding to the IP interface name above.
Version	Enter the IGMP version (1 or 2) that will be used to interpret IGMP queries on the interface.
Query Interval	Allows the entry of a value between *1* and *65535* seconds, with a default of 125 seconds. This specifies the length of time between sending IGMP queries.
Max Response Time	Sets the maximum amount of time allowed before sending an IGMP response report. A value between 1 and 25 seconds can be entered, with a default of 10 seconds.
Robustness Variable	A tuning variable to allow for subnetworks that are expected to lose a large number of packets. A value between 2 and 255 can be entered, with larger values being specified for subnetworks that are expected to lose larger numbers of packets.
Last Member Query Interval	Specifies the maximum amount of time between group-specific query messages, including those sent in response to leave group messages. A value between 1 and 25. The default is *1* second.
State	This field can be toggled between *Enabled* and *Disabled* and enables or disables IGMP for the IP interface. The default is *Disabled*.

NOTE: The Robustness Variable field allows IGMP to be ‘tuned’ for sub-networks that are expected to lose many packets. A high value (max. 255) for the robustness variable will help compensate for ‘lossy’ sub-networks. A low value (min. 2) should be used for less ‘lossy’ sub-networks.

DVMRP

The Distance Vector Multicast Routing Protocol (**DVMRP**) is a hop-based method of building multicast delivery trees from multicast sources to all nodes of a network. Because the delivery trees are 'pruned' and 'shortest path', DVMRP is relatively efficient. Because multicast group membership information is forwarded by a distance-vector algorithm, propagation is slow. DVMRP is optimized for high delay (high latency) relatively low bandwidth networks, and can be considered as a 'best-effort' multicasting protocol.

DVMRP resembles the Routing Information Protocol (RIP), but is extended for multicast delivery. DVMRP builds a routing table to calculate 'shortest paths' back to the source of a multicast message, but defines a 'route cost' (similar to the hop count in RIP) as a relative number that represents the real cost of using this route in the construction of a multicast delivery tree to be 'pruned' - once the delivery tree has been established.

When a sender initiates a multicast, DVMRP initially assumes that all users on the network will want to receive the multicast message. When an adjacent router receives the message, it checks its unicast routing table to determine the interface that gives the shortest path (lowest cost) back to the source. If the multicast was received over the shortest path, then the adjacent router enters the information into its tables and forwards the message. If the message is not received on the shortest path back to the source, the message is dropped.

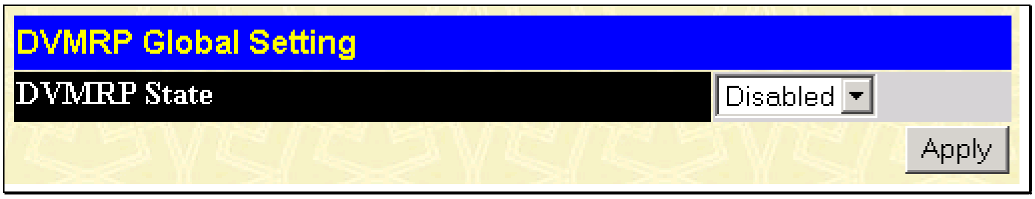
Route cost is a relative number that is used by DVMRP to calculate which branches of a multicast delivery tree should be 'pruned'. The 'cost' is relative to other costs assigned to other DVMRP routes throughout the network.

The higher the route cost, the lower the probability that the current route will be chosen to be an active branch of the multicast delivery tree (not 'pruned') - if there is an alternative route.

The DVMRP settings links are located in the **DVMRP** subfolder located in the **Layer 3 IP Networking** configuration folder.

DVMRP Global Setting

To use DVMRP on the Switch it must be enabled globally. Use the **DVMRP Global Setting** window to enable or disable DVMRP globally. Disabling DVMRP will not affect any DVMRP settings that have been configured so it can later be enabled and apply the same settings. To enable DVMRP globally on the Switch, click **Configuration** > **Layer 3 IP Networking** > **IP Multicast** > **DVMRP** > **DVMRP Global Settings**. This will give the user access to the following screen:



DVMRP Global Setting

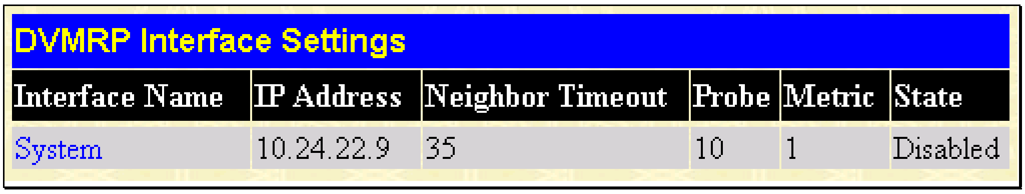
DVMRP State: Disabled

Figure 5- 51. DVMRP Global Setting window

Select *Enabled* or *Disabled* and click on the **Apply** button to make the change.

DVMRP Interface Settings

To configure existing IP interfaces on the Switch for DVMRP, use the **DVMRP Interface Settings** window.

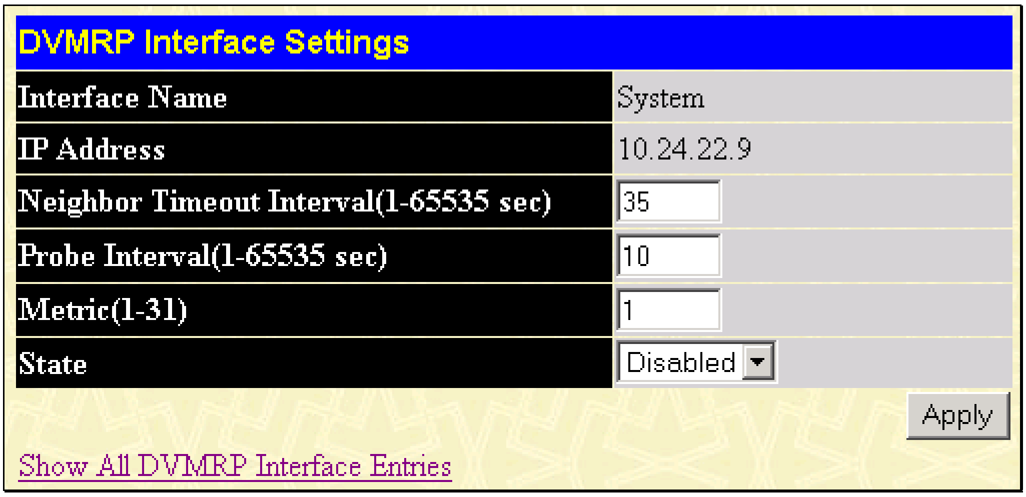


DVMRP Interface Settings

Interface Name	IP Address	Neighbor Timeout	Probe	Metric	State
System	10.24.22.9	35	10	1	Disabled

Figure 5- 52. DVMRP Interface Settings window

DVMRP settings can be configured on the Switch for existing IP interfaces. Each IP interface configured on the Switch is displayed in the **DVMRP Interface Settings** table. To configure an IP interface, click on the hyperlinked **Interface Name**:



DVMRP Interface Settings

Interface Name	System
IP Address	10.24.22.9
Neighbor Timeout Interval(1-65535 sec)	35
Probe Interval(1-65535 sec)	10
Metric(1-31)	1
State	Disabled

Figure 5- 53. DVMRP Interface Settings window - Modify

Configure DVMRP settings for each IP interface and click on the **Apply** button to apply the new or changed settings. The new values will appear in the DVMRP Interface Settings table in the previous window. To view the table click Show All DVMRP Interface Entries.

The table below describes the parameters necessary for DVMRP configuration.

Configure these settings for each DVMRP interface:

Parameter	Description
Interface Name	Displays the name of the IP interface for which DVMRP is to be configured. This must be a previously defined IP interface.
IP Address	Displays the IP address corresponding to the IP Interface name entered above.
Neighbor Timeout Interval (1-65535)	This field allows an entry between *1* and *65,535* seconds and defines the time period DVMRP will hold Neighbor Router reports before issuing poison route messages. The default is *35* seconds*.*
Probe Interval (1-65535)	This field allows an entry between *1* and *65,535* seconds and defines the interval between 'probes'. The default is *10*.
Metric (1-31)	This field allows an entry between *1* and *31* and defines the route cost for the IP interface. The DVMRP route cost is a relative number that represents the real cost of using this route in the construction of a multicast delivery tree. It is similar to, but not defined as, the hop count in RIP. The default cost is *1*.
State	This field can be toggled between *Enabled* and *Disabled* and enables or disables DVMRP for the IP interface. The default is *Disabled*.

PIM

The *Protocol Independent Multicast - Dense Mode* (PIM-DM) protocol should be used in networks with a low delay (low latency) and high bandwidth as PIM-DM is optimized to guarantee delivery of multicast packets, not to reduce overhead.

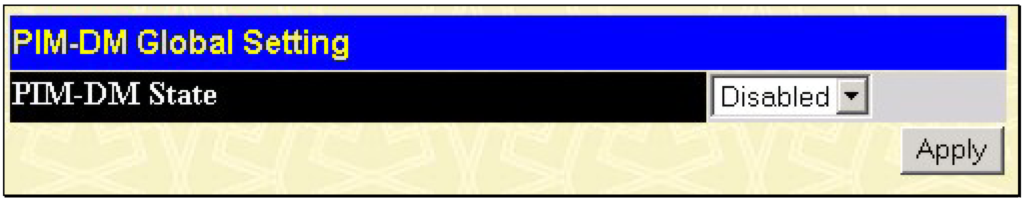
The PIM-DM multicast routing protocol is assumes that all downstream routers want to receive multicast messages and relies upon explicit prune messages from downstream routers to remove branches from the multicast delivery tree that do not contain multicast group members.

PIM-DM has no explicit ‘join’ messages. It relies upon periodic flooding of multicast messages to all interfaces and then either waiting for a timer to expire (the **Join/Prune Interval**) or for the downstream routers to transmit explicit ‘prune’ messages indicating that there are no multicast members on their respective branches. PIM-DM then removes these branches (‘prunes’ them) from the multicast delivery tree.

Because a member of a pruned branch of a multicast delivery tree may want to join a multicast delivery group (at some point in the future), the protocol periodically removes the ‘prune’ information from its database and floods multicast messages to all interfaces on that branch. The interval for removing ‘prune’ information is the **Join/Prune Interval**.

PIM-DM Global Setting

To use PIM-DM on the Switch it must be enabled globally. Use the **PIM-DM Global Setting** window to enable or disable PIM-DM globally. Disabling PIM-DM will not affect any PIM-DM settings that have been configured so it can later be enabled and apply the same settings. To enable PIM-DM globally on the Switch, go to **Configuration > Layer 3 IP Networking > IP Multicast > PIM > PIM-DM Interface Settings**. This will give the user access to the following screen:



PIM-DM Global Setting

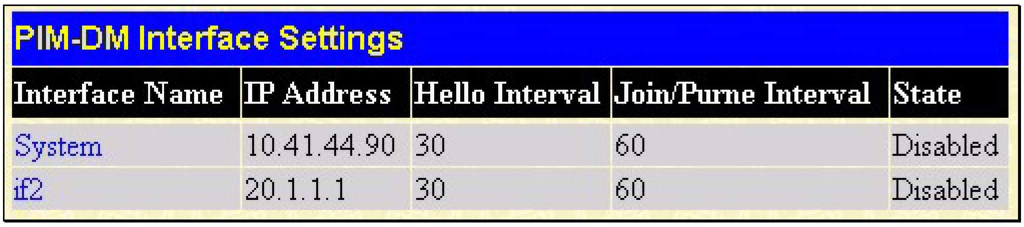
PIM-DM State: Disabled

Figure 5- 54. PIM-DM Global Setting window

Select *Enabled* or *Disabled* and click on the **Apply** button to make the change.

PIM-DM Interface Settings

To view the **PIM-DM Interface Settings**, click **Configuration > Layer 3 IP Networking > IP Multicast > PIM > PIM-DM Interface Settings.** This window allows the **PIM-DM** to be configured for each IP interface defined on the Switch. Each IP interface configured on the Switch is displayed in the below **PIM-DM Interface Settings** dialog box. To configure PIM-DM for a particular interface, click the corresponding hyperlink for that IP interface. This will open the **PIM-DM Interface Settings** window:

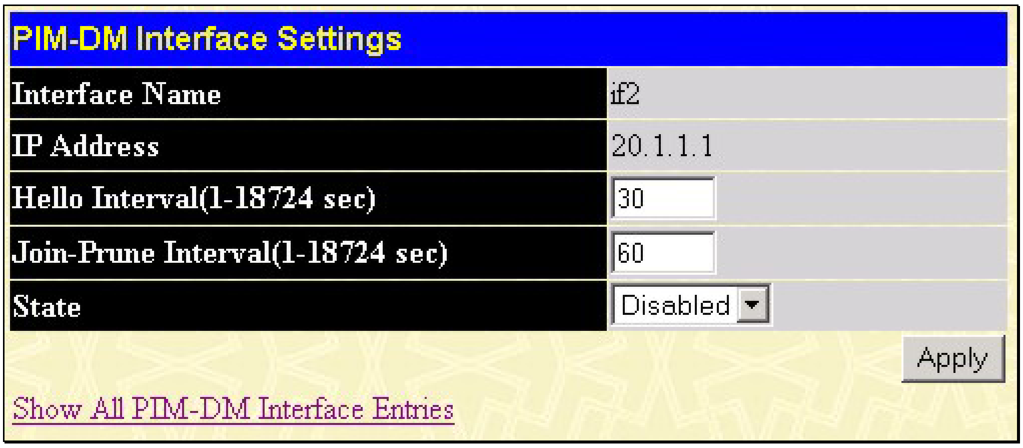


PIM-DM Interface Settings

Interface Name	IP Address	Hello Interval	Join/Purne Interval	State
System	10.41.44.90	30	60	Disabled
if2	20.1.1.1	30	60	Disabled

Figure 5- 55. PIM-DM Interface Settings window

PIM-DM settings can be configured on the Switch for existing IP interfaces. Each IP interface configured on the Switch is displayed in the **PIM-DM Interface Settings** window. To configure an IP interface click on the hyperlinked **Interface Name**:



PIM-DM Interface Settings

Interface Name	if2
IP Address	20.1.1.1
Hello Interval(1-18724 sec)	30
Join-Prune Interval(1-18724 sec)	60
State	Disabled

Figure 5- 56. 2nd PIM-DM Interface Settings window - Modify

Configure PIM-DM settings for each IP interface and click on the **Apply** button to apply the new or changed settings. The new values will appear in the **PIM-DM Interface Settings** window. To view the table click Show All PIM-DM Interface Entries.

The table below describes the parameters necessary for PIM-DM configuration.

Configure these parameters for PIM-DM interfaces:

Parameter	Description
Interface Name	Allows the entry of the name of the IP interface for which PIM-DM is to be configured. This must be a previously defined IP interface.
IP Address	Displays the IP address for the IP interface named above.
Hello Interval (1-18724)	This field allows an entry of between *1* and *18724* seconds and determines the interval between sending Hello packets to other routers on the network. The default is *30* seconds.
Join/Prune Interval (1-18724)	This field allows an entry of between *1* and *18724* seconds. This interval also determines the time interval the router uses to automatically remove prune information from a branch of a multicast delivery tree and begin to flood multicast messages to all branches of that delivery tree. These two actions are equivalent. The default is *60* seconds.
State	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu, and is used to enable or disable PIM-DM for the IP interface. The default is *Disabled*.

Section 6

Security

Trusted Host

Secure Socket Layer (SSL)

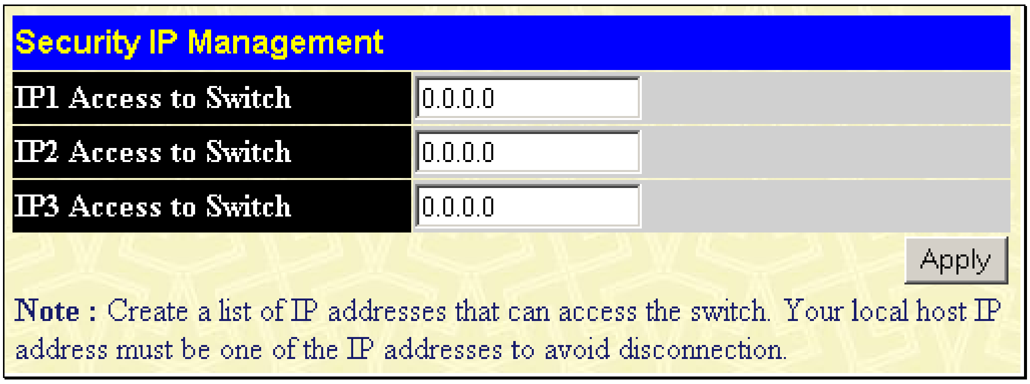
Secure Shell (SSH)

Access Authentication Control

Trusted Host

The **Security IP Management** window allows you to specify the IP addresses of management stations (PCs) on your network that will be allowed to access the Switch's Web-based management agent.

You can enter up to three IP addresses of local hosts (on the same subnet as the Switch) that will be allowed to manage the Switch. It is recommended that the IP address of the local host that will be used to manage the Switch be entered here to avoid possible frequent disconnection from the Switch's Web-based management agent.



Security IP Management

IP1 Access to Switch	0.0.0.0
IP2 Access to Switch	0.0.0.0
IP3 Access to Switch	0.0.0.0

Note : Create a list of IP addresses that can access the switch. Your local host IP address must be one of the IP addresses to avoid disconnection.

Figure 6- 1. Security IP Management window

Use the **Security IP Management** to permit remote stations to manage the Switch. If you choose to define one or more designated management stations, only the chosen stations, as defined by IP address, will be allowed management privilege through the web manager or Telnet session. This IP address must be on the same subnet as the Switch. To define a management station IP setting, type in the IP address and click the **Apply** button.

Secure Socket Layer (SSL)

Secure Sockets Layer or SSL is a security feature that will provide a secure communication path between a host and client through the use of authentication, digital signatures and encryption. These security functions are implemented through the use of a ciphersuite, which is a security string that determines the exact cryptographic parameters, specific encryption algorithms and key sizes to be used for an authentication session and consists of three levels:

Key Exchange: The first part of the ciphersuite string specifies the public key algorithm to be used. This switch utilizes the Rivest Shamir Adleman (RSA) public key algorithm and the Digital Signature Algorithm (DSA), specified here as the DHE DSS Diffie-Hellman (DHE) public key algorithm. This is the first authentication process between client and host as they “exchange keys” in looking for a match and therefore authentication to be accepted to negotiate encryptions on the following level.

Encryption: The second part of the ciphersuite that includes the encryption used for encrypting the messages sent between client and host. The Switch supports two types of cryptology algorithms:

Stream Ciphers – There are two types of stream ciphers on the Switch, RC4 with 40-bit keys and RC4 with 128-bit keys. These keys are used to encrypt messages and need to be consistent between client and host for optimal use.

CBC Block Ciphers – CBC refers to Cipher Block Chaining, which means that a portion of the previously encrypted block of encrypted text is used in the encryption of the current block. The Switch supports the 3DES EDE encryption code defined by the Data Encryption Standard (DES) to create the encrypted text.

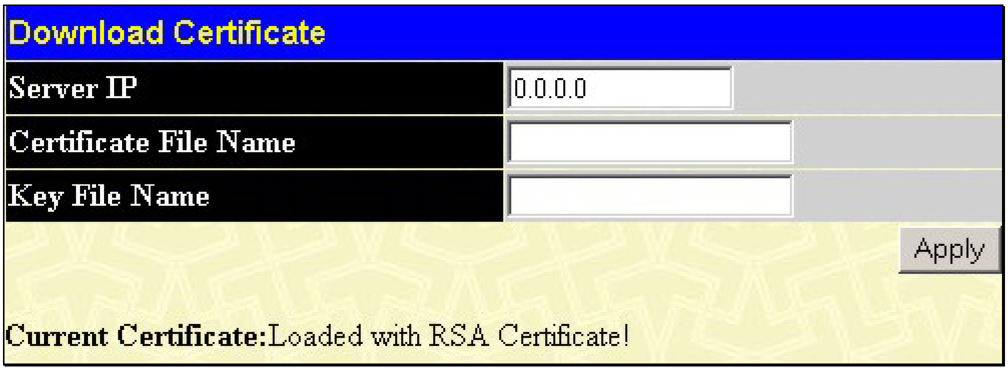
Hash Algorithm: This part of the ciphersuite allows the user to choose a message digest function that will determine a Message Authentication Code. This Message Authentication Code will be encrypted with a sent message to provide integrity and prevent against replay attacks. The Switch supports two hash algorithms, MD5 (Message Digest 5) and SHA (Secure Hash Algorithm).

These three parameters are uniquely assembled in four choices on the Switch to create a three-layered encryption code for secure communication between the server and the host. The user may implement any one or combination of the ciphersuites available, yet different ciphersuites will affect the security level and the performance of the secured connection. The information included in the ciphersuites is not included with the Switch and requires downloading from a third source in a file form called a certificate. This function of the Switch cannot be executed without the presence and implementation of the certificate file and can be downloaded to the Switch by utilizing a TFTP server. The Switch supports SSLv3 and TLSv1. Other versions of SSL may not be compatible with this switch and may cause problems upon authentication and transfer of messages from client to host.

Download Certificate

This window is used to download a certificate file for the SSL function on the Switch from a TFTP server. The certificate file is a data record used for authenticating devices on the network. It contains information on the owner, keys for authentication and digital signatures. Both the server and the client must have consistent certificate files for optimal use of the SSL function. The Switch only supports certificate files with `.der` file extensions and comes with one RSA certificate already set in the Switch.

To view the following window, click **Security** > **Secure Socket Layer (SSL)** > **Download Certificate**:



Download Certificate

Server IP	0.0.0.0
Certificate File Name	
Key File Name	

Current Certificate:Loaded with RSA Certificate!

Figure 6- 2. Download Certificate window

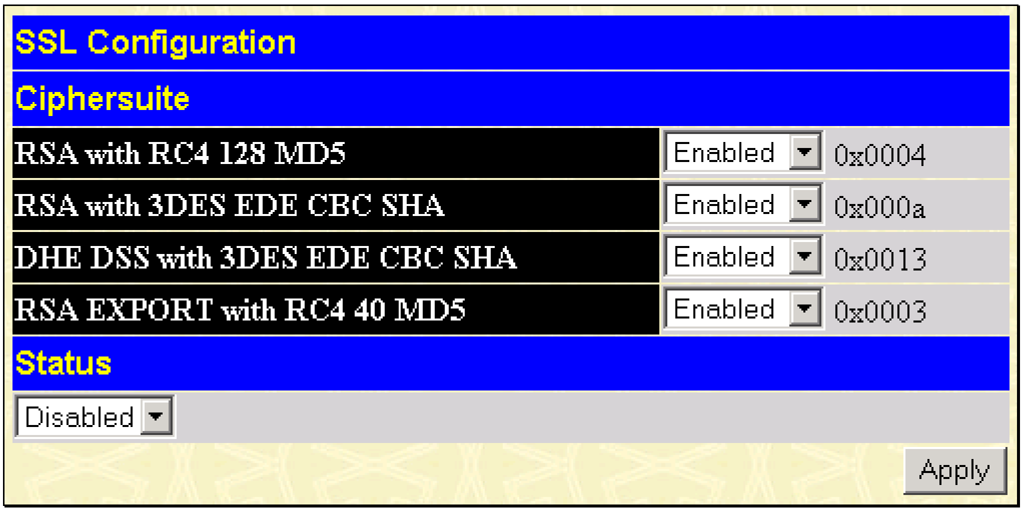
To download certificates, set the following parameters and click **Apply**.

Parameter	Description
Server IP	Enter the IP address of the TFTP server where the certificate files are located.
Certificate File Name	Enter the path and the filename of the certificate file to download. This file must have a .der extension. (Ex. c:/cert.der)
Key File Name	Enter the path and the filename of the key file you wish to download. This file must have a .der extension (Ex. c:/pkey.der)

Configuration

This window will allow the user to enable SSL on the Switch and implement any one or combination of listed ciphersuites on the Switch. A ciphersuite is a security string that determines the exact cryptographic parameters, specific encryption algorithms and key sizes to be used for an authentication session. The Switch possesses four possible ciphersuites for the SSL function, which are all enabled by default. To utilize a particular ciphersuite, disable the unwanted ciphersuites, leaving the desired one for authentication. When the SSL function has been enabled, the web will become disabled. To manage the Switch through the web based management while utilizing the SSL function, the web browser must support SSL encryption and the header of the URL must begin with https://. (Ex. https://10.90.90.90) Any other method will result in an error and no access can be authorized for the web-based management.

To view the following window, click **Security** > **Secure Socket Layer (SSL)** > **Configuration**:



SSL Configuration

Ciphersuite

RSA with RC4 128 MD5	Enabled	0x0004
RSA with 3DES EDE CBC SHA	Enabled	0x000a
DHE DSS with 3DES EDE CBC SHA	Enabled	0x0013
RSA EXPORT with RC4 40 MD5	Enabled	0x0003

Status

Disabled

Figure 6- 3. SSL Configuration window

To set up the SSL function on the Switch, configure the following parameters and click **Apply**.

Parameter	Description
RSA with RC4 128 MD5	This ciphersuite combines the RSA key exchange, stream cipher RC4 encryption with 128-bit keys and the MD5 Hash Algorithm. Use the pull-down menu to enable or disable this ciphersuite. This field is *Enabled* by default.
RSA with 3DES EDE CBC SHA	This ciphersuite combines the RSA key exchange, CBC Block Cipher 3DES_EDE encryption and the SHA Hash Algorithm. Use the pull-down menu to enable or disable this ciphersuite. This field is *Enabled* by default.
DHE DSS with 3DES EDE CBC SHA	This ciphersuite combines the DSA Diffie Hellman key exchange, CBC Block Cipher 3DES_EDE encryption and SHA Hash Algorithm. Use the pull-down menu to enable or disable this ciphersuite. This field is *Enabled* by default.

RSA EXPORT with RC4 40 MD5	This ciphersuite combines the RSA Export key exchange and stream cipher RC4 encryption with 40-bit keys. Use the pull-down menu to enable or disable this ciphersuite. This field is *Enabled* by default.
Status	You can individually enable or disable these four ciphersuites above or use this Status drop-down menu to globally turn encryption on or off without changing the ciphersuite settings you have already made. The default is *Disabled*.

NOTE: Certain implementations concerning the function and configuration of SSL are not available on the web-based management of this Switch and need to be configured using the command line interface. For more information on SSL and its functions, see the ***DGS-3312SR Command Line Reference Manual***, located on the documentation CD of this product.

NOTE: Enabling the SSL command will disable the web-based switch management. To log on to the Switch again, the header of the URL must begin with https://. Entering anything else into the address field of the web browser will result in an error and no authentication will be granted.

Secure Shell (SSH)

SSH is the abbreviation of Secure Shell, which is a program allowing secure remote login and secure network services over an insecure network. It allows you to securely login to remote host computers, to execute commands safely in a remote computer and so forth, and to provide secure encrypted and authenticated communications between two non-trusted hosts. SSH with its array of unmatched security features is an essential tool in today's network environment. It is a powerful guardian against the numerous security hazards that nowadays threaten network communications.

The steps required to use the SSH protocol for secure communication between a remote PC (the SSH Client) and the Switch (the SSH Server), are as follows:

1. Create a user account with admin-level access using the **User Accounts** window in the **Management** folder. This is identical to creating any other admin-lever User account on the Switch, including specifying a password. This password is used to login to the Switch, once secure communication has been established using the SSH protocol.

2. Configure the user account to use a specified authorization method to identify users that are allowed to establish SSH connections with the Switch using the **SSH User Authentication** window. There are three choices as to the method SSH will use to authorize the user, and they are Host Based, Password, Public Key, and None.

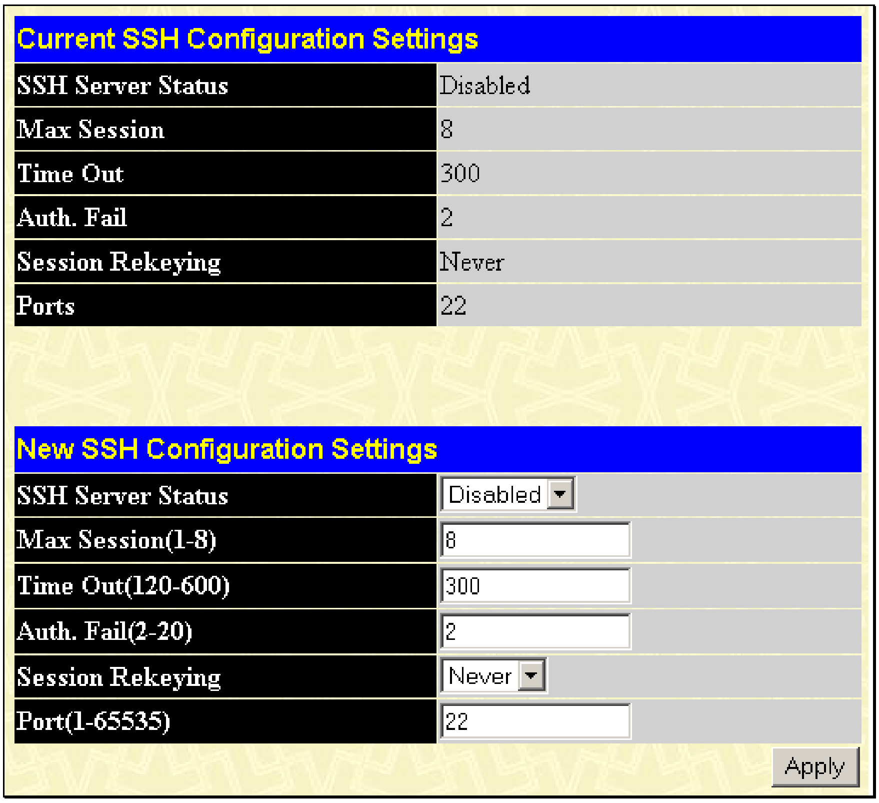
3. Configure the encryption algorithm that SSH will use to encrypt and decrypt messages sent between the SSH Client and the SSH Server, using the **SSH Algorithm** window.

4. Finally, enable SSH on the Switch using the **SSH User Authentication** window.

After following the above steps, you can configure an SSH Client on the remote PC and manage the Switch using secure, in-band communication.

SSH Configuration

The following window is used to configure and view settings on the SSH server and can be opened by clicking **Security > Secure Shell (SSH) > SSH Configuration**:



Current SSH Configuration Settings	
SSH Server Status	Disabled
Max Session	8
Time Out	300
Auth. Fail	2
Session Rekeying	Never
Ports	22

New SSH Configuration Settings	
SSH Server Status	Disabled
Max Session(1-8)	8
Time Out(120-600)	300
Auth. Fail(2-20)	2
Session Rekeying	Never
Port(1-65535)	22

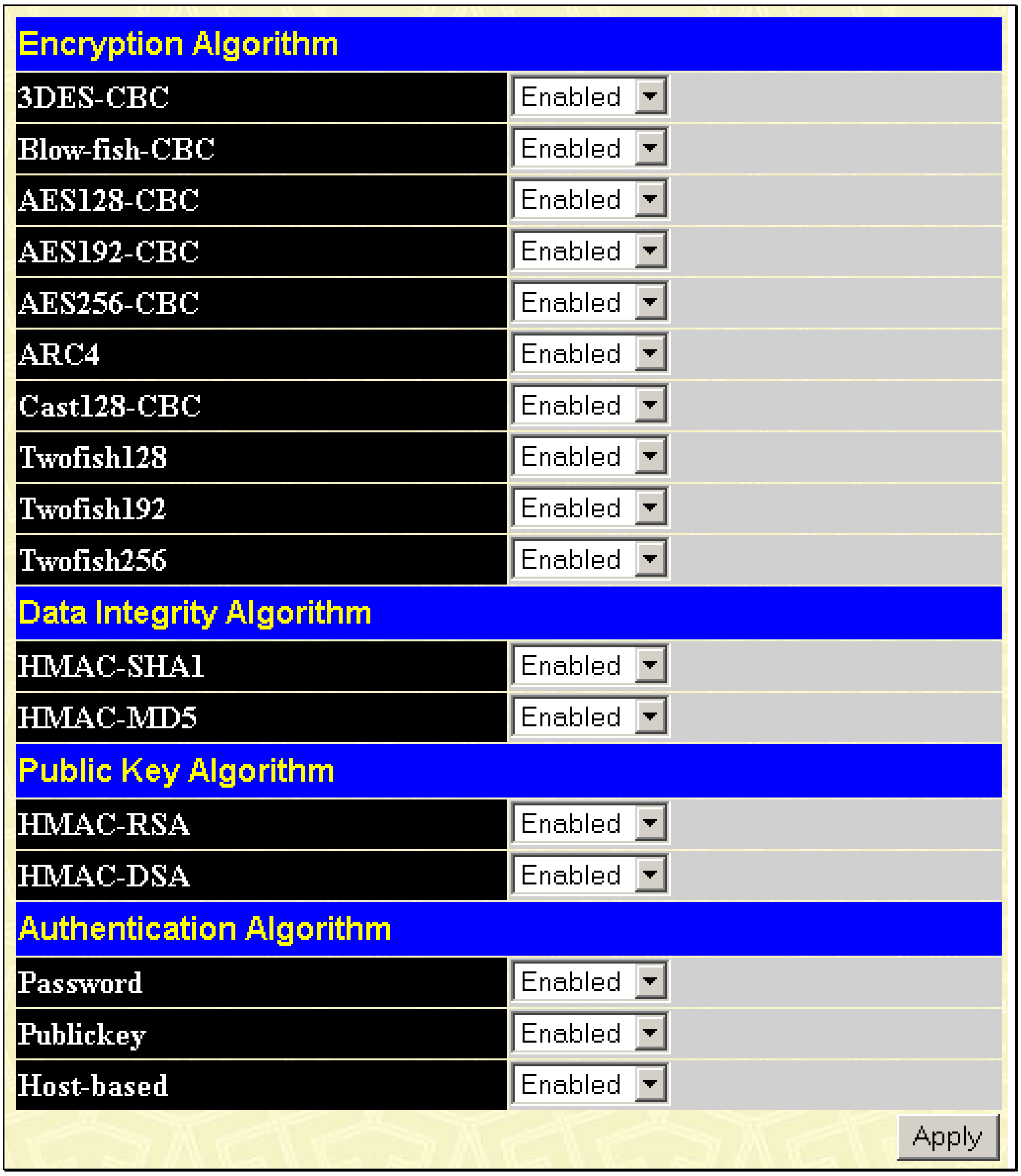
Figure 6- 4. Current SSH Configuration Settings window

To set up the SSH server on the Switch, configure the following parameters and click **Apply**.

Parameter	Description
SSH Server Status	Use the pull-down menu to enable or disable SSH on the Switch. The default is *Disabled*.
Max Session (1-8)	Enter a value between *1* and *8* to set the number of users that may simultaneously access the Switch. The default is *8*.
Time Out (120-600)	Allows the user to set the connection timeout. The user may set a time between *120* and *600* seconds. The default is *300* seconds.
Auth. Fail (2-20)	Allows the administrator to set the maximum number of attempts that a user may try to log on to the SSH Server utilizing SSH authentication. After the maximum number of attempts is exceeded, the Switch will be disconnected and the user must reconnect to the Switch to attempt another login. The number of maximum attempts may be set between *2* and *20*. The default is *2*.
Session Rekeying	The user may set the time period that the Switch will change the security shell encryptions by using the pull-down menu. The options are *Never*, *10 min, 30 min,* and *60 min*. The default setting is *Never*.
Port (1-65535)	Enter the TCP port number associated with this function. The default TCP port number for SSH is *22*.

SSH Algorithm

The **Encryption Algorithm** window allows the configuration of the desired types of SSH algorithm used for authentication encryption. There are four categories of algorithms listed and specific algorithms in each may be enabled or disabled by using their corresponding pull-own menu. All algorithms are enabled by default. To view the following window, click **Security** > **Secure Shell (SSH)** > **SSH Algorithm**.



Encryption Algorithm	
3DES-CBC	Enabled
Blow-fish-CBC	Enabled
AES128-CBC	Enabled
AES192-CBC	Enabled
AES256-CBC	Enabled
ARC4	Enabled
Cast128-CBC	Enabled
Twofish128	Enabled
Twofish192	Enabled
Twofish256	Enabled
Data Integrity Algorithm	
HMAC-SHA1	Enabled
HMAC-MD5	Enabled
Public Key Algorithm	
HMAC-RSA	Enabled
HMAC-DSA	Enabled
Authentication Algorithm	
Password	Enabled
Publickey	Enabled
Host-based	Enabled

Figure 6- 5. Encryption Algorithm window

The user may set the following parameters:

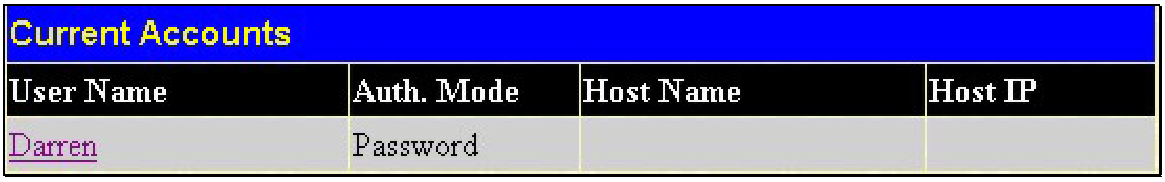
Parameter	Description
Encryption Algorithm	
3DES-CBC	Use the pull-down menu to enable or disable the Triple_Data Encryption Standard encryption algorithm with Cipher Block Chaining. The default is *Enabled.*
Blow-fish CBC	Use the pull-down menu to enable or disable the Blowfish encryption algorithm with Cipher Block Chaining. The default is *Enabled.*

AES128-CBC	Use the pull-down menu to enable or disable the Advanced Encryption Standard AES128 encryption algorithm with Cipher Block Chaining. The default is *Enabled.*
AES192-CBC	Use the pull-down menu to enable or disable the Advanced Encryption Standard AES192 encryption algorithm with Cipher Block Chaining. The default is *Enabled.*
AES256-CBC	Use the pull-down menu to enable or disable the Advanced Encryption Standard AES256 encryption algorithm with Cipher Block Chaining. The default is *Enabled.*
ARC4	Use the pull-down menu to enable or disable the Arcfour encryption algorithm. The default is *Enabled.*
Cast128-CBC	Use the pull-down menu to enable or disable the Cast128 encryption algorithm with Cipher Block Chaining. The default is *Enabled.*
Twofish128	Use the pull-down menu to enable or disable the twofish128 encryption algorithm. The default is *Enabled.*
Twofish192	Use the pull-down menu to enable or disable the twofish192 encryption algorithm. The default is *Enabled.*
Twofish256	Use the pull-down menu to enable or disable the twofish256 encryption algorithm. The default is *Enabled.*
Data Integrity Algorithm	
HMAC-SHA1	Use the pull-down menu to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Secure Hash Algorithm encryption. The default is *Enabled.*
HMAC-MD5	Use the pull-down menu to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the MD5 Message Digest encryption algorithm. The default is *Enabled.*
Public Key Algorithm	
HMAC-RSA	Use the pull-down menu to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the RSA encryption algorithm. The default is *Enabled.*
HMAC-DSA	Use the pull-down menu to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Digital Signature Algorithm encryption. The default is *Enabled.*
Authentication Algorithm	
Password	This parameter may be enabled if the administrator wishes to use a locally configured password for authentication on the Switch. The default is *Enabled.*
Public Key	This parameter may be enabled if the administrator wishes to use a publickey configuration set on a SSH server, for authentication. The default is *Enabled.*
Host-based	This parameter may be enabled if the administrator wishes to use a host computer for authentication. This parameter is intended for Linux users requiring SSH authentication techniques and the host computer is running the Linux operating system with a SSH program previously installed. The default is *Enabled.*

Click **Apply** to implement changes made.

SSH User Authentication

The following windows are user to configure parameters for users attempting to access the Switch through SSH. To access the following window, click **Security** > **Secure Shell (SSH)** > **SSH User Authentication**.

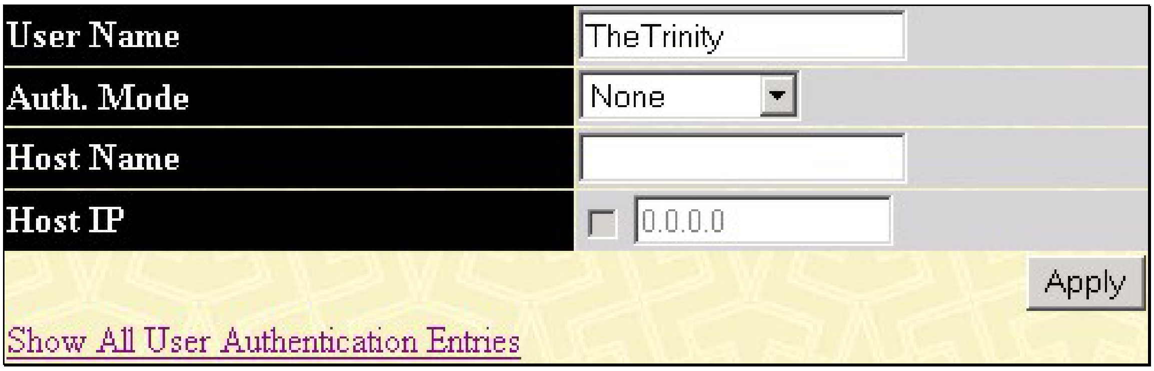


Current Accounts

User Name	Auth. Mode	Host Name	Host IP
Darren	Password		

Figure 6- 6. Current Accounts window

In the example window above, the user account “TheTrinity” has been previously set using the **User Accounts** window in the **Management** folder. A user account MUST be set in order to set the parameters for the SSH user. To configure the parameters for the SSH user, click on the hyperlinked user name in the window above, which will reveal the following window.



User Name	TheTrinity
Auth. Mode	None
Host Name	
Host IP	□ 0.0.0.0

Figure 6- 7. SSH User window

The user may set the following parameters:

Parameter	Description
User Name	Enter a username of no more than 15 characters to identify the SSH user. This User Name must be a previously configured user account on the Switch.
Auth. Mode	The administrator may choose one of the following to set the authorization for users attempting to access the Switch: *Host Based* – This parameter should be chosen if the administrator wishes to use a remote SSH server for authentication purposes. Choosing this parameter requires the user to input the following information to identify the SSH user. *Host Name* – Enter an alphanumeric string of up to 31 characters identifying the remote SSH user. *Host IP* – Enter the corresponding IP address of the SSH user. *Password* – This parameter should be chosen if the user wishes to use an administrator-defined password for authentication. Upon entry of this command, the Switch will prompt the user for a password, and then to retype the password for confirmation. *Public Key* – This parameter should be chosen if the user wishes to use the public key on a SSH server for authentication. *None* – Choose this parameter if no authentication is desired.

Host Name	Enter an alphanumeric string of up to 31 characters identifying the remote SSH user. This parameter is only used in conjunction with the Host Based choice in the *Auth. Mode.*
Host IP	Enter the corresponding IP address of the SSH user. This parameter is only used in conjunction with the Host Based choice in the *Auth. Mode.*

Click **Apply** to implement changes made.

NOTE: To set the SSH User Authentication parameters on the Switch, a user account must be previously configured. For more information on configuring local user accounts on the Switch, see the Security IP section of this document.

Access Authentication Control

The TACACS / XTACACS / TACACS+ / RADIUS commands let you secure access to the Switch using the TACACS / XTACACS / TACACS+ / RADIUS protocols. When a user logs in to the Switch or tries to access the administrator level privilege, he or she is prompted for a password. If TACACS / XTACACS / TACACS+ / RADIUS authentication is enabled on the Switch, it will contact a TACACS / XTACACS / TACACS+ / RADIUS server to verify the user. If the user is verified, he or she is granted access to the Switch.

There are currently three versions of the TACACS security protocol, each a separate entity. The Switch's software supports the following versions of TACACS:

- **TACACS** (Terminal Access Controller Access Control System) - Provides password checking and authentication, and notification of user actions for security purposes utilizing via one or more centralized TACACS servers, utilizing the UDP protocol for packet transmission.
- **Extended TACACS (XTACACS)** - An extension of the TACACS protocol with the ability to provide more types of authentication requests and more types of response codes than TACACS. This protocol also uses UDP to transmit packets.
- **TACACS+ (Terminal Access Controller Access Control System plus**) - Provides detailed access control for authentication for network devices. TACACS+ is facilitated through Authentication commands via one or more centralized servers. The TACACS+ protocol encrypts all traffic between the Switch and the TACACS+ daemon, using the TCP protocol to ensure reliable delivery

In order for the TACACS / XTACACS / TACACS+ / RADIUS security function to work properly, a TACACS / XTACACS / TACACS+ / RADIUS server must be configured on a device other than the Switch, called an Authentication Server Host and it must include usernames and passwords for authentication. When the user is prompted by the Switch to enter usernames and passwords for authentication, the Switch contacts the TACACS / XTACACS / TACACS+ / RADIUS server to verify, and the server will respond with one of three messages:

- The server verifies the username and password, and the user is granted normal user privileges on the Switch.
- The server will not accept the username and password and the user is denied access to the Switch.
- The server doesn't respond to the verification query. At this point, the Switch receives the timeout from the server and then moves to the next method of verification configured in the method list.

The Switch has four built-in ***Authentication Server Groups***, one for each of the TACACS, XTACACS, TACACS+ and RADIUS protocols. These built-in Authentication Server Groups are used to authenticate users trying to access the Switch. The users will set ***Authentication Server Hosts*** in a preferable order in the built-in Authentication Server Groups and when a user tries to gain access to the Switch, the Switch will ask the first Authentication Server Hosts for authentication. If no authentication is made, the second server host in the list will be queried, and so on. The built-in Authentication Server Groups can only have hosts that are running the specified protocol. For example, the TACACS Authentication Server Groups can only have TACACS Authentication Server Hosts.

The administrator for the Switch may set up six different authentication techniques per user-defined method list (TACACS / XTACACS / TACACS+ / RADIUS / local / none) for authentication. These techniques will be listed in an order preferable, and defined by the user for normal user authentication on the Switch, and may contain up to eight authentication techniques. When a user attempts to access the Switch, the Switch will select the first technique listed for authentication. If the first technique goes through its Authentication Server Hosts and no authentication is returned, the Switch will then go to the next technique listed in the server group for authentication, until the authentication has been verified or denied, or the list is exhausted.

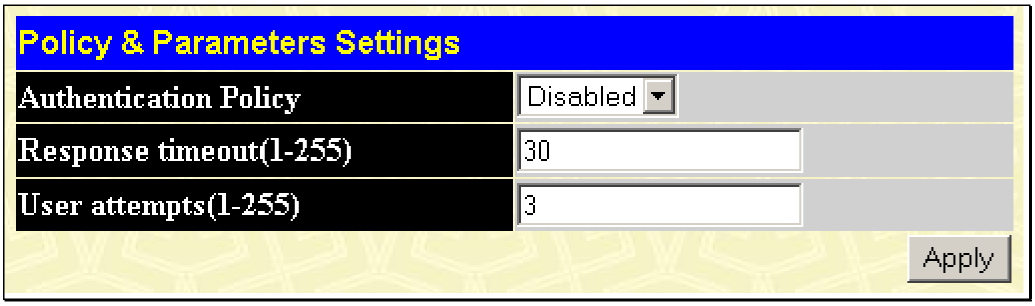
Please note that users granted access to the Switch will be granted normal user privileges on the Switch. To gain access to administrator level privileges, the user must access the **Enable Admin** window and then enter a password, which was previously configured by the administrator of the Switch.

NOTE: TACACS, XTACACS, and TACACS+ are separate entities and are not compatible. The Switch and the server must be configured exactly the same, using the same protocol. (For example, if the Switch is set up for TACACS authentication, so must be the host server.)

Policy & Parameters

This command will enable an administrator-defined authentication policy for users trying to access the Switch. When enabled, the device will check the **Login Method List** and choose a technique for user authentication upon login.

To access the following window, click **Security** > **Access Authentication Control** > **Policy & Parameters**:



Policy & Parameters Settings

Authentication Policy	Disabled
Response timeout(1-255)	30
User attempts(1-255)	3

Figure 6- 8. Policy & Parameters Settings window

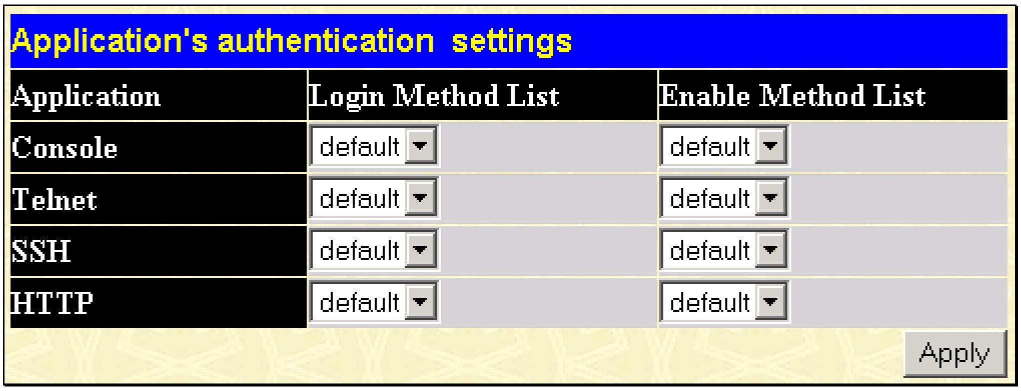
The following parameters can be set:

Parameters	**Description**
Authentication Policy	Use the pull-down menu to enable or disable the Authentication Policy on the Switch.
Response timeout (1-255)	This field will set the time the Switch will wait for a response of authentication from the user. The user may set a time between *1* and *255* seconds. The default setting is *30* seconds.
User attempts (1-255)	This command will configure the maximum number of times the Switch will accept authentication attempts. Users failing to be authenticated after the set amount of attempts will be denied access to the Switch and will be locked out of further authentication attempts. Command line interface users will have to wait *60* seconds before another authentication attempt. Telnet and web users will be disconnected from the Switch. The user may set the number of attempts from *1* to *255*. The default setting is *3*.

Click **Apply** to implement changes made.

Application Authentication Settings

This window is used to configure switch configuration applications (console, Telnet, SSH, and web) for login at the user level and at the administration level (Enable Admin) utilizing a previously configured method list.



Application's authentication settings

Application	Login Method List	Enable Method List
Console	default	default
Telnet	default	default
SSH	default	default
HTTP	default	default

Figure 6- 9. Application's authentication settings window

The following parameters can be set:

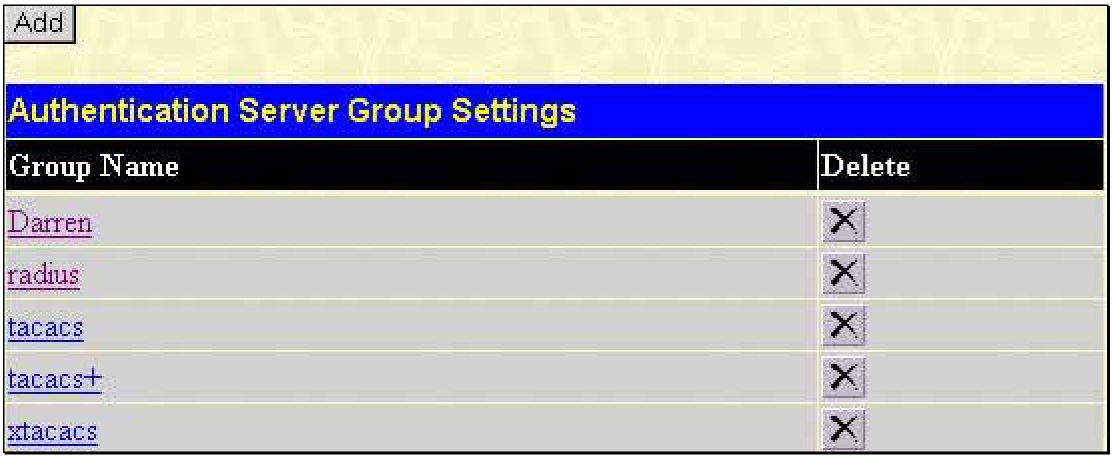
Parameter	Description
Application	Lists the configuration applications on the Switch. The user may configure the Login Method List and Enable Method List for authentication for users utilizing the Console (Command Line Interface) application, the Telnet application, the Secure Shell (SSH) application, and the Web (HTTP) application.
Login Method List	Using the pull-down menu, configure an application for normal login on the user level, utilizing a previously configured method list. The user may use the default Method List or other Method List configured by the user. See the **Login Method List Settings** window, in this section, for more information
Enable Method List	Using the pull-down menu, configure an application for normal login on the user level, utilizing a previously configured method list. The user may use the default Method List or other Method List configured by the user. See the **Enable Method List Settings** window, in this section, for more information

Click **Apply** to implement changes made.

Authentication Server Group

This window will allow users to set up **Authentication Server Groups** on the Switch. A server group is a technique used to group RADIUS, TACACS, TACACS+, and XTACACS server hosts into user-defined categories for authentication using method lists. The user may define the type of server group by protocol or by previously defined server group. The Switch has four built-in Authentication Server Groups that cannot be removed but can be modified. Up to eight authentication server hosts may be added to any particular group.

To view the following window, click **Security** > **Access Authentication Control** > **Authentication Server Group**:

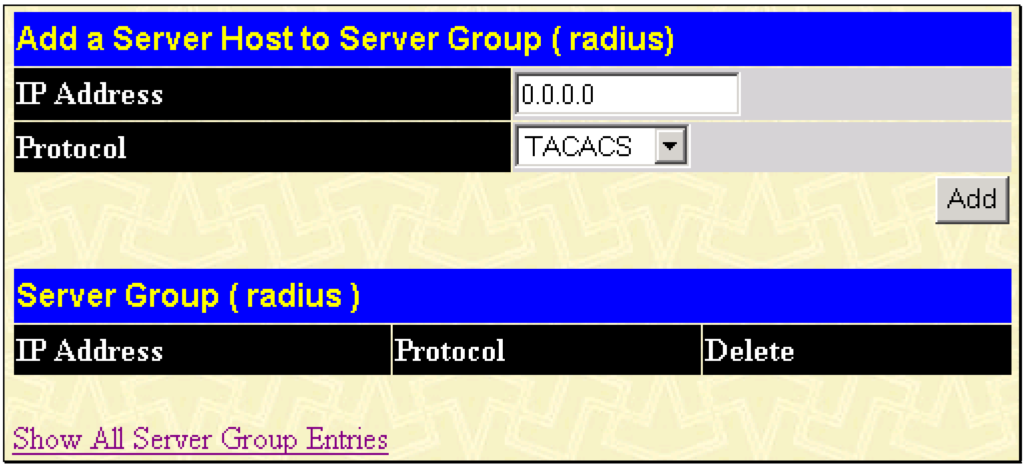


Authentication Server Group Settings

Group Name	Delete
Darren	✕
radius	✕
tacacs	✕
tacacs+	✕
xtacacs	✕

Figure 6- 10. Authentication Server Group Settings window

This window displays the **Authentication Server Groups** on the Switch. The Switch has four built-in **Authentication Server Groups** that cannot be removed but can be modified. To modify a particular group, click its hyperlinked **Group Name**, which will then display the following window.



Add a Server Host to Server Group (radius)

IP Address	0.0.0.0
Protocol	TACACS

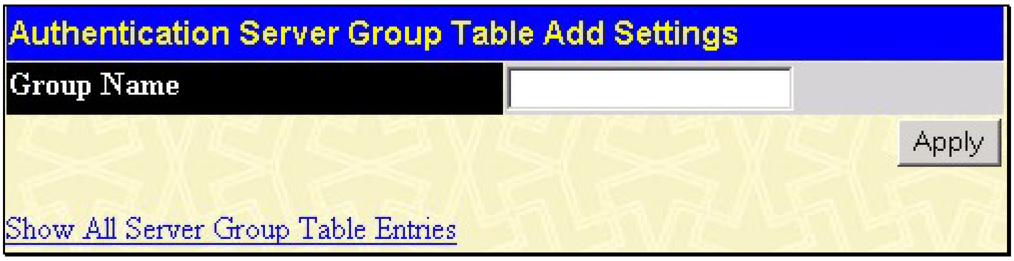
Server Group (radius)

IP Address	Protocol	Delete

Figure 6- 11. Add a Server Host to Server Group (radius) window

To add an **Authentication Server Host** to the list, enter its IP address in the IP Address field, choose the protocol associated with the IP address of the Authentication Server Host (*RADIUS*, *TACACS*, *TACACS+*, or *XTACACS*) and click **Add** to add this Authentication Server Host to the group.

To add a server group other than the ones listed, click the add button, revealing the following window to configure.



Authentication Server Group Table Add Settings

Group Name	

Figure 7- 1. Authentication Server Group Table Add Settings window

Enter a group name of up to 16 characters into the **Group Name** field and click **Apply**. The entry should appear in the **Authentication Server Group Settings** window, as shown in Figure 6-10 (Darren).

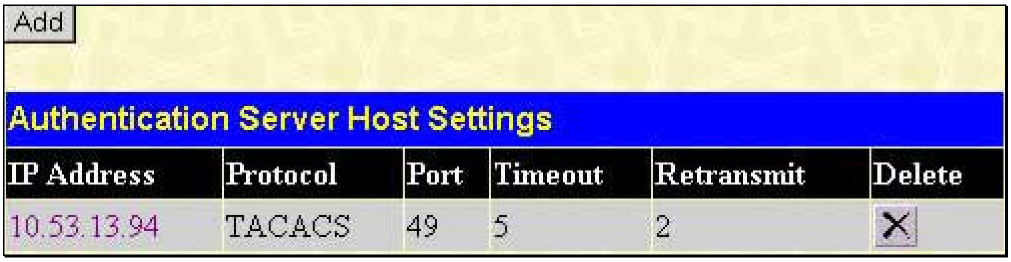
NOTE: The user must configure Authentication Server Hosts using the **Authentication Server Host Settings** window before adding hosts to the list. Authentication Server Hosts must be configured for their specific protocol on a remote centralized server before this function can work properly.

NOTE: The four built in server groups can only have server hosts running the same TACACS / RADIUS daemon. RADIUS, TACACS, TACACS+, and XTACACS protocols are separate entities and are not compatible with each other.

Authentication Server Host

This window will set user-defined Authentication Server Hosts for the RADIUS, TACACS, TACACS+, and XTACACS security protocols on the Switch. When a user attempts to access the Switch with Authentication Policy enabled, the Switch will send authentication packets to a remote RADIUS/TACACS/XTACACS/TACACS+ server host on a remote host. The RADIUS/TACACS/TACACS+/XTACACS server host will then verify or deny the request and return the appropriate message to the Switch. More than one authentication protocol can be run on the same physical server host but, remember that RADIUS/TACACS/TACACS+/XTACACS are separate entities and are not compatible with each other. The maximum supported number of server hosts is 16.

To view the following window, click **Security** > **Access Authentication Control** > **Authentication Server Host**:

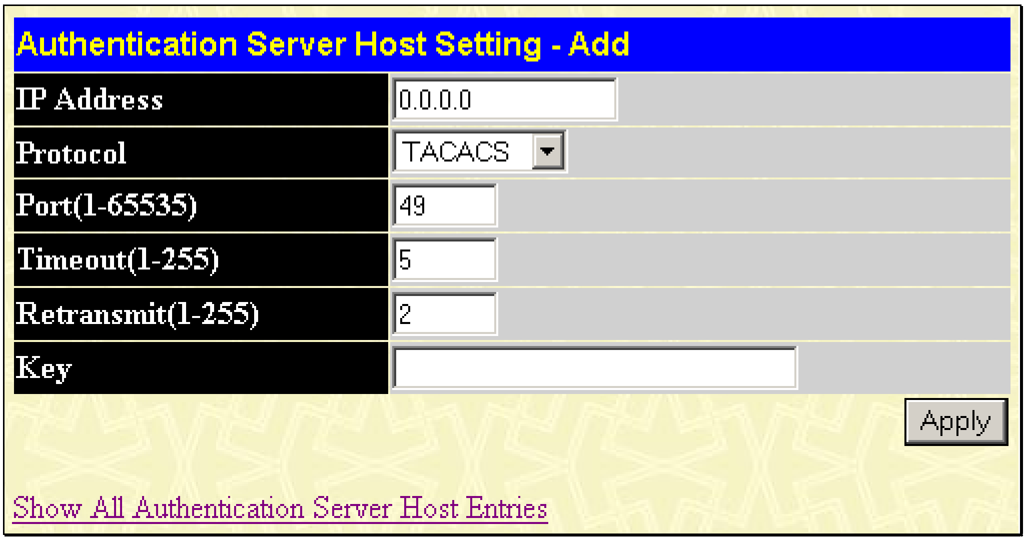


Authentication Server Host Settings

IP Address	Protocol	Port	Timeout	Retransmit	Delete
10.53.13.94	TACACS	49	5	2	☒

Figure 6- 12. Authentication Server Host Settings window

To add an Authentication Server Host, click the **Add** button, revealing the following window:

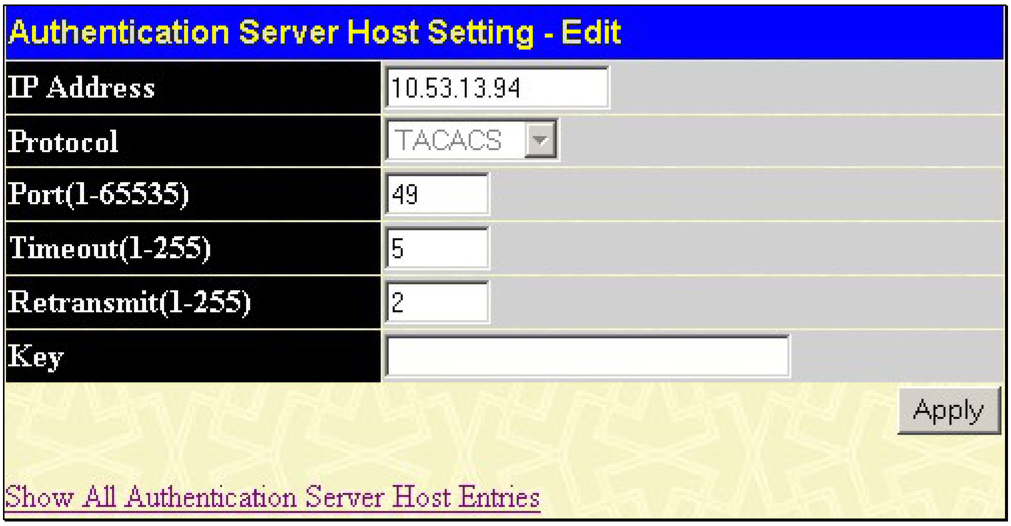


Authentication Server Host Setting - Add

IP Address	0.0.0.0
Protocol	TACACS
Port(1-65535)	49
Timeout(1-255)	5
Retransmit(1-255)	2
Key	

Figure 6- 13. Authentication Server Host Setting – Add window

The user may also modify an existing **Authentication Server Host** by clicking the Hyperlinked IP Address in the **Authentication Server Host Settings** window (Figure 6-12), which will display a similar window, as shown below.



Authentication Server Host Setting - Edit

IP Address	10.53.13.94
Protocol	TACACS
Port(1-65535)	49
Timeout(1-255)	5
Retransmit(1-255)	2
Key	

Figure 6- 14. Authentication Server Host Setting – Edit window

Configure the following parameters to add or edit an **Authentication Server Host**:

Parameter	Description
IP Address	The IP address of the remote server host to add.
Protocol	The protocol used by the server host. The user may choose one of the following: *TACACS* – Enter this parameter if the server host utilizes the TACACS protocol. *XTACACS* – Enter this parameter if the server host utilizes the XTACACS protocol. *TACACS+* – Enter this parameter if the server host utilizes the TACACS+ protocol. *RADIUS* – Enter this parameter if the server host utilizes the RADIUS protocol.
Port (1-65535)	Enter a number between *1* and *65535* to define the virtual port number of the authentication protocol on a server host. The default port number is *49* for TACACS/XTACACS/TACACS+ and 1812 for RADIUS servers, but the user may set a unique port number for higher security.
Timeout (1-255)	Enter the time in seconds the Switch will wait for the server host to reply to an authentication request. The default value is *5* seconds.
Retransmit (1-255)	Enter the value in the retransmit field to change how many times the device will resend an authentication request when the TACACS/RADIUS server does not respond.
Key	Authentication key to be shared with a configured TACACS+ server only. Specify an alphanumeric string up to *254* characters.

Click **Apply** to add the server host.

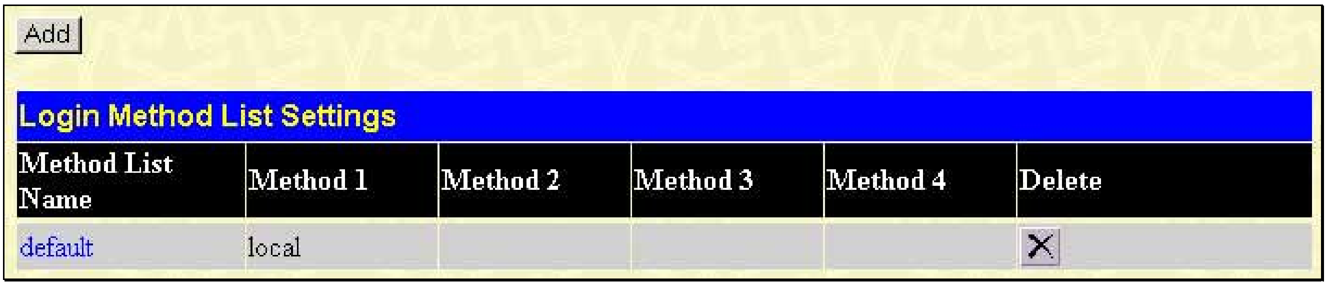
NOTE: More than one authentication protocol can be run on the same physical server host but, remember that RADIUS, TACACS, TACACS+, and XTACACS are separate entities and are not compatible with each other

Login Method Lists

This command will configure a user-defined or default Login Method List of authentication techniques for users logging on to the Switch. The sequence of techniques implemented in this command will affect the authentication result. For example, if a user enters a sequence of techniques, for example TACACS – XTACACS – local, the Switch will send an authentication request to the first TACACS host in the server group. If no response comes from the server host, the Switch will send an authentication request to the second TACACS host in the server group and so on, until the list is exhausted. At that point, the Switch will restart the same sequence with the following protocol listed, XTACACS. If no authentication takes place using the XTACACS list, the local account database set in the Switch is used to authenticate the user. When the local method is used, the privilege level will be dependant on the local account privilege configured on the Switch.

Successful login using any of these techniques will give the user a “user” privilege only. If the user wishes to upgrade his or her status to the administrator level, the user must use the **Enable Admin** window, in which the user must enter a previously configured password, set by the administrator. *(*See the **Enable Admin** part of this section for more detailed information concerning the **Enable Admin** command.*)*

To view the following window, click **Security** > **Access Authentication Control** > **Login Method Lists**:



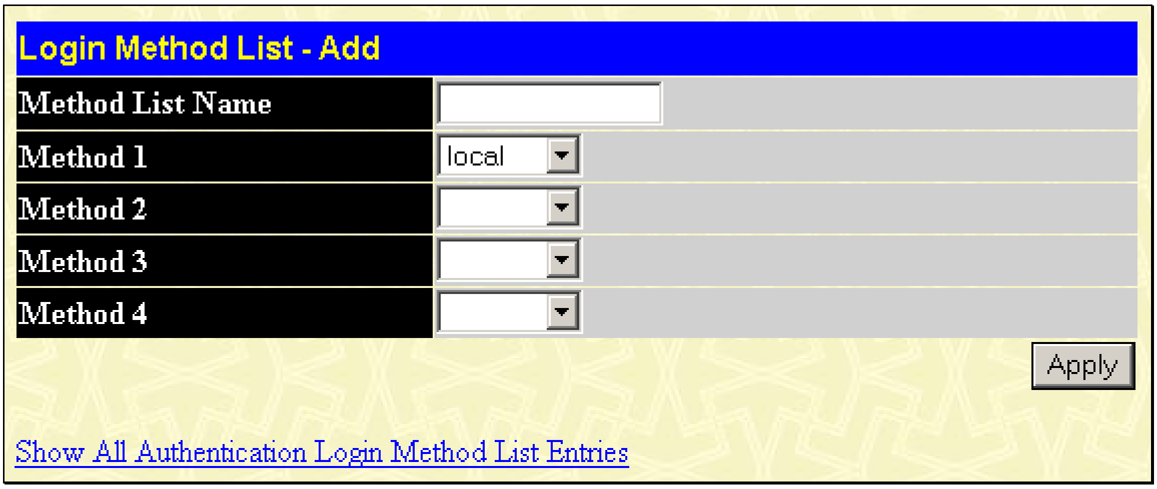
Login Method List Settings

Method List Name	Method 1	Method 2	Method 3	Method 4	Delete
default	local				☒

Figure 6- 15. Login Method Lists Settings window

The Switch contains one Method List that is set and cannot be removed, yet can be modified. To delete a Login Method List defined by the user, click the ☒ under the **Delete** heading corresponding to the entry desired to be deleted. To modify a Login Method List, click on its hyperlinked Method List Name. To configure a Method List, click the **Add** button.

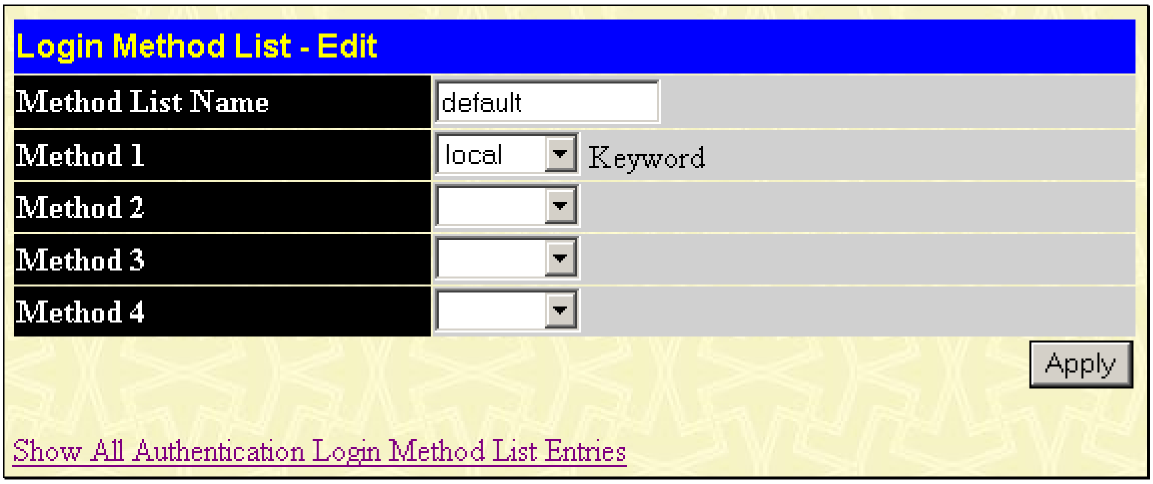
Both actions will result in the same window to configure:



Login Method List - Add

Method List Name	
Method 1	local
Method 2	
Method 3	
Method 4	

Figure 6- 16. Login Method List – Add window



Login Method List - Edit

Method List Name	default
Method 1	local Keyword
Method 2	
Method 3	
Method 4	

Figure 6- 17. Login Method List – Edit window

To define a Login Method List, set the following parameters and click **Apply**:

Parameter	Description
Method List Name	Enter a method list name defined by the user of up to 15 characters.
Method 1, 2, 3, 4	The user may add one, or a combination of up to four of the following authentication methods to this method list: *local* - Adding this parameter will require the user to be authenticated using the local user account database on the Switch. *none* – Adding this parameter will require no authentication to access the Switch. *radius* - Adding this parameter will require the user to be authenticated using the RADIUS protocol from a remote RADIUS server. *tacacs* – Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server. *tacacs+* – Adding this parameter will require the user to be authenticated using the TACACS+ protocol from a remote TACACS+ server. *xtacacs* – Adding this parameter will require the user to be authenticated using the XTACACS protocol from a remote XTACACS server.

Enable Method Lists

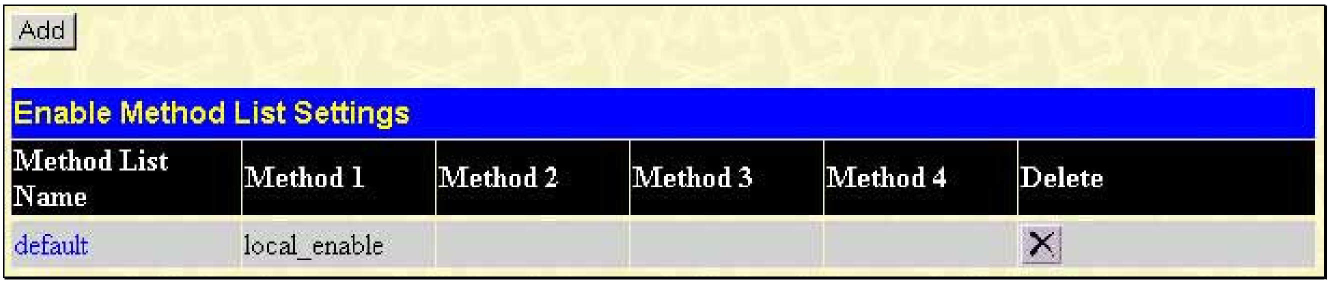
This window is used to set up Method Lists to promote users with normal level privileges to Administrator level privileges using authentication methods on the Switch. Once a user acquires normal user level privileges on the Switch, he or she must be authenticated by a method on the Switch to gain administrator privileges on the Switch, which is defined by the Administrator. A maximum of eight Enable Method Lists can be implemented on the Switch, one of which is a default Enable Method List. This default Enable Method List cannot be deleted but can be configured.

The sequence of methods implemented in this command will affect the authentication result. For example, if a user enters a sequence of methods like TACACS – XTACACS – Local Enable, the Switch will send an authentication request to the first TACACS host in the server group. If no verification is found, the Switch will send an authentication request to the second TACACS host in the server group and so on, until the list is exhausted. At that point, the Switch will restart the same sequence with the following protocol listed, XTACACS. If no authentication takes place using the XTACACS list, the Local Enable password set in the Switch is used to authenticate the user.

Successful authentication using any of these methods will give the user an "Admin" privilege.

NOTE: To set the Local Enable Password, see the next section, entitled **Local Enable Password.**

To view the following table, click **Security** > **Access Authentication Control** > **Enable Method Lists**:



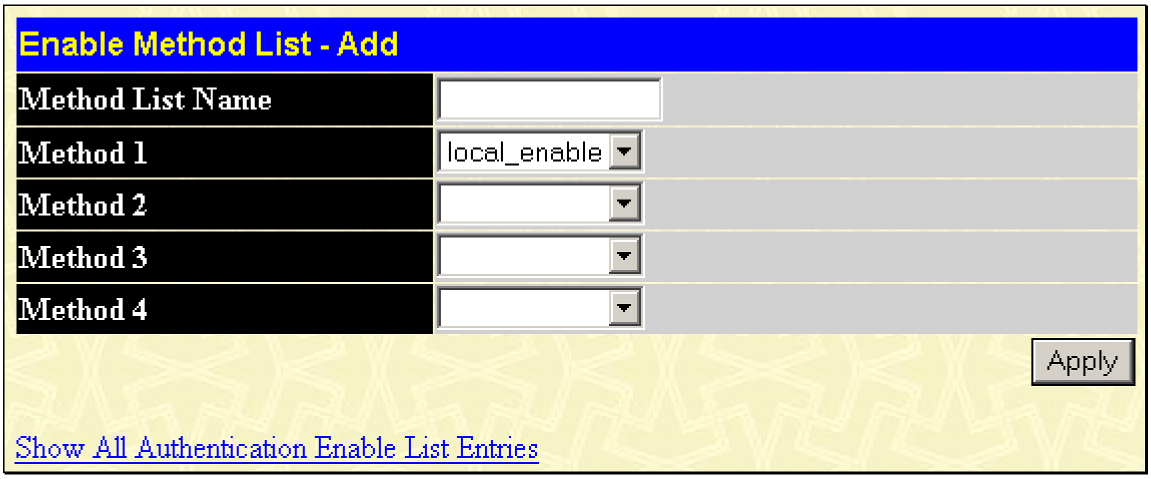
Enable Method List Settings

Method List Name	Method 1	Method 2	Method 3	Method 4	Delete
default	local_enable				☒

Figure 6- 18. Enable Method List Settings window

To delete an Enable Method List defined by the user, click the ☒ under the **Delete** heading corresponding to the entry desired to be deleted. To modify an Enable Method List, click on its hyperlinked Enable Method List Name. To configure a Method List, click the **Add** button.

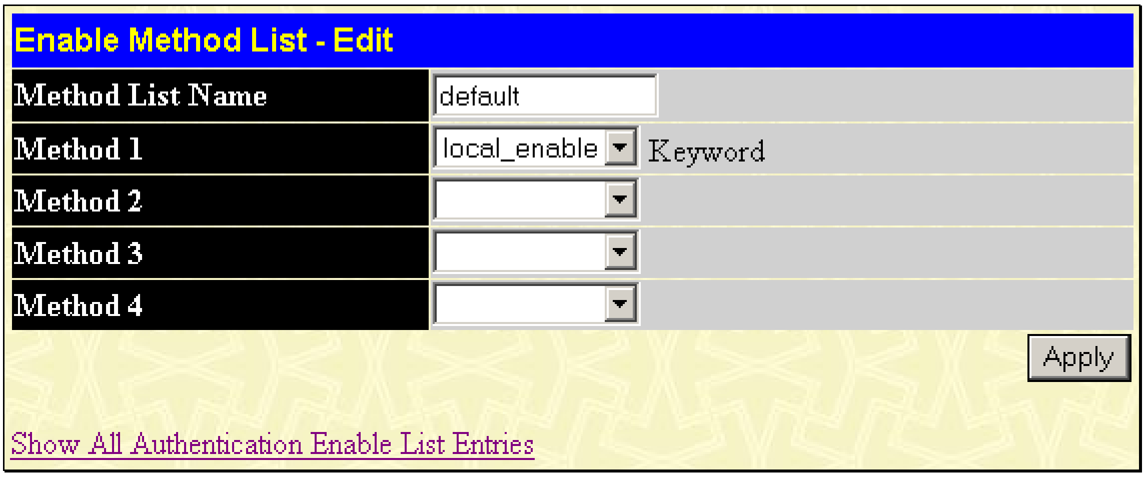
Both actions will result in the same window to configure:



Enable Method List - Add

Method List Name	
Method 1	local_enable
Method 2	
Method 3	
Method 4	

Figure 6- 19. Enable Method List – Add window



Enable Method List - Edit

Method List Name	default
Method 1	local_enable Keyword
Method 2	
Method 3	
Method 4	

Figure 6- 20. Enable Method List – Edit window

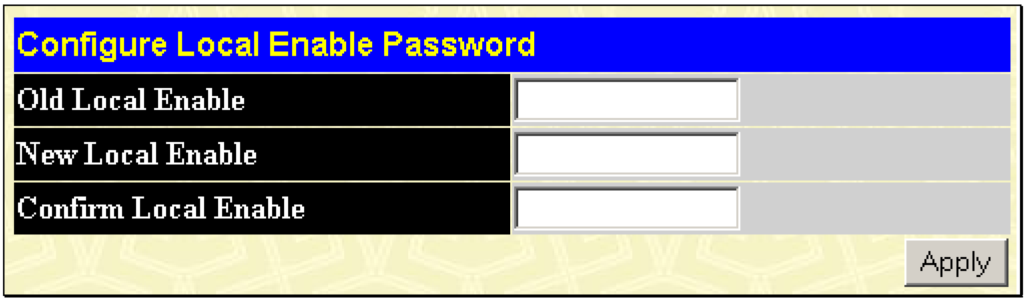
To define an **Enable Login Method List**, set the following parameters and click **Apply**:

Parameter	Description
Method List Name	Enter a method list name defined by the user of up to 15 characters.
Method 1, 2, 3, 4	The user may add one, or a combination of up to four of the following authentication methods to this method list: *local_enable* - Adding this parameter will require the user to be authenticated using the local enable password database on the Switch. The local enable password must be set by the user in the next section, entitled Local Enable Password. *none* – Adding this parameter will require no authentication to access the Switch. *radius* - Adding this parameter will require the user to be authenticated using the RADIUS protocol from a remote RADIUS server. *tacacs* – Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server. *tacacs+* – Adding this parameter will require the user to be authenticated using the TACACS+ protocol from a remote TACACS+ server. *xtacacs* – Adding this parameter will require the user to be authenticated using the XTACACS protocol from a remote XTACACS server.

Local Enable Password

This window will configure the locally enabled password for Enable Admin. When a user chooses the Local_Enable method to promote user level privileges to administrator privileges, he or she will be prompted to enter the password configured here that is locally set on the Switch.

To view the following window, click **Security** > **Access Authentication Control** > **Local Enable Password**:



Configure Local Enable Password

Old Local Enable	
New Local Enable	
Confirm Local Enable	

Figure 4- 82. Configure Local Enable Password window

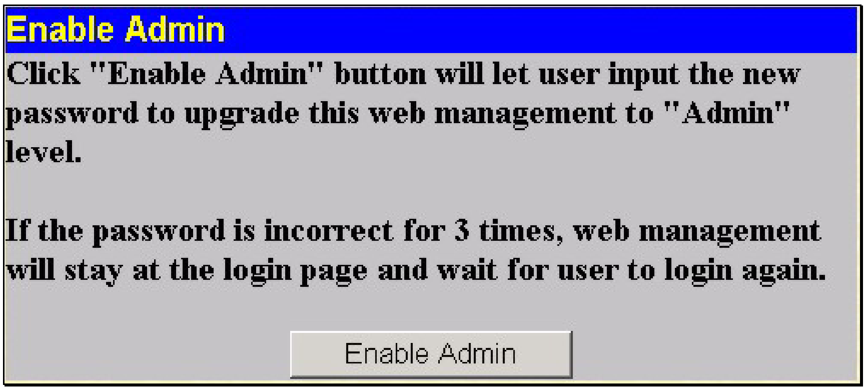
To set the Local Enable Password, set the following parameters and click **Apply**.

Parameter	Description
Old Local Enable	If a password was previously configured for this entry, enter it here in order to change it to a new password.
New Local Enable	Enter the new password that you wish to set on the Switch to authenticate users attempting to access Administrator Level privileges on the Switch. The user may set a password of up to 16 characters.
Confirm Local Enable	Confirm the new password entered above. Entering a different password here from the one set in the New Local Enabled field will result in a fail message.

Enable Admin

This window is for users who have logged on to the Switch on the normal user level, and wish to be promoted to the administrator level. After logging on to the Switch, users will have only user level privileges. To gain access to administrator level privileges, the user will open this window and will have to enter an authentication password. Possible authentication methods for this function include RADIUS, TACACS, TACACS+, and XTACACS, local enable (local account on the Switch), or no authentication (none). Because XTACACS and TACACS do not support the enable function, the user must create a special account on the server host, which has the username “enable”, and a password configured by the administrator that will support the enable function. This function becomes inoperable when the authentication policy is disabled.

To view the following window, click **Security** > **Access Authentication Control** > **Enable Admin**:



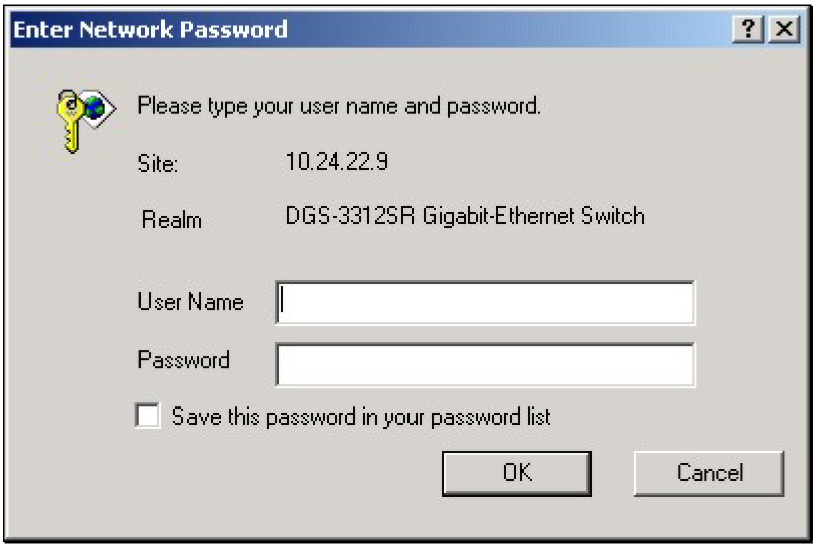
Enable Admin

Click "Enable Admin" button will let user input the new password to upgrade this web management to "Admin" level.

If the password is incorrect for 3 times, web management will stay at the login page and wait for user to login again.

Figure 6- 21. Enable Admin window

When this window appears, click the **Enable Admin** button revealing a dialog box for the user to enter authentication (password, username), as seen below. A successful entry will promote the user to Administrator level privileges on the Switch.



Enter Network Password

Please type your user name and password.

Site: 10.24.22.9

Realm DGS-3312SR Gigabit-Ethernet Switch

User Name

Password

□ Save this password in your password list

Figure 6- 22. Enter Network Password dialog box

Section 7

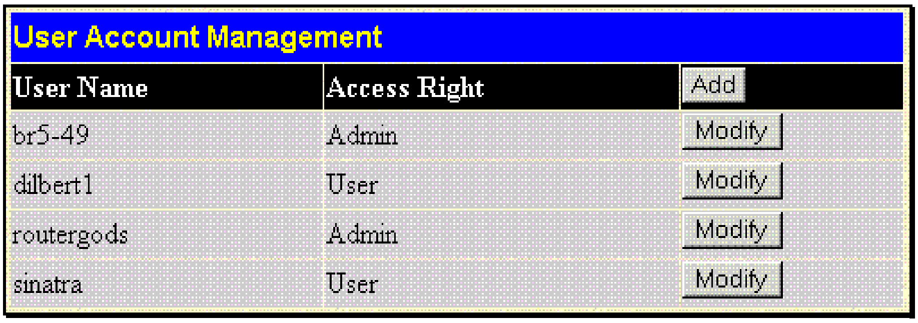
Management

User Accounts

SNMP Manager

User Accounts

Use the **User Account Management** to control user privileges. To view existing User Accounts, open the **Management** folder and click on the **User Accounts** link. This will open the **User Account Management** window, as shown below.

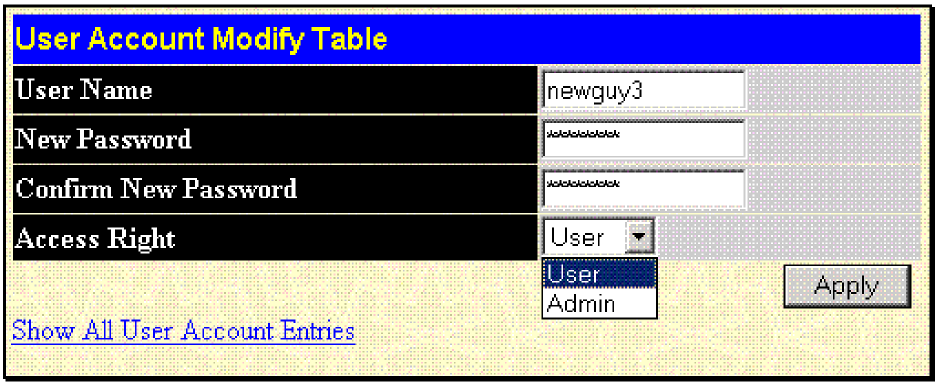


User Account Management

User Name	Access Right	Add
br5-49	Admin	Modify
dilbert1	User	Modify
routergods	Admin	Modify
sinatra	User	Modify

Figure 7- 2. User Account Management window

To add a new user, click on the **Add** button. To modify or delete an existing user, click on the **Modify** button for that user.

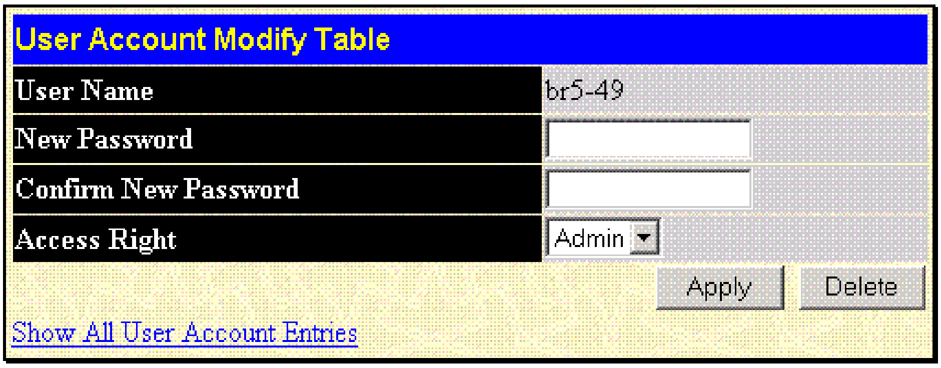


User Account Modify Table

User Name	newguy3
New Password	********
Confirm New Password	********
Access Right	User

Figure 7- 3. User Account Modify Table window

Add a new user by typing in a **User Name**, and **New Password** and retype the same password in the **Confirm New Password**. Choose the level of privilege (*Admin* or *User*) from the Access Right drop-down menu.



User Account Modify Table

User Name	br5-49
New Password	
Confirm New Password	
Access Right	Admin

Figure 7- 4. User Account Modify Table window

Modify or delete an existing user account in the **User Account Modify Table** window. To delete the user account, click on the **Delete** button. To change the password, type in the New Password and retype it in the Confirm New Password entry field. Choose the level of privilege (*Admin* or *User*) from the Access Right drop-down menu.

Admin and User Privileges

There are two levels of user privileges: *Admin* and *User*. Some menu selections available to users with *Admin* privileges may not be available to those with *User* privileges.

The following table summarizes the *Admin* and *User* privileges:

Management	Admin	User
Configuration	Yes	Read Only
Network Monitoring	Yes	Read Only
Community Strings and Trap Stations	Yes	Read Only
Update Firmware and Configuration Files	Yes	No
System Utilities	Yes	No
Factory Reset	Yes	No
User Account Management		
Add/Update/Delete User Accounts	Yes	No
View User Accounts	Yes	No

Table 7- 1. Admin and User Privileges

After establishing a User Account with *Admin*-level privileges, be sure to save the changes (see below).

SNMP

SNMP Settings

Simple Network Management Protocol (SNMP) is an OSI Layer 7 (Application Layer) designed specifically for managing and monitoring network devices. SNMP enables network management stations to read and modify the settings of gateways, routers, switches, and other network devices. Use SNMP to configure system features for proper operation, monitor performance and detect potential problems in the Switch, switch group or network.

Managed devices that support SNMP include software (referred to as an agent), which runs locally on the device. A defined set of variables (managed objects) is maintained by the SNMP agent and used to manage the device. These objects are defined in a Management Information Base (MIB), which provides a standard presentation of the information controlled by the on-board SNMP agent. SNMP defines both the format of the MIB specifications and the protocol used to access this information over the network.

The DGS-3312SR supports the SNMP versions 1, 2c, and 3. You can specify which version of the SNMP you want to use to monitor and control the Switch. The three versions of SNMP vary in the level of security provided between the management station and the network device.

In SNMP v.1 and v.2, user authentication is accomplished using 'community strings', which function like passwords. The remote user SNMP application and the Switch SNMP must use the same community string. SNMP packets from any station that has not been authenticated are ignored (dropped).

The default community strings for the Switch used for SNMP v.1 and v.2 management access are:

public - Allows authorized management stations to retrieve MIB objects.

private - Allows authorized management stations to retrieve and modify MIB objects.

SNMPv3 uses a more sophisticated authentication process that is separated into two parts. The first part is to maintain a list of users and their attributes that are allowed to act as SNMP managers. The second part describes what each user on that list can do as an SNMP manager.

The Switch allows groups of users to be listed and configured with a shared set of privileges. The SNMP version may also be set for a listed group of SNMP managers. Thus, you may create a group of SNMP managers that are allowed to view read-only information or receive traps using SNMPv1 while assigning a higher level of security to another group, granting read/write privileges using SNMPv3.

Using SNMPv3 individual users or groups of SNMP managers can be allowed to perform or be restricted from performing specific SNMP management functions. The functions allowed or restricted are defined using the Object Identifier (OID) associated with a specific MIB. An additional layer of security is available for SNMPv3 in that SNMP messages may be encrypted. To read more about how to configure SNMPv3 settings for the Switch read the next section.

Traps

Traps are messages that alert network personnel of events that occur on the Switch. The events can be as serious as a reboot (someone accidentally turned OFF the Switch), or less serious like a port status change. The Switch generates traps and sends them to the trap recipient (or network manager). Typical traps include trap messages for Authentication Failure, Topology Change and Broadcast\Multicast Storm.

MIBs

Management and counter information are stored by the Switch in the Management Information Base (MIB). The Switch uses the standard MIB-II Management Information Base module. Consequently, values for MIB objects can be retrieved from any SNMP-based network management software. In addition to the standard MIB-II, the Switch also supports its own proprietary enterprise MIB as an extended Management Information Base. The proprietary MIB may also be retrieved by specifying the MIB Object Identifier. MIB values can be either read-only or read-write.

The DGS-3312SR incorporates a flexible SNMP management for the switching environment. SNMP management can be customized to suit the needs of the networks and the preferences of the network administrator. Use the SNMP V3 menus to select the SNMP version used for specific tasks.

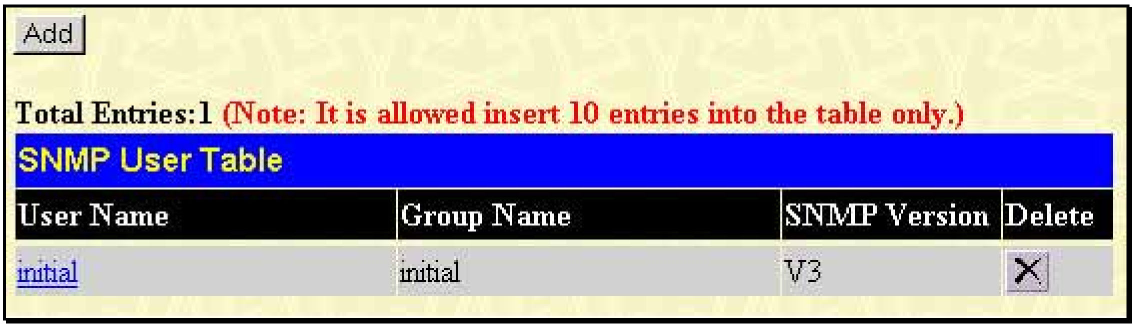
The DGS-3312SR supports the Simple Network Management Protocol (SNMP) versions 1, 2c, and 3. The administrator can specify the SNMP version used to monitor and control the Switch. The three versions of SNMP vary in the level of security provided between the management station and the network device.

SNMP settings are configured using the menus located on the SNMP V3 folder of the web manager. Workstations on the network that are allowed SNMP privileged access to the Switch can be restricted with the Management Station IP Address menu.

SNMP User Table

The **SNMP User Table** displays all of the SNMP User’s currently configured on the Switch.

Open the **Management** folder and then the **SNMP Manager** folder. Finally, click on the **SNMP User Table** link. This will open the **SNMP User Table**, as shown below.



Total Entries:1 (Note: It is allowed insert 10 entries into the table only.)

SNMP User Table

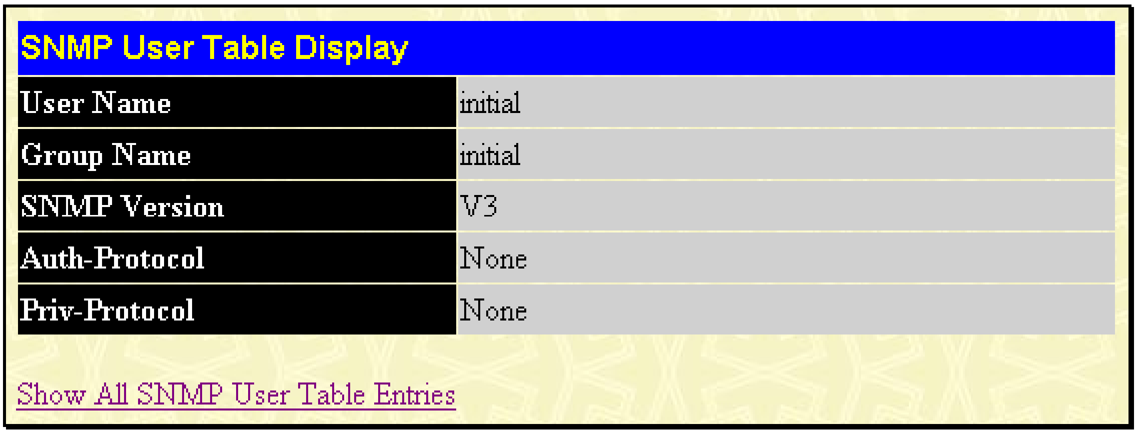
User Name	Group Name	SNMP Version	Delete
initial	initial	V3	☒

Figure 7- 5. SNMP User Table window

To delete an existing SNMP User Table entry, click on the **X** icon below the **Delete** heading corresponding to the entry you want to delete.

SNMP User Table Display

To display the detailed entry for a given user, click on the blue hyperlinked User Name. This will open the **SNMP User Table Display** window, as shown below.



SNMP User Table Display

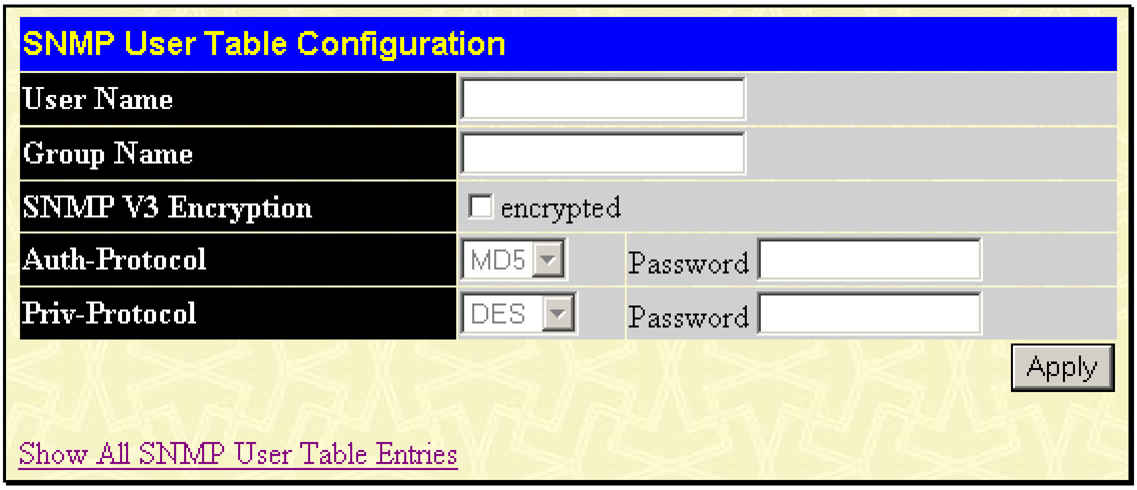
User Name	initial
Group Name	initial
SNMP Version	V3
Auth-Protocol	None
Priv-Protocol	None

Figure 7- 6. SNMP User Table Display window

The following parameters are displayed:

Parameter	Description
User Name	An alphanumeric string of up to 32 characters. This is used to identify the SNMP users.
Group Name	This name is used to specify the SNMP group created can request SNMP messages.
SNMP Version	*V1* - Indicates that SNMP version 1 is in use. *V2* - Indicates that SNMP version 2 is in use. *V3* - Indicates that SNMP version 3 is in use.
Auth-Protocol	*None* - Indicates that no authorization protocol is in use. *MD5* - Indicates that the HMAC-MD5-96 authentication level will be used. *SHA* - Indicates that the HMAC-SHA authentication protocol will be used.
Priv-Protocol	*None* - Indicates that no authorization protocol is in use. *DES* - Indicates that DES 56-bit encryption is in use based on the CBC-DES (DES-56) standard.

To add a new entry to the **SNMP User Table Configuration**, click on the **Add** button on the **SNMP User Table** window. This will open the **SNMP User Table Configuration** window, as shown below.



SNMP User Table Configuration

User Name			
Group Name			
SNMP V3 Encryption	□ encrypted		
Auth-Protocol	MD5	Password	
Priv-Protocol	DES	Password	

Figure 7- 7. SNMP User Table Configuration window

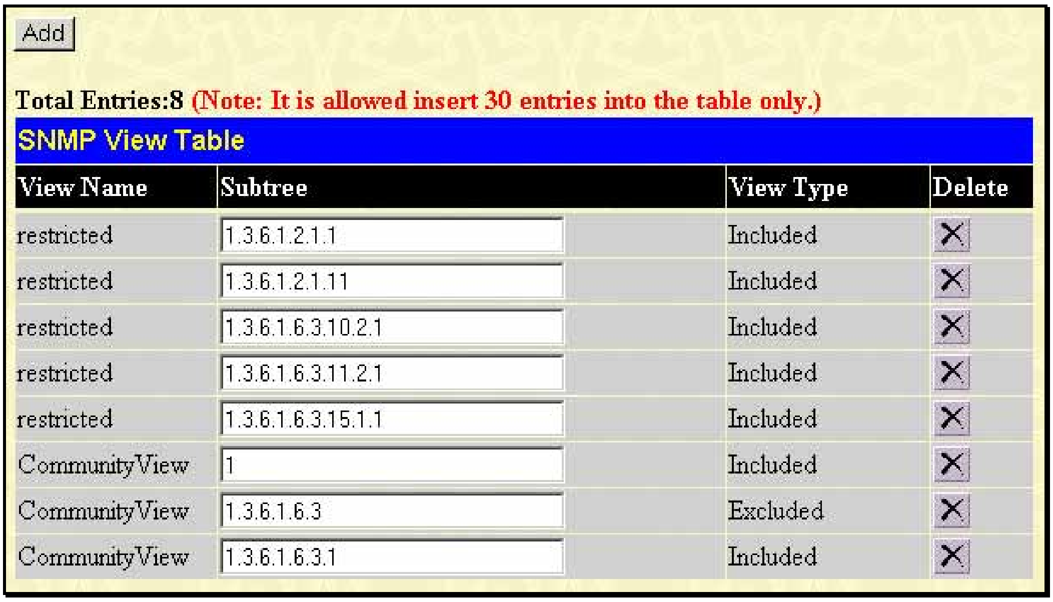
The following parameters can set:

Parameter	Description
User Name	Enter an alphanumeric string of up to 32 characters. This is used to identify the SNMP user.
Group Name	This name is used to specify the SNMP group created can request SNMP messages.
SNMP Version	*V1* - Specifies that SNMP version 1 will be used. *V2* - Specifies that SNMP version 2 will be used. *V3* - Specifies that SNMP version 3 will be used.
Auth-Protocol	*MD5* - Specifies that the HMAC-MD5-96 authentication level will be used. This field is only operable when *V3* is selected in the **SNMP Version** field and the **Encryption** field has been checked. This field will require the user to enter a password. *SHA* - Specifies that the HMAC-SHA authentication protocol will be used. This field is only operable when *V3* is selected in the **SNMP Version** field and the **Encryption** field has been checked. This field will require the user to enter a password.
Priv-Protocol	*None* - Specifies that no authorization protocol is in use. *DES* - Specifies that DES 56-bit encryption is in use, based on the CBC-DES (DES-56) standard. This field is only operable when *V3* is selected in the **SNMP Version** field and the **Encryption** field has been checked. This field will require the user to enter a password between 8 and 16 alphanumeric characters.

Click **Apply** to implement changes made.

SNMP View Table

The SNMP View Table is used to assign views to community strings that define which MIB objects can be accessed by a remote SNMP manager. To view the **SNMP View Table**, open the **SNMP Manager** folder, located in the **Management** folder, and click the **SNMP View Table** entry. The following screen should appear:



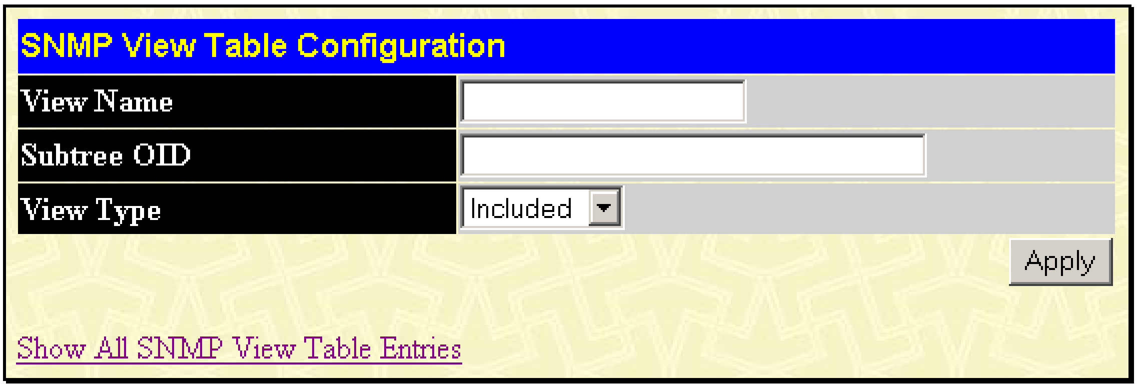
Total Entries:8 (Note: It is allowed insert 30 entries into the table only.)

SNMP View Table

View Name	Subtree	View Type	Delete
restricted	1.3.6.1.2.1.1	Included	☒
restricted	1.3.6.1.2.1.11	Included	☒
restricted	1.3.6.1.6.3.10.2.1	Included	☒
restricted	1.3.6.1.6.3.11.2.1	Included	☒
restricted	1.3.6.1.6.3.15.1.1	Included	☒
CommunityView	1	Included	☒
CommunityView	1.3.6.1.6.3	Excluded	☒
CommunityView	1.3.6.1.6.3.1	Included	☒

Figure 7- 8. SNMP View Table window

To delete an existing **SNMP View Table** entry, click the ***X*** button listed under **Delete** on the far left that corresponds to **View Name**. To create a new entry, click the **Add** button, a separate window will appear.



SNMP View Table Configuration

View Name	
Subtree OID	
View Type	Included

Figure 7- 9. SNMP View Table Configuration window

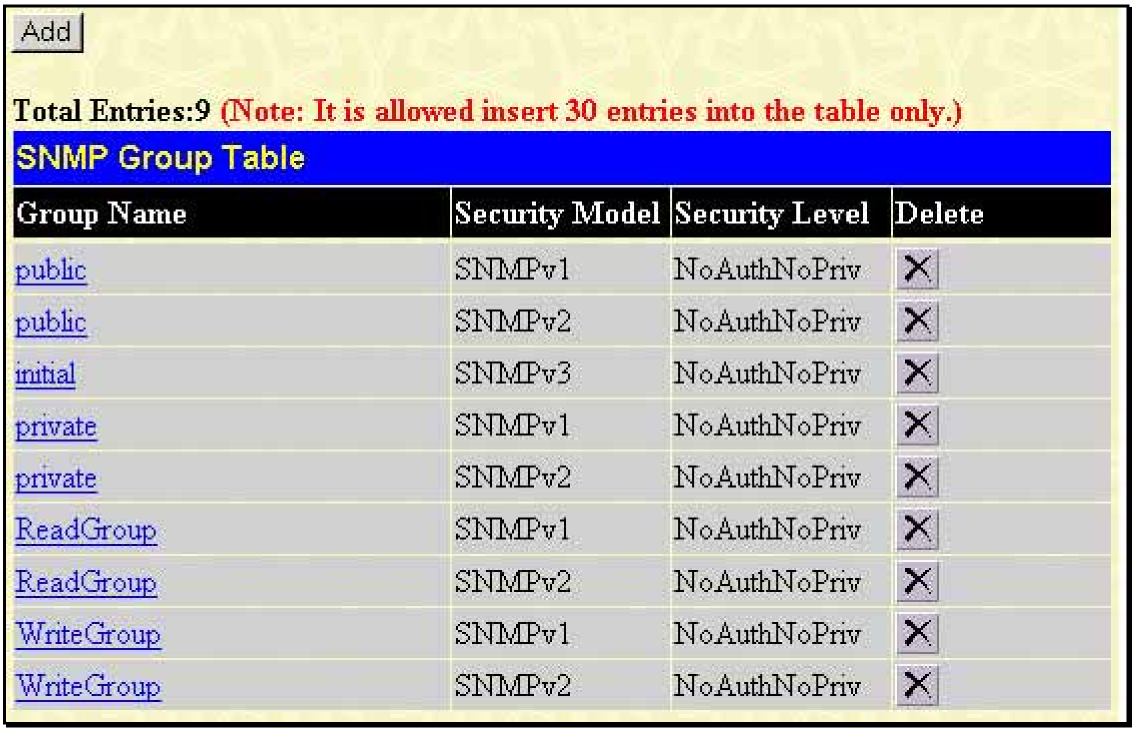
The SNMP Group created with this table maps SNMP users (identified in the **SNMP User Table** window) to the views created in the previous window.

The following parameters can set:

Parameter	Description
View Name	Type an alphanumeric string of up to 32 characters. This is used to identify the new SNMP view being created.
Subtree OID	Type the Object Identifier (OID) Subtree for the view. The OID identifies an object tree (MIB tree) that will be included or excluded from access by an SNMP manager.
View Type	Select Included to include this object in the list of objects that an SNMP manager can access. Select Excluded to exclude this object from the list of objects that an SNMP manager can access.

SNMP Group Table

An SNMP Group created with this table maps SNMP users (identified in the SNMP User Table) to the views created in the previous menu. To view the **SNMP Group Table**, open the **SNMP Manager** folder, located in the **Management** folder, and click the **SNMP Group Table** entry. The following screen should appear:



Total Entries:9 (Note: It is allowed insert 30 entries into the table only.)

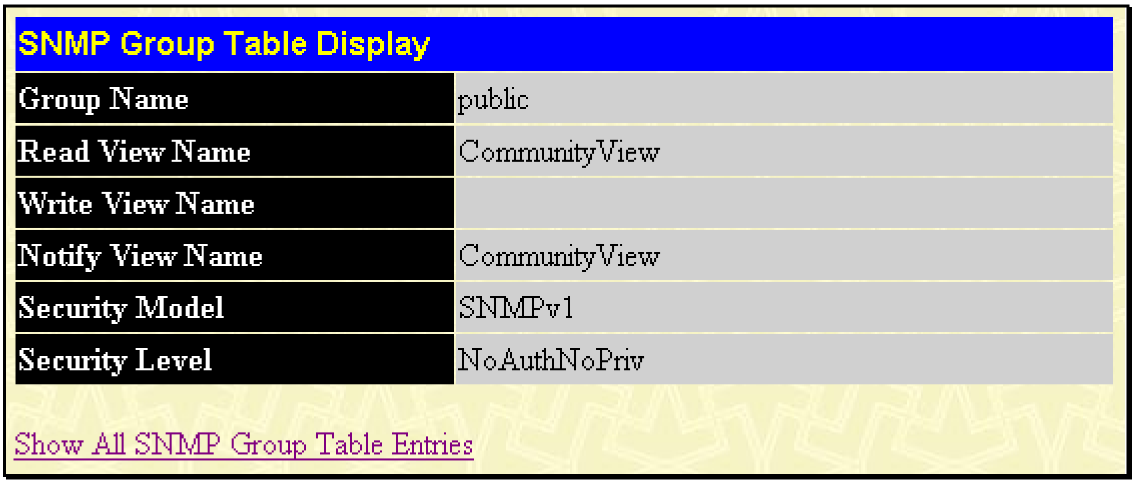
SNMP Group Table

Group Name	Security Model	Security Level	Delete
public	SNMPv1	NoAuthNoPriv	X
public	SNMPv2	NoAuthNoPriv	X
initial	SNMPv3	NoAuthNoPriv	X
private	SNMPv1	NoAuthNoPriv	X
private	SNMPv2	NoAuthNoPriv	X
ReadGroup	SNMPv1	NoAuthNoPriv	X
ReadGroup	SNMPv2	NoAuthNoPriv	X
WriteGroup	SNMPv1	NoAuthNoPriv	X
WriteGroup	SNMPv2	NoAuthNoPriv	X

Figure 7- 10. SNMP Group Table window

To delete an existing **SNMP Group Table** entry, click the corresponding **X** icon under the **Delete** heading.

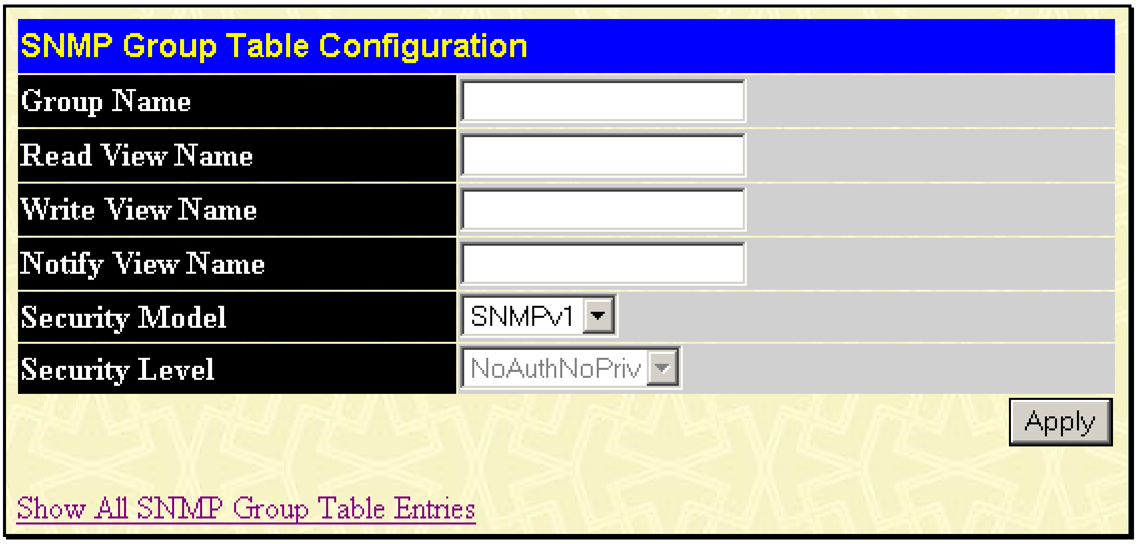
To display the current settings for an existing **SNMP Group Table** entry, click the blue hyperlink for the entry under the **Group Name** heading, revealing the following window.


SNMP Group Table Display

Group Name	public
Read View Name	CommunityView
Write View Name	
Notify View Name	CommunityView
Security Model	SNMPv1
Security Level	NoAuthNoPriv

Figure 7- 11. SNMP Group Table Display window

To add a new entry to the Switch's SNMP Group Table, click the **Add** button in the upper left-hand corner of the **SNMP Group Table** window. This will open the **SNMP Group Table Configuration** window, as shown below.



SNMP Group Table Configuration

Group Name	
Read View Name	
Write View Name	
Notify View Name	
Security Model	SNMPv1
Security Level	NoAuthNoPriv

Show All SNMP Group Table Entries

Figure 7- 12. SNMP Group Table Configuration window

The following parameters can be set:

Parameter	Description
Group Name	Type an alphanumeric string of up to 32 characters. This is used to identify the new SNMP group of SNMP users.
Read View Name	This name is used to specify the SNMP group created can request SNMP messages.
Write View Name	Specify a SNMP group name for users that are allowed SNMP write privileges to the Switch's SNMP agent.
Notify View Name	Specify a SNMP group name for users that can receive SNMP trap messages generated by the Switch's SNMP agent.
Security Model	*SNMPv1* - Specifies that SNMP version 1 will be used. *SNMPv2* - Specifies that SNMP version 2c will be used. The SNMPv2 supports both centralized and distributed network management strategies. It includes improvements in the Structure of Management Information (SMI) and adds some security features. *SNMPv3* - Specifies that the SNMP version 3 will be used. SNMPv3 provides secure access to devices through a combination of authentication and encrypting packets over the network.
Security Level	The Security Level settings only apply to SNMPv3. • *NoAuthNoPriv* - Specifies that there will be no authorization and no encryption of packets sent between the Switch and a remote SNMP manager. • *AuthNoPriv* - Specifies that authorization will be required, but there will be no encryption of packets sent between the Switch and a remote SNMP manager. • *AuthPriv* - Specifies that authorization will be required, and that packets sent between the Switch and a remote SNMP manger will be encrypted.

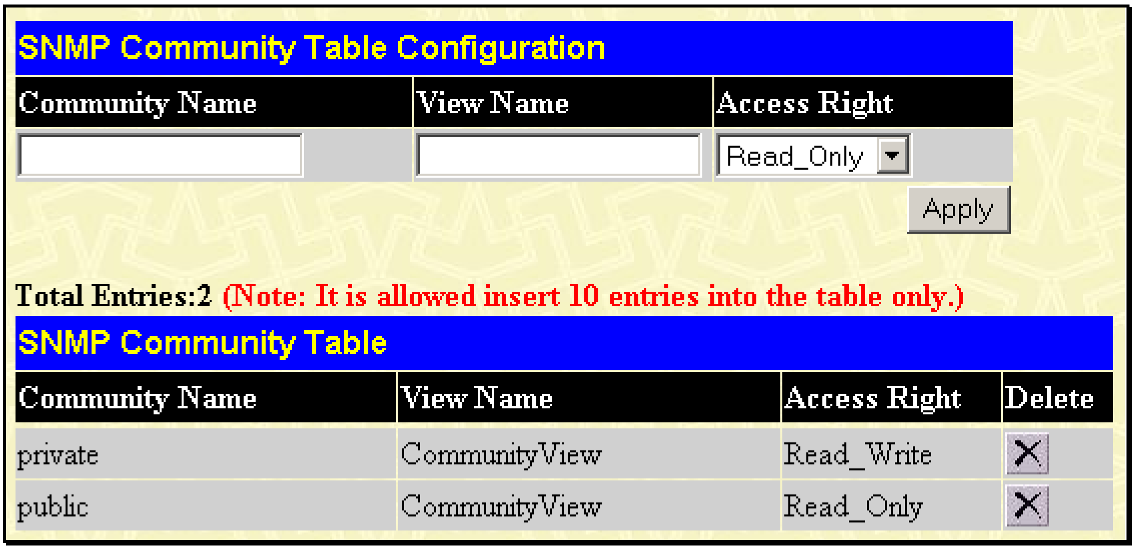
Click **Apply** to implement changes made.

SNMP Community Table

Use this table to create an SNMP community string to define the relationship between the SNMP manager and an agent. The community string acts like a password to permit access to the agent on the Switch. One or more of the following characteristics can be associated with the community string:

- An Access List of IP addresses of SNMP managers that are permitted to use the community string to gain access to the Switch's SNMP agent.
- Any MIB view that defines the subset of all MIB objects will be accessible to the SNMP community.
- Read/write or read-only level permission for the MIB objects accessible to the SNMP community.

To configure **SNMP Community** entries, open the **SNMP Manager** folder, located in the **Management** folder, and click the **SNMP Community Table** link, which will open the following screen:



SNMP Community Table Configuration

Community Name	View Name	Access Right
		Read_Only

Total Entries:2 (Note: It is allowed insert 10 entries into the table only.)

SNMP Community Table

Community Name	View Name	Access Right	Delete
private	CommunityView	Read_Write	☒
public	CommunityView	Read_Only	☒

Figure 7- 13. SNMP Community Table Configuration window

The following parameters can set:

Parameter	Description
Community Name	Type an alphanumeric string of up to 32 characters that is used to identify members of an SNMP community. This string is used like a password to give remote SNMP managers access to MIB objects in the Switch's SNMP agent.
View Name	Type an alphanumeric string of up to 32 characters that is used to identify the group of MIB objects that a remote SNMP manager is allowed to access on the Switch. The view name must exist in the SNMP View Table.
Access Right	*Read Only* - Specifies that SNMP community members using the community string created can only read the contents of the MIBs on the Switch. *Read Write* - Specifies that SNMP community members using the community string created can read from, and write to the contents of the MIBs on the Switch.

Click **Apply** to implement changes made.

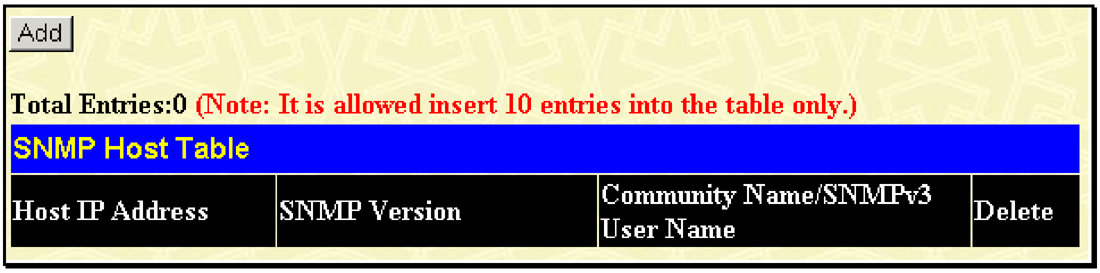
SNMP Host Table

Use the **SNMP Host Table** to set up SNMP trap recipients.

Open the **SNMP Manager** folder, located in the Management folder, and click on the **SNMP Host Table** link. This will open the **SNMP Host Table** page, as shown below.

To delete an existing **SNMP Host Table** entry, click the corresponding ☒ under the **Delete** heading.

To display the current settings for an existing **SNMP Group Table** entry, click the blue link for the entry under the **Host IP Address** heading.



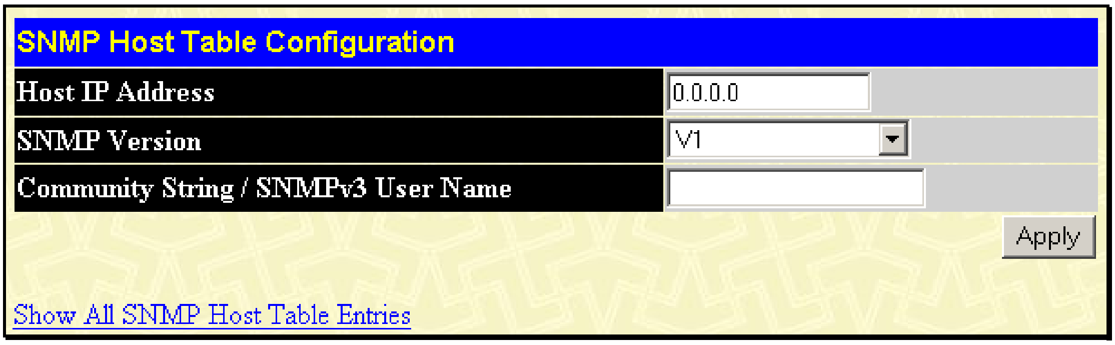
Total Entries:0 (Note: It is allowed insert 10 entries into the table only.)

SNMP Host Table

Host IP Address	SNMP Version	Community Name/SNMPv3 User Name	Delete

Figure 7- 14. SNMP Host Table window

To add a new entry to the Switch's **SNMP Group Table**, click the **Add** button in the upper left-hand corner of the **SNMP Host Table** window. This will open the **SNMP Host Table Configuration** window, as shown below.



SNMP Host Table Configuration

Host IP Address	0.0.0.0
SNMP Version	V1
Community String / SNMPv3 User Name	

Figure 7- 15. SNMP Host Table Configuration window

The following parameters can set:

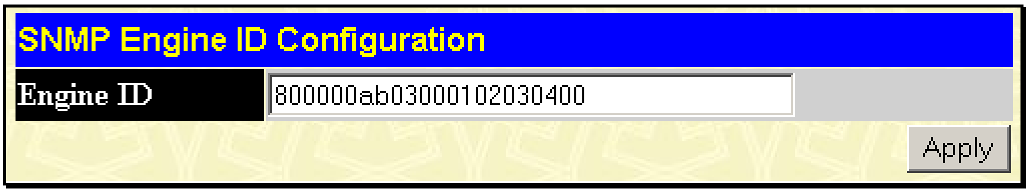
Parameter	Description
Host IP Address	Type the IP address of the remote management station that will serve as the SNMP host for the Switch.
SNMP Version	*V1* - To specifies that SNMP version 1 will be used. *V2* - To specify that SNMP version 2 will be used. *V3-NoAuth-NoPriv* - To specify that the SNMP version 3 will be used, with a NoAuth-NoPriv security level. *V3-Auth-NoPriv* - To specify that the SNMP version 3 will be used, with an Auth-NoPriv security level. *V3-Auth-Priv* - To specify that the SNMP version 3 will be used, with an Auth-Priv security level.
Community String or SNMP V3 User Name	Type in the community string or SNMP V3 user name as appropriate.

Click **Apply** to implement changes made.

SNMP Engine ID

The Engine ID is a unique identifier used for SNMP V3 implementations. This is an alphanumeric string used to identify the SNMP engine on the Switch.

To display the Switch's SNMP Engine ID, open the **SNMP Manger** folder, located in the **Management** folder and click on the **SNMP Engine ID** link. This will open the **SNMP Engine ID Configuration** window, as shown below.



SNMP Engine ID Configuration

Engine ID: 800000ab03000102030400

Figure 7- 16. SNMP Engine ID Configuration window

To change the Engine ID, type the new Engine ID in the space provided and click the **Apply** button.

Section 8

Monitoring

The DGS-3312SR provides extensive network monitoring capabilities that can be viewed from the **Monitoring** folder. Links to monitoring windows associated with Layer 3 Switch operations are located in a sub-folder within the **Monitoring** folder.

Stack Information

The DGS-3312SR Switch can be used as a standalone high-capacity Switch or be used in a stacked arrangement. There are two hardware requirements to use the Switch in a stacked group:

1. The proper module(s) must be installed to use the DES-3226S. One or two DEM-540, DEM-340T or the DEM-340MG Stacking modules must be installed in order to use the Switch in a stacked configuration.
2. Slave Switch units in a stacked Switch group must be one of the Switch models intended for use with the DGS-3312SR, namely the DES-3226S and the DES-3250TG Switches. The user may employ any combination of these two switches in a star topology.

One stacking module can be installed to stack up to four additional slave Switch units or two modules can be installed to stack up to eight additional slave Switch units.

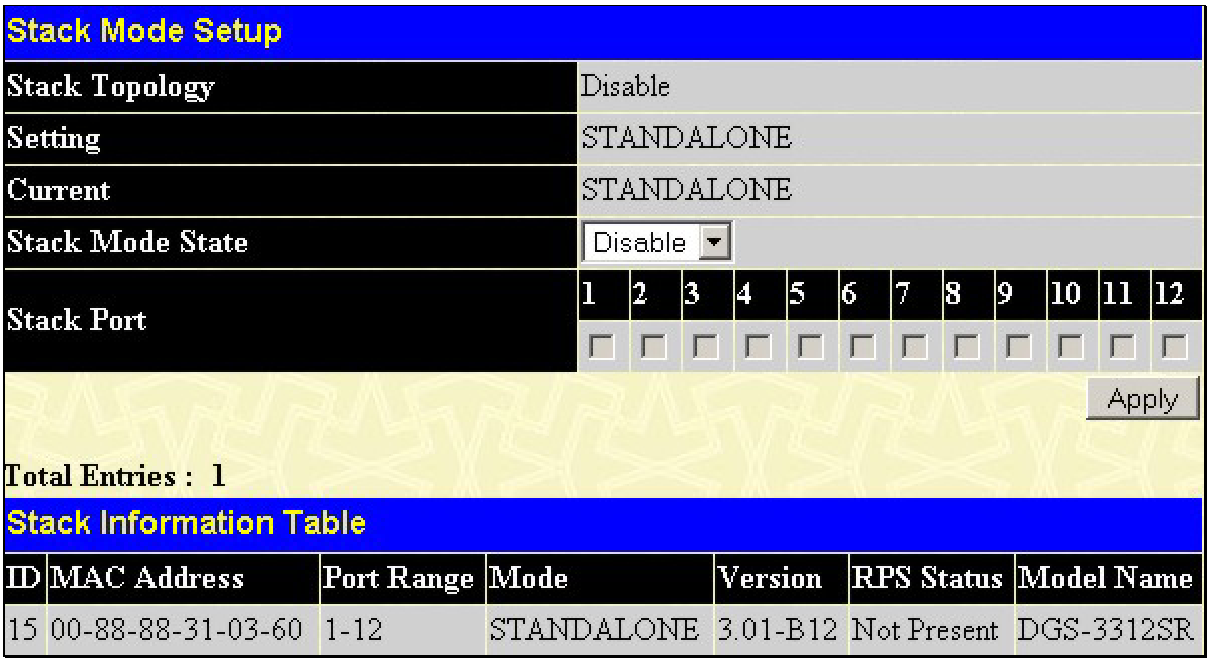
The DES-3250TG will stack with the DGS-3312SR only with a gigabit Ethernet connection, namely one the first four Mini-GBIC combo ports to the left of the front panel of the Switch or through the use of a gigabit Ethernet module. One of these ports MUST be connected to the Mini-GBIC combo port number 50 to the far right of the DES-3250TG for the proper stacking implementation to function correctly.

The DES-3226S will stack with the DGS-3312SR with a gigabit Ethernet connection or over IEEE 1394 fire wire cabling. One of these ports MUST be connected to module port number 26 to the far right of the DES-3226S for the proper stacking implementation to function correctly.

The web manager can be used to enable or disable the stacking mode and to enable stacking for any of the built-in combination ports.

The Switch stack displayed in the upper right-hand corner of your web-browser is a virtual representation of the actual stack. The icons appear in the same order as their respective Switches.

When the Switches are properly interconnected, information about the resulting Switch stack is displayed in the **Stack Mode Setup** window. To view stacking information or to enable/disable the stacking mode, click the **Stack Information** link in the **Monitoring** folder.



Stack Mode Setup

Stack Topology	Disable
Setting	STANDALONE
Current	STANDALONE
Stack Mode State	Disable ▾

Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	□	□	□	□	□	□	□	□	□	□	□	□

Total Entries : 1

Stack Information Table

ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-88-88-31-03-60	1-12	STANDALONE	3.01-B12	Not Present	DGS-3312SR

Figure 8- 1. Stack Mode Setup (stacking disabled) window

To enable the stacking mode, follow the steps listed below.

1. Select *Enable* from the **Stack Mode State** drop-down menu.
2. Click on the **Apply** button.

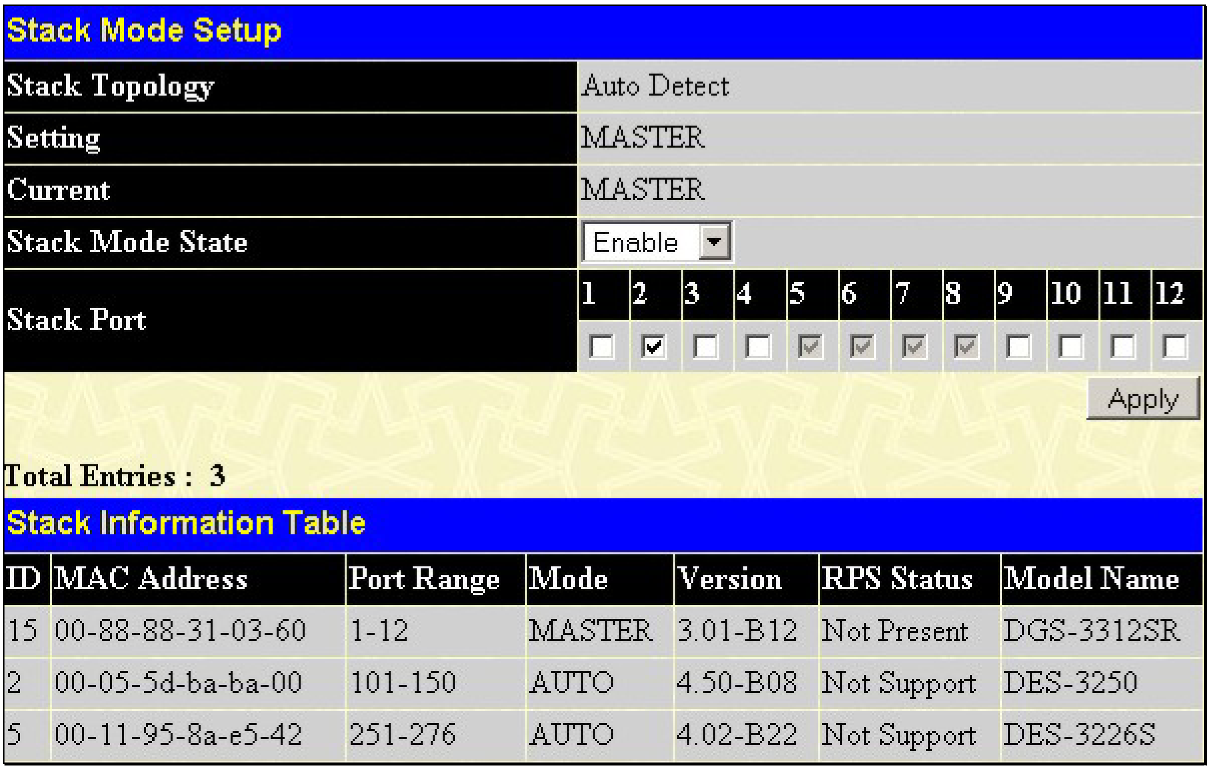
To enable stacking for one or more built-in combination ports, do the following:

1. Select *Enable* from the **Stack Mode State** drop-down menu.
2. Select the **Stack Port** by clicking to check a corresponding selection box.

The Stack Information Table displays the read-only information listed in the table on the next page.

The current order in the Switch stack is also displayed on the front panel of each slave Switch, under the STACK NO. heading. The Stack ID LED display on the front panel of the DGS-3312SR will always display an F (15 in hex), regardless of whether the DGS-3312SR is the master Switch in a Switch stack or in standalone mode.

Below is an example of the **Stack Mode Setup** window with stacking mode enabled on Port 1.



Stack Mode Setup

Stack Topology	Auto Detect
Setting	MASTER
Current	MASTER
Stack Mode State	Enable

Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	□	☑	□	□	☑	☑	☑	☑	□	□	□	□

Total Entries : 3

Stack Information Table

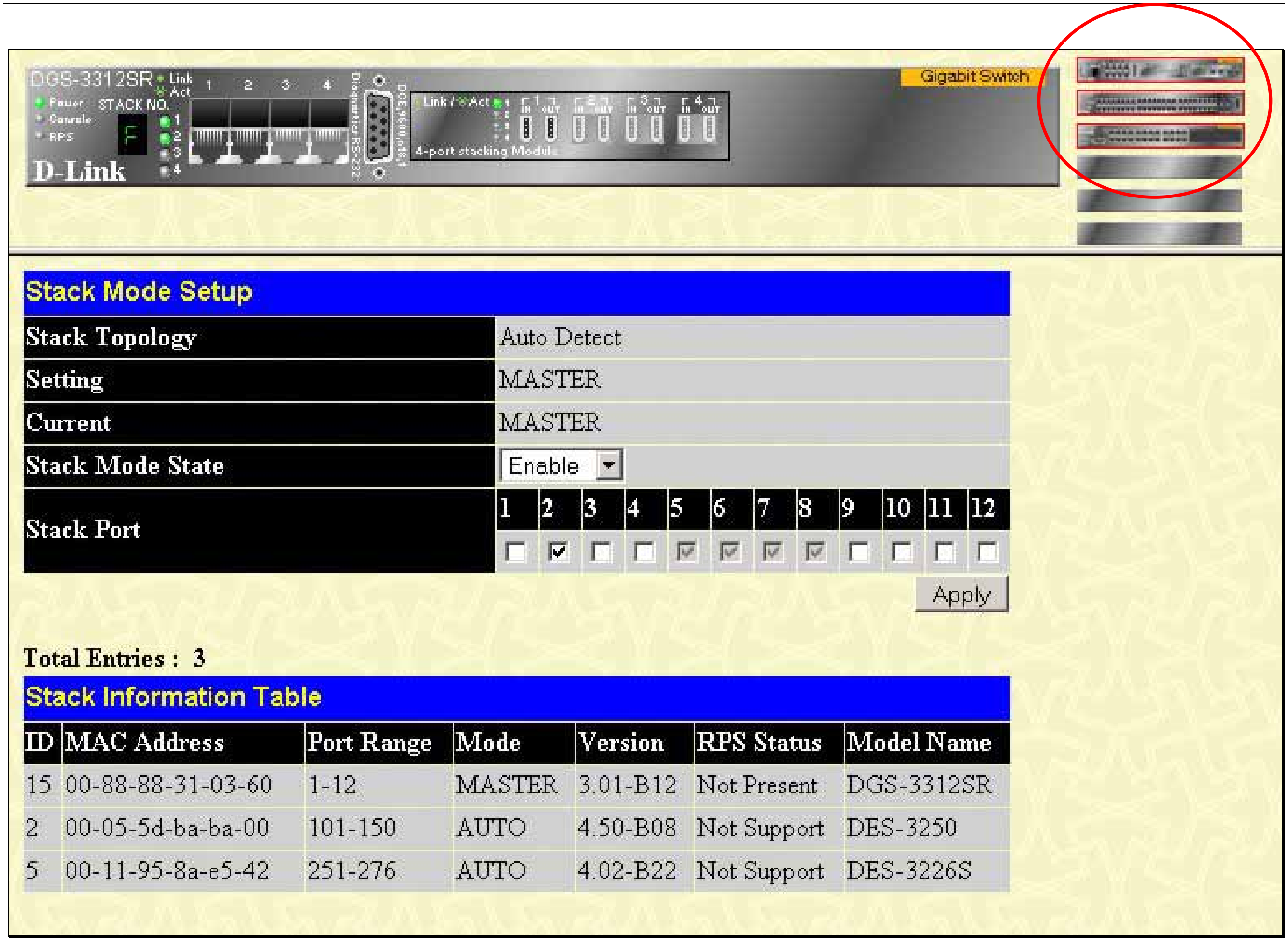
ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-88-88-31-03-60	1-12	MASTER	3.01-B12	Not Present	DGS-3312SR
2	00-05-5d-ba-ba-00	101-150	AUTO	4.50-B08	Not Support	DES-3250
5	00-11-95-8a-e5-42	251-276	AUTO	4.02-B22	Not Support	DES-3226S

Figure 8- 2. Stack Mode Setup (stacking enabled) window

Variables in this window are described below:

Parameter	Description
ID	Displays the Switch's order in the stack. The Switch with a unit id of 1 is the master Switch.
MAC Address	Displays the unique address of the Switch assigned by the factory.
Port Range	Displays the total number of ports on the Switch. Note that the stacking port is included in the total count.
Mode	Displays the method used to determine the stacking order of the Switches in the Switch stack.
Version	Displays the version number of the stacking firmware.
RPS Status	Displays the status of an optional Redundant Power Supply.
Model Name	Displays the model name of the corresponding Switch in a stack.

When the stacked group is connected and properly configured, the virtual stack appears in the upper right-hand corner of the web page.



Stack Mode Setup

Stack Topology	Auto Detect
Setting	MASTER
Current	MASTER
Stack Mode State	Enable ▾

Stack Port	1	2	3	4	5	6	7	8	9	10	11	12
	□	☑	□	□	☑	☑	☑	☑	□	□	□	□

Apply

Total Entries : 3

Stack Information Table

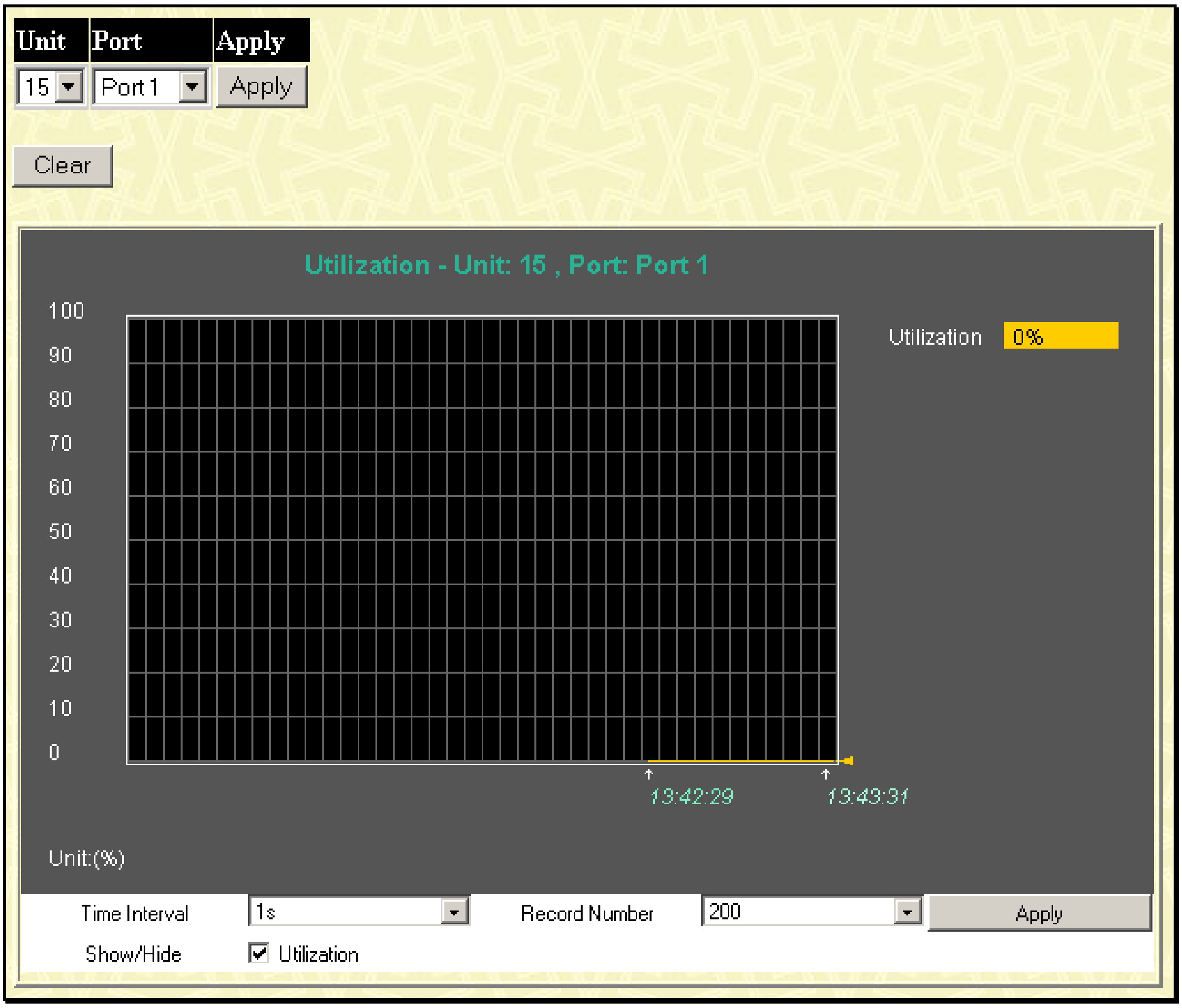
ID	MAC Address	Port Range	Mode	Version	RPS Status	Model Name
15	00-88-88-31-03-60	1-12	MASTER	3.01-B12	Not Present	DGS-3312SR
2	00-05-5d-ba-ba-00	101-150	AUTO	4.50-B08	Not Support	DES-3250
5	00-11-95-8a-e5-42	251-276	AUTO	4.02-B22	Not Support	DES-3226S

Figure 8- 3. Stack Information web page

Port Utilization

The **Port Utilization** window displays the percentage of the total available bandwidth being used on the port.

To view the port utilization, click on the **Monitoring** folder and then the **Port Utilization** link:



Unit	Port	Apply
15	Port 1	Apply

Utilization - Unit: 15 , Port: Port 1

Utilization 0%

Time Interval 1s

Record Number 200

Show/Hide ☑ Utilization

Figure 8- 4. Utilization window

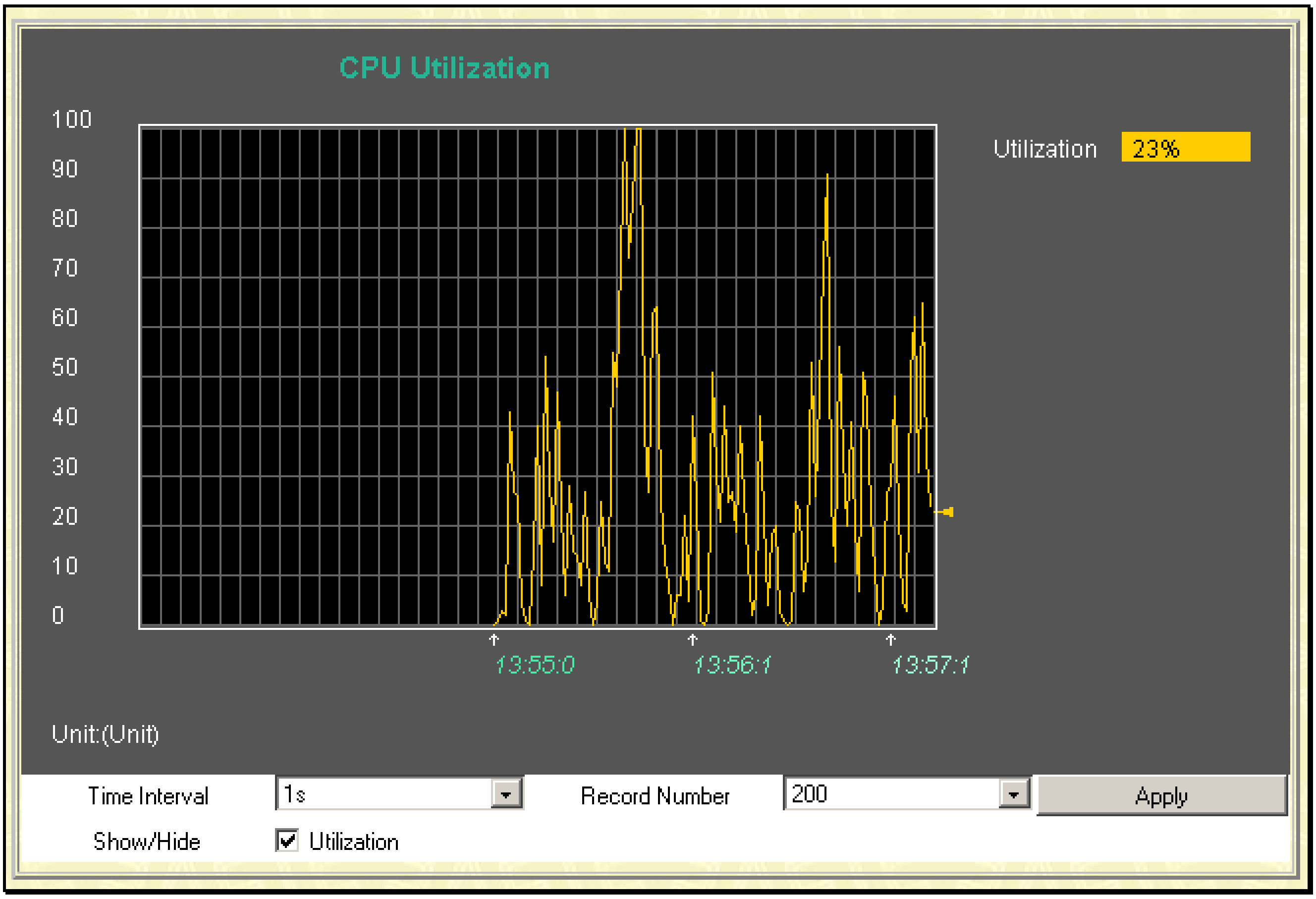
The following field can be set:

Parameter	Description
Unit	Allows you to specify a Switch in a Switch stack using that Switch's Unit ID. The number 15 indicates a Switch in standalone mode.
Port	Allows you to specify a port to monitor from the Switch selected above.
Clear	Clicking this button clears all statistics counters on this window.
Time Interval <*1s*>	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number <*200*>	Select number of times the Switch will be polled between *20* and *200*. The default value is *200.*
Show/Hide	Check to display Utilization.

CPU Utilization

This **CPU Utilization** window displays the moving average of the CPU.

To view the CPU utilization, click on the **Monitoring** folder and then the **CPU Utilization** link:



Utilization 23%

Time Interval 1s

Record Number 200

Show/Hide ☑ Utilization

Figure 8- 5. CPU Utilization window

The following field can be set:

Parameter	**Description**
Time Interval <*1s*>	Select the desired setting between *1s* and *60s*, where “s” stands for seconds. The default value is one second.
Record Number <*200*>	Select number of times the Switch will be polled between *20* and *200*. The default value is *200.*
Show/Hide	Check to display Utilization.

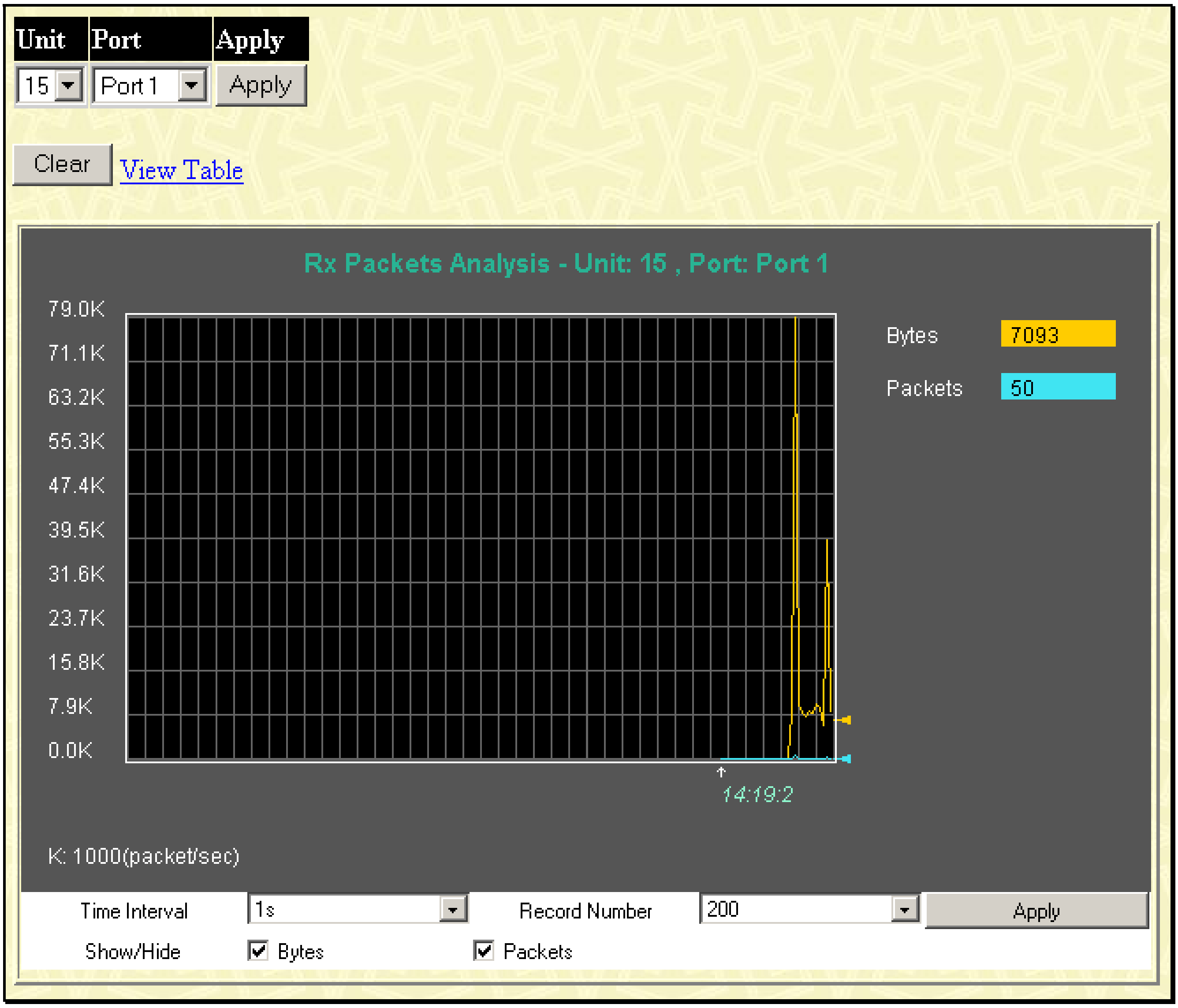
Packets

Various statistics can be viewed as either a line graph or a table:

- **Received Packets**
- **Received Unicast/Multicast/Broadcast Packets**
- **Transmitted Packet**

Received Packets

Click the **Received (RX)** link in the **Packets** folder of the **Monitoring** menu to view the following graph of packets received on the Switch. To select a port to view these statistics for, first select the Switch in the Switch stack by using the **Unit** pull-down menu and then select the port by using the **Port** pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.

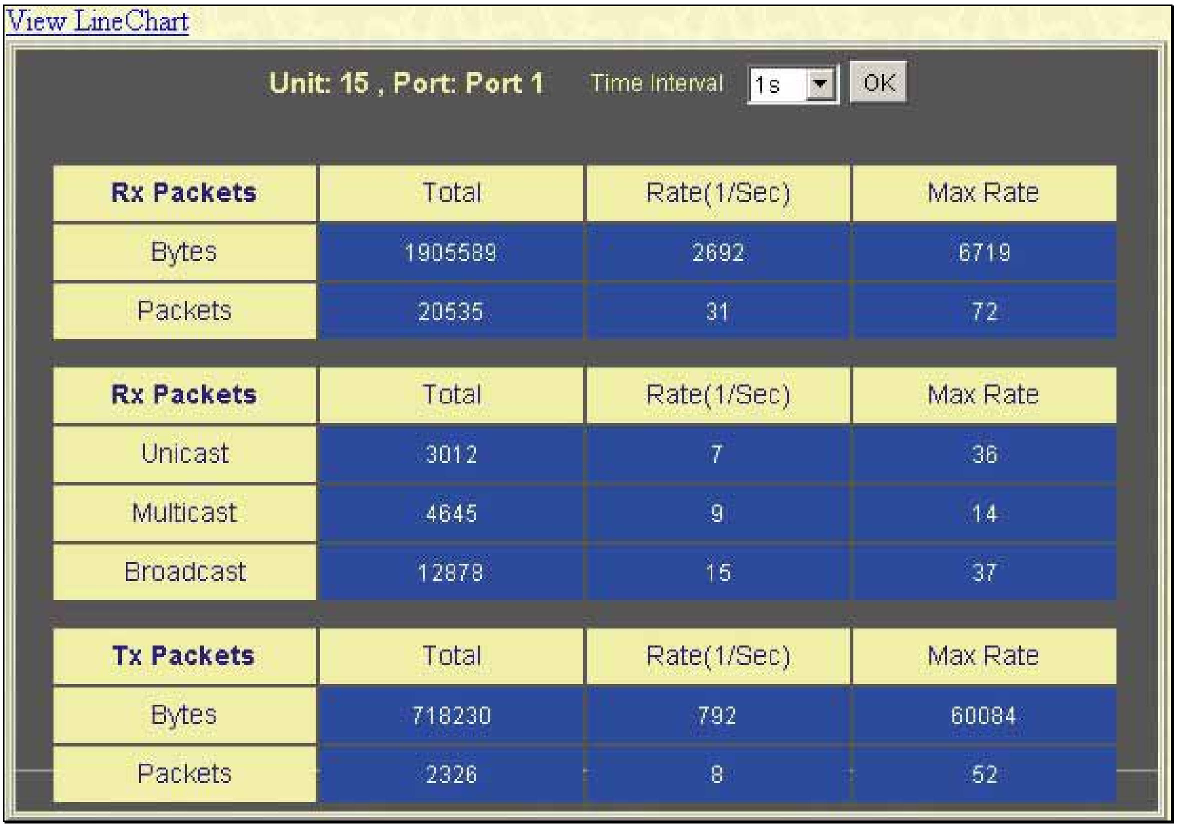


Unit	Port	Apply
15	Port 1	Apply

Bytes 7093
Packets 50

Time Interval 1s
Record Number 200
Apply
Show/Hide ☑ Bytes ☑ Packets

Figure 8- 6. Rx Packets Analysis (line graph for Bytes & Packets) window



Unit: 15 , Port: Port 1

Rx Packets	Total	Rate(1/Sec)	Max Rate
Bytes	1905589	2692	6719
Packets	20535	31	72

Rx Packets	Total	Rate(1/Sec)	Max Rate
Unicast	3012	7	36
Multicast	4645	9	14
Broadcast	12878	15	37

Tx Packets	Total	Rate(1/Sec)	Max Rate
Bytes	718230	792	60084
Packets	2326	8	52

Figure 8- 7. Rx Packets Analysis (table for Bytes & Packets) window

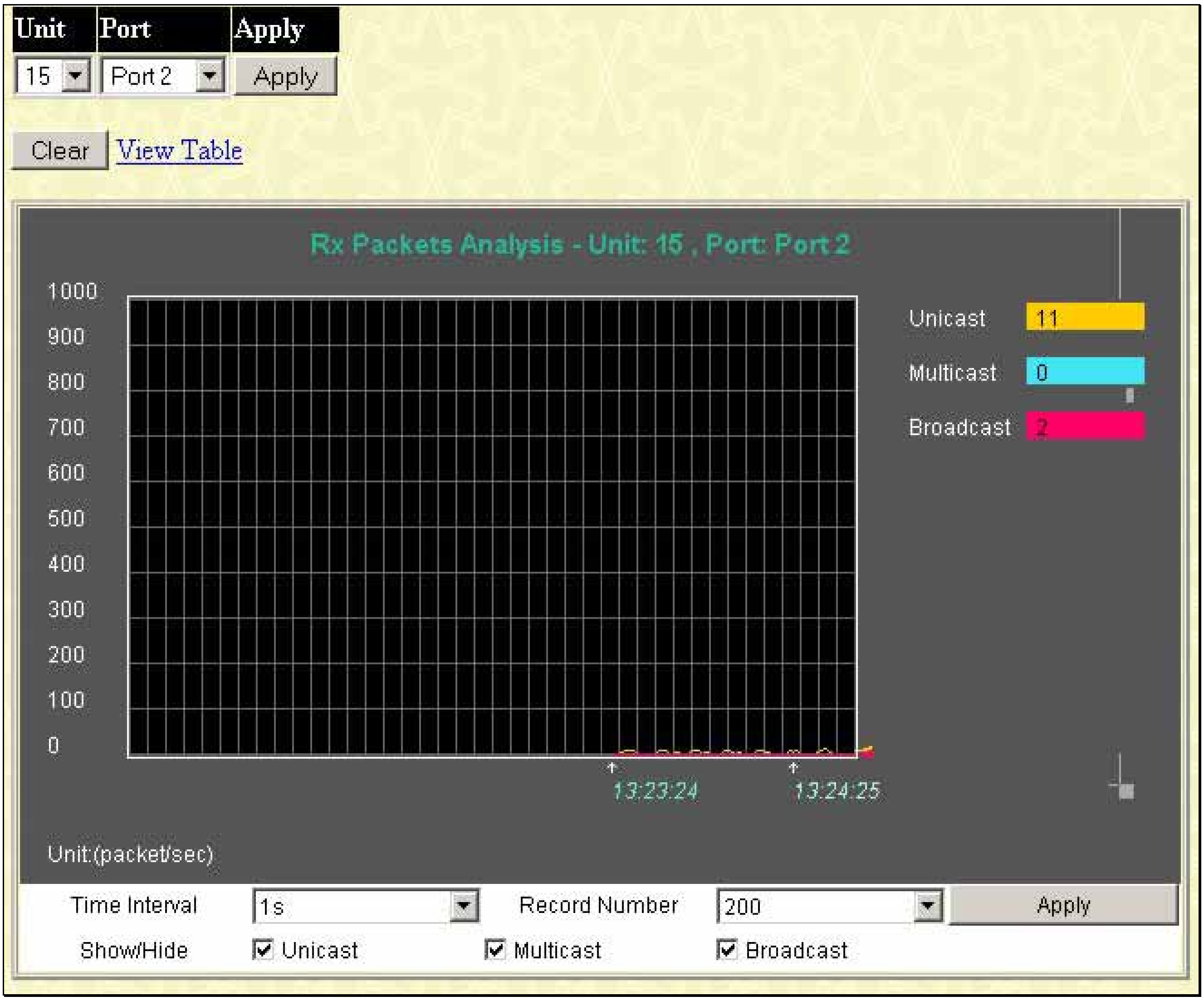
Select the desired Switch using the **Unit** drop-down menu and the desired port using the **Port** drop-down menu. The **Time Interval** field sets the interval at which the error statistics are updated.

The following field can be set:

Parameter	Description
Time Interval [1s]	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number [200]	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
Bytes	Counts the number of bytes received on the port.
Packets	Counts the number of packets received on the port.
Unicast	Counts the total number of good packets that were received by a unicast address.
Multicast	Counts the total number of good packets that were received by a multicast address.
Broadcast	Counts the total number of good packets that were received by a broadcast address.
Show/Hide	Check whether to display Bytes and Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

Received Unicast/Multicast/Broadcast Packets

Click the **UMB Cast (RX)** link in the **Packets** folder of the **Monitoring** menu to view the following graph of UMB cast packets received on the Switch. To select a port to view these statistics for, first select the Switch in the Switch stack by using the **Unit** pull-down menu and then select the port by using the **Port** pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.



Unit	Port	Apply
15	Port 2	Apply

Clear View Table

Rx Packets Analysis - Unit: 15 , Port: Port 2

Unicast 11

Multicast 0

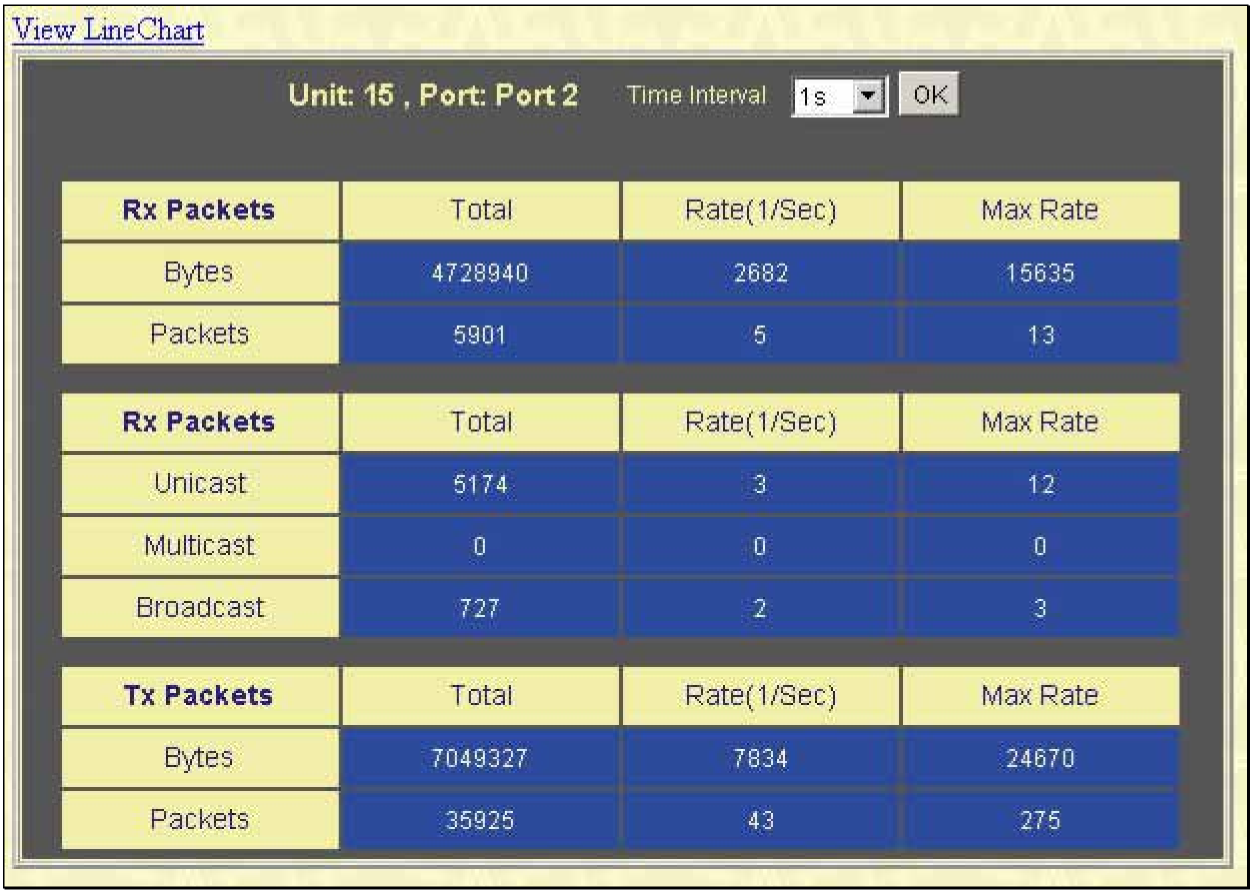
Broadcast 2

Unit:(packet/sec)

Time Interval 1s Record Number 200 Apply

Show/Hide ☑ Unicast ☑ Multicast ☑ Broadcast

Figure 8- 8. Rx Packets Analysis (line graph for Unicast, Multicast, & Broadcast) window



Unit: 15 , Port: Port 2

Rx Packets	Total	Rate(1/Sec)	Max Rate
Bytes	4728940	2682	15635
Packets	5901	5	13

Rx Packets	Total	Rate(1/Sec)	Max Rate
Unicast	5174	3	12
Multicast	0	0	0
Broadcast	727	2	3

Tx Packets	Total	Rate(1/Sec)	Max Rate
Bytes	7049327	7834	24670
Packets	35925	43	275

Figure 8- 9. Rx Packets Analysis (table for Unicast, Multicast, & Broadcast) window

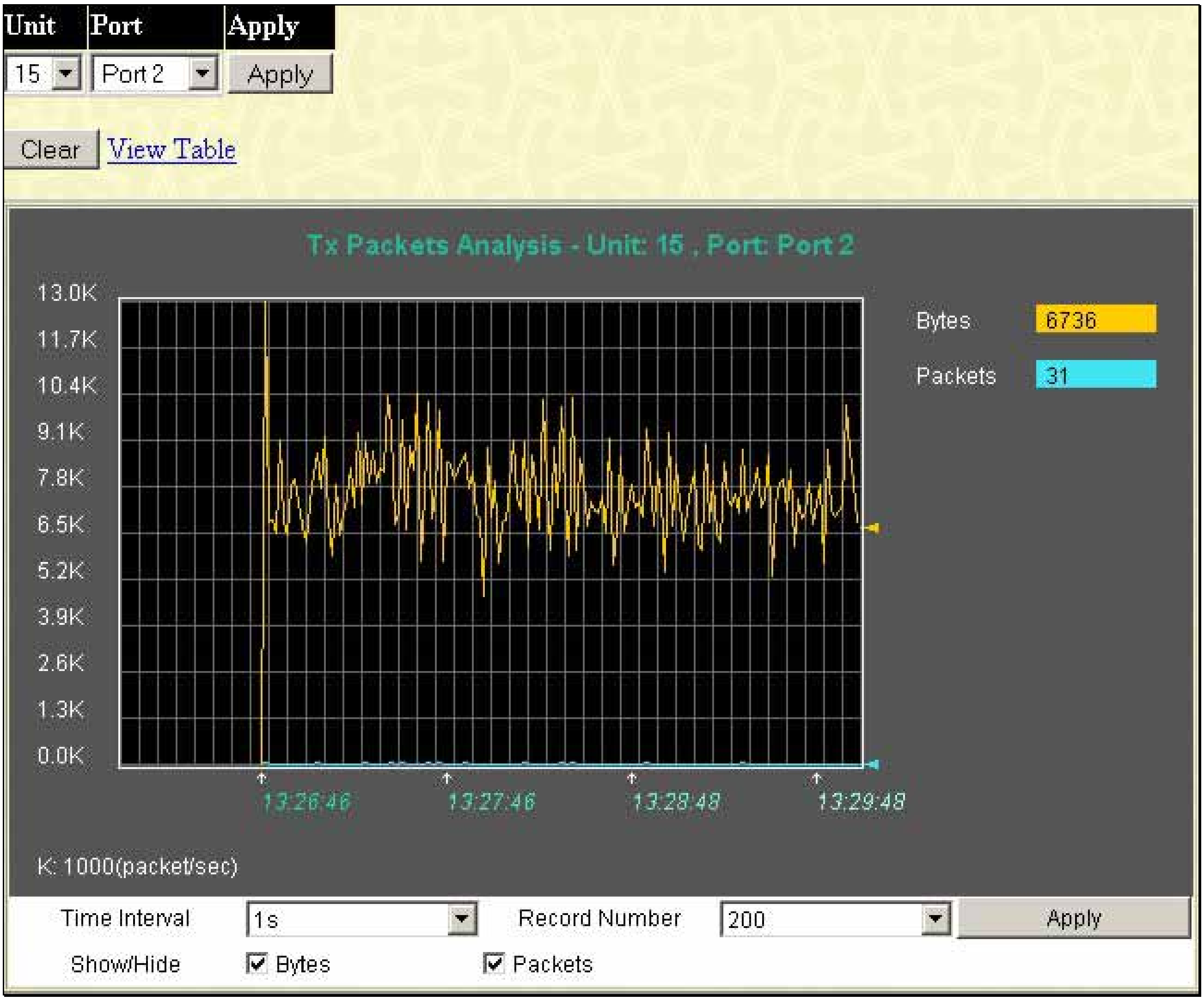
Select the desired Switch using the **Unit** drop-down menu and the desired port using the **Port** drop-down menu. The **Time Interval** field sets the interval at which the error statistics are updated.

The following fields can be set:

Parameter	Description
Time Interval [1s]	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number [200]	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
Unicast	Counts the total number of good packets that were received by a unicast address.
Multicast	Counts the total number of good packets that were received by a multicast address.
Broadcast	Counts the total number of good packets that were received by a broadcast address.
Show/Hide	Check whether or not to display Multicast, Broadcast, and Unicast Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

Transmitted Packets

Click the **Transmitted (TX)** link in the **Packets** folder of the **Monitoring** menu to view the following graph of packets transmitted from the Switch. To select a port to view these statistics for, first select the Switch in the Switch stack by using the **Unit** pull-down menu and then select the port by using the Port pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.



Unit: 15 | Port: Port 2

Bytes: 6736

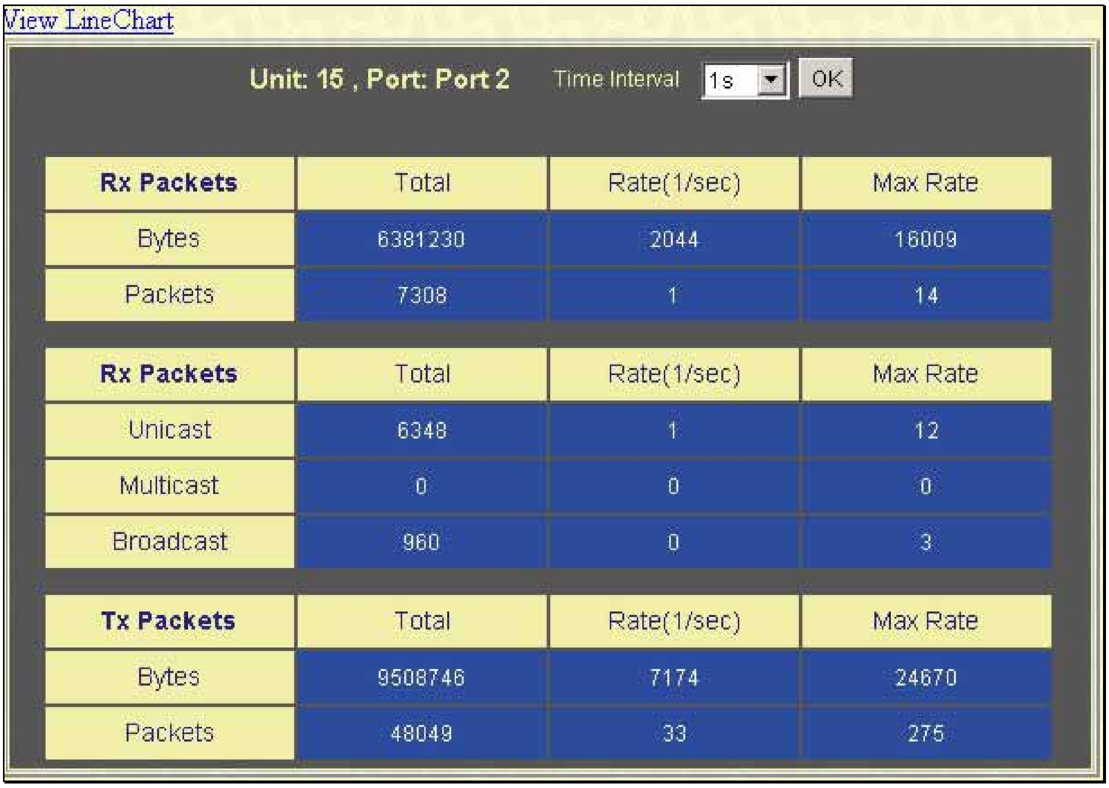
Packets: 31

Time Interval: 1s

Record Number: 200

Show/Hide: ☑ Bytes ☑ Packets

Figure 8- 10. Tx Packets Analysis (line graph for Bytes & Packets) window



View LineChart

Unit: 15 , Port: Port 2 Time Interval 1s OK

Rx Packets	Total	Rate(1/sec)	Max Rate
Bytes	6381230	2044	16009
Packets	7308	1	14

Rx Packets	Total	Rate(1/sec)	Max Rate
Unicast	6348	1	12
Multicast	0	0	0
Broadcast	960	0	3

Tx Packets	Total	Rate(1/sec)	Max Rate
Bytes	9508746	7174	24670
Packets	48049	33	275

Figure 8- 11. Tx Packets Analysis (table for Bytes & Packets) window

Select the desired Switch using the **Unit** drop-down menu and the desired port using the **Port** drop-down menu. The **Time Interval** field sets the interval at which the error statistics are updated.

The following fields can be set or are displayed:

Parameter	Description
Time Interval [1s]	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number [200]	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
Bytes	Counts the number of bytes successfully sent from the port.
Packets	Counts the number of packets successfully sent on the port.
Unicast	Counts the total number of good packets that were transmitted by a unicast address.
Multicast	Counts the total number of good packets that were transmitted by a multicast address.
Broadcast	Counts the total number of good packets that were transmitted by a broadcast address.
Show/Hide	Check whether or not to display Bytes and Packets.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

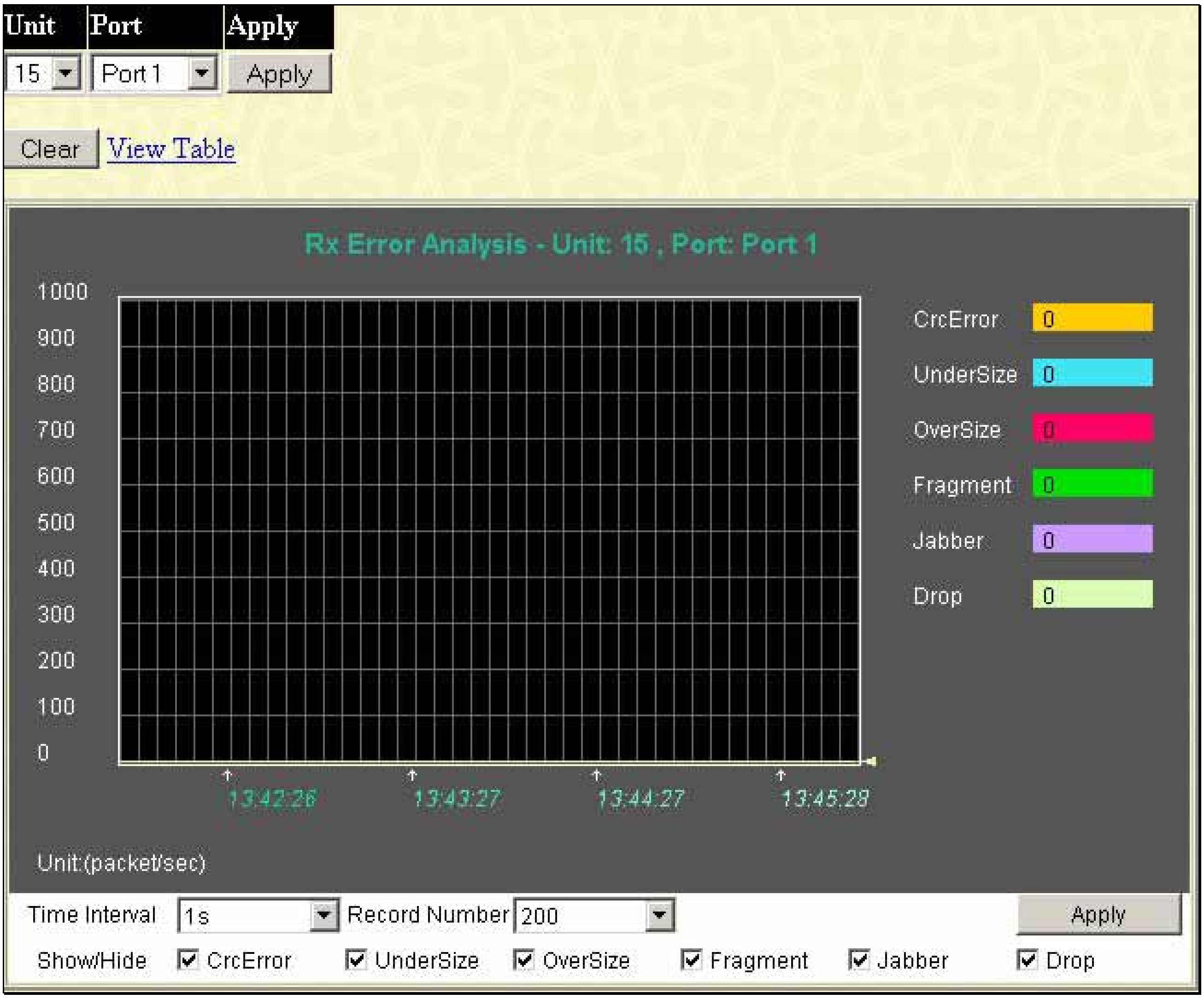
Errors

Various statistics can be viewed as either a line graph or a table:

- **Received Errors**
- **Transmitted Errors**

Received Errors

Click the **Received (RX)** link in the **Error** folder of the **Monitoring** menu to view the following graph of error packets received on the Switch. To select a port to view these statistics for, first select the Switch in the Switch stack by using the **Unit** pull-down menu and then select the port by using the **Port** pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.



Unit	Port	Apply
15	Port 1	Apply

Clear View Table

Rx Error Analysis - Unit: 15 , Port: Port 1

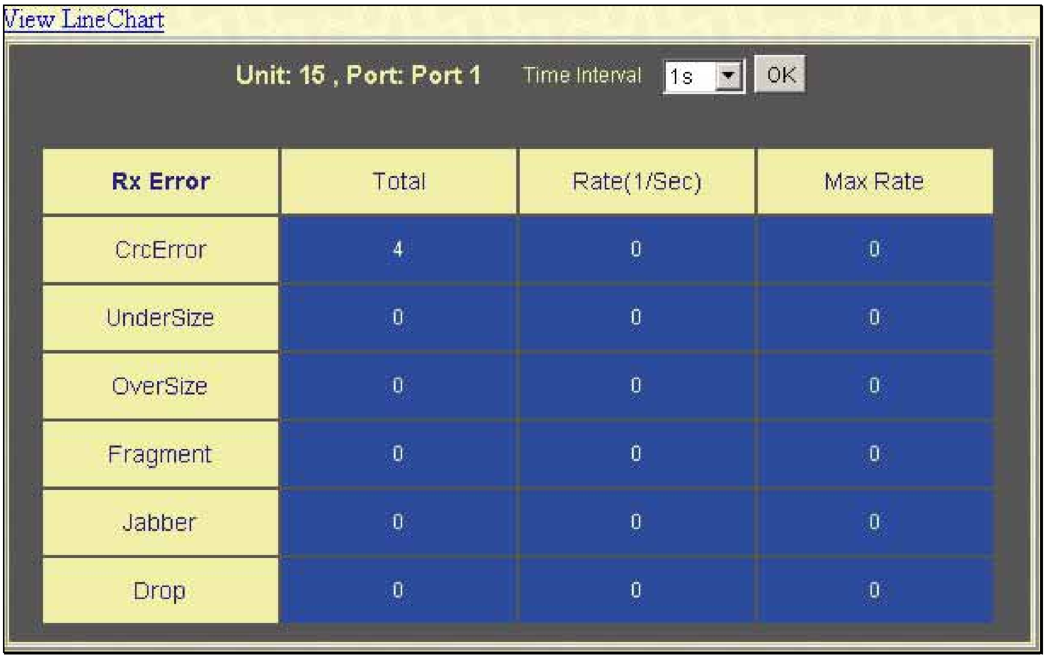
CrcError	0
UnderSize	0
OverSize	0
Fragment	0
Jabber	0
Drop	0

Unit:(packet/sec)

Time Interval 1s Record Number 200 Apply

Show/Hide ☑ CrcError ☑ UnderSize ☑ OverSize ☑ Fragment ☑ Jabber ☑ Drop

Figure 8- 12. Rx Error Analysis (line graph) window



View LineChart

Unit: 15 , Port: Port 1 Time Interval 1s OK

Rx Error	Total	Rate(1/Sec)	Max Rate
CrcError	4	0	0
UnderSize	0	0	0
OverSize	0	0	0
Fragment	0	0	0
Jabber	0	0	0
Drop	0	0	0

Figure 8- 13. Rx Error Analysis (table) window

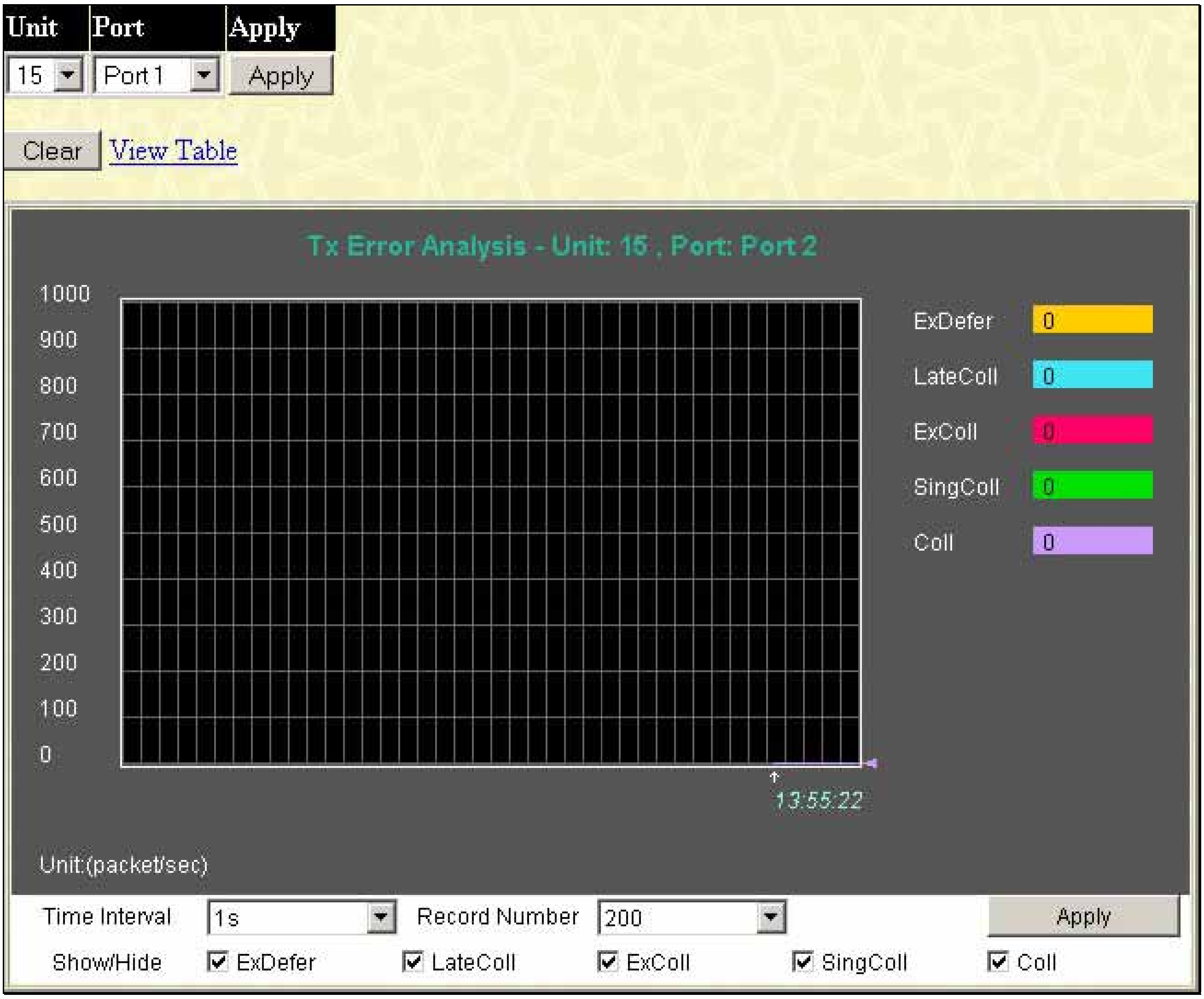
Select the desired Switch using the Unit drop-down menu and the desired port using the Port drop-down menu. The Time Interval field sets the interval at which the error statistics are updated.

The following fields can be set or are displayed:

Parameter	Description
Time Interval [1s]	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number [200]	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
Crc Error	Counts otherwise valid packets that did not end on a byte (octet) boundary.
UnderSize	The number of packets detected that are less than the minimum permitted packets size of 64 bytes and have a good CRC. Undersize packets usually indicate collision fragments, a normal network occurrence.
OverSize	Counts packets received that were longer than 1518 octets, or if a VLAN frame is 1522 octets, and less than the MAX_PKT_LEN. Internally, MAX_PKT_LEN is equal to 1522.
Fragment	The number of packets less than 64 bytes with either bad framing or an invalid CRC. These are normally the result of collisions.
Jabber	The number of packets with lengths more than the MAX_PKT_LEN bytes. Internally, MAX_PKT_LEN is equal to 1522.
Drop	The number of packets that are dropped by this port since the last Switch reboot.
Show/Hide	Check whether or not to display Crc Error, Under Size, Over Size, Fragment, Jabber, and Drop errors.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

Transmitted Errors

Click the Transmitted (TX) link in the Error folder of the Monitoring menu to view the following graph of error packets received on the Switch. To select a port to view these statistics for, first select the Switch in the switch stack by using the **Unit** pull-down menu and then select the port by using the **Port** pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.



Unit: 15
Port: Port 1

Tx Error Analysis - Unit: 15 , Port: Port 2

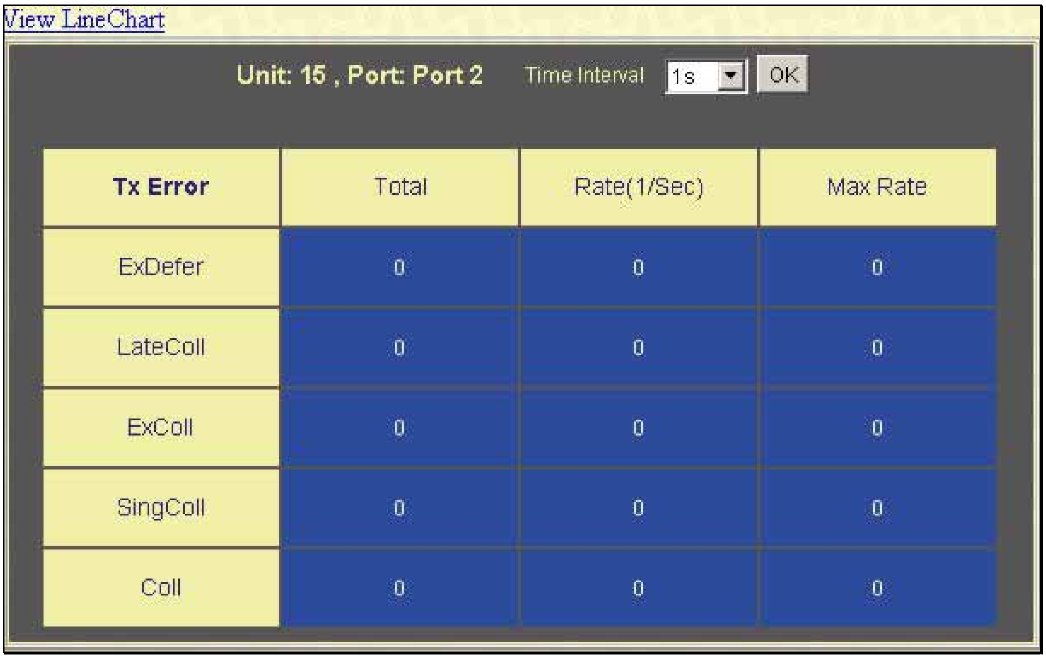
ExDefer 0
LateColl 0
ExColl 0
SingColl 0
Coll 0

Unit:(packet/sec)

Time Interval: 1s
Record Number: 200

Show/Hide ☑ ExDefer ☑ LateColl ☑ ExColl ☑ SingColl ☑ Coll

Figure 8- 14. Tx Error Analysis (line graph) window



Unit: 15 , Port: Port 2

Time Interval 1s

Tx Error	Total	Rate(1/Sec)	Max Rate
ExDefer	0	0	0
LateColl	0	0	0
ExColl	0	0	0
SingColl	0	0	0
Coll	0	0	0

Figure 8- 15. Tx Error Analysis (table) window

Select the desired Switch using the **Unit** drop-down menu and the desired port using the **Port** drop-down menu. The **Time Interval** field sets the interval at which the error statistics are updated.

The following fields can be set:

Parameter	Description
Time Interval *[1s]*	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number *[200]*	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
ExDefer	Counts the number of packets for which the first transmission attempt on a particular interface was delayed because the medium was busy.
CRC Error	Counts otherwise valid packets that did not end on a byte (octet) boundary.
LateColl	Counts the number of times that a collision is detected later than 512 bit-times into the transmission of a packet.
ExColl	Excessive Collisions. The number of packets for which transmission failed due to excessive collisions.
SingColl	Single Collision Frames. The number of successfully transmitted packets for which transmission is inhibited by more than one collision.
Coll	An estimate of the total number of collisions on this network segment.
Show/Hide	Check whether or not to display ExDefer, LateColl, ExColl, SingColl, and Coll errors.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

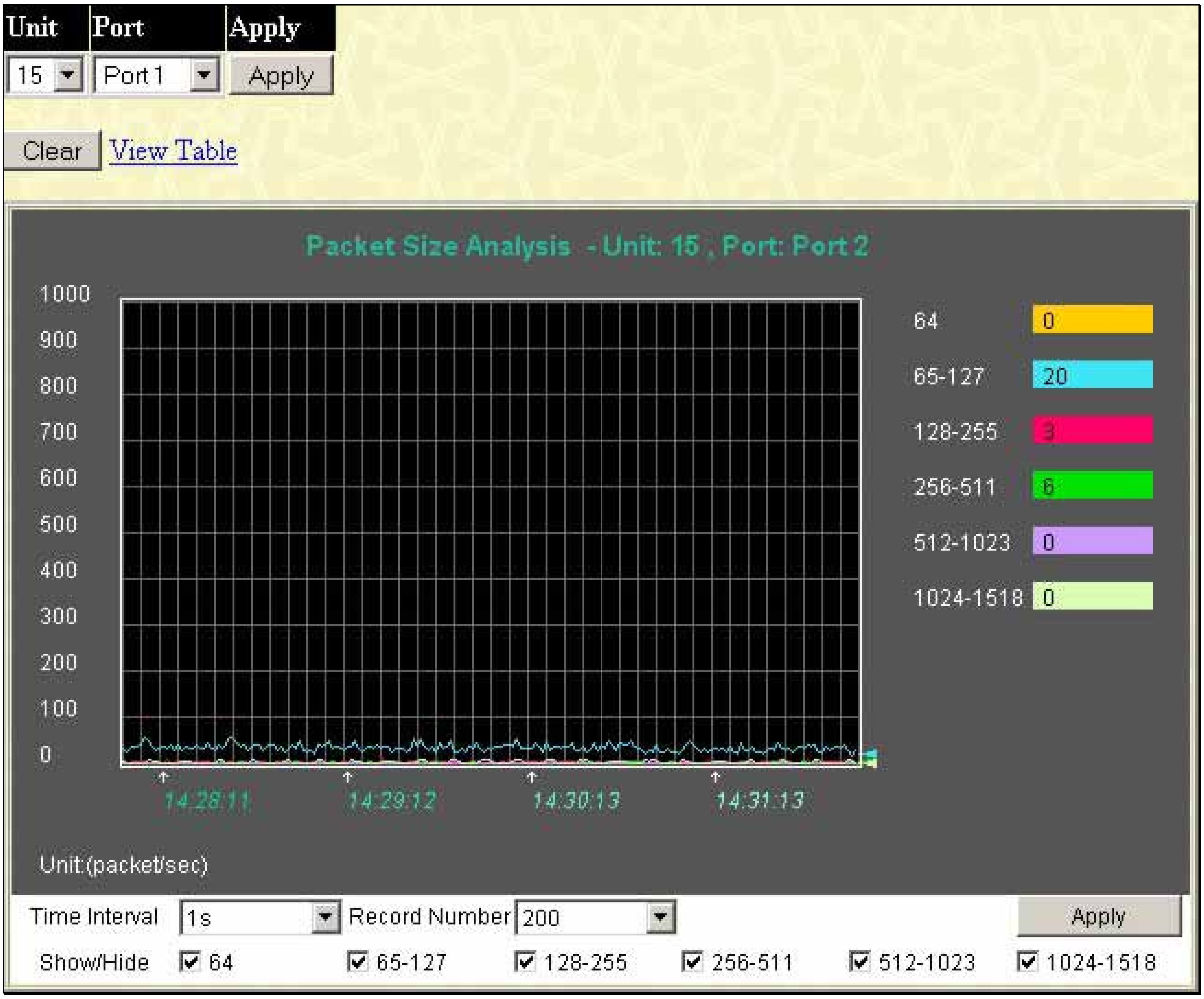
Size

Various statistics can be viewed as either a line graph or a table:

- **Packet Size**

Packet Size

The Web Manager allows packets received by the Switch, arranged in six groups and classed by size, to be viewed as either a line graph or a table. Two windows are offered. To select a port to view these statistics for, first select the Switch in the Switch stack by using the **Unit** pull-down menu and then select the port by using the **Port** pull down menu. The user may also use the real-time graphic of the Switch and/or switch stack at the top of the web page by simply clicking on a port.



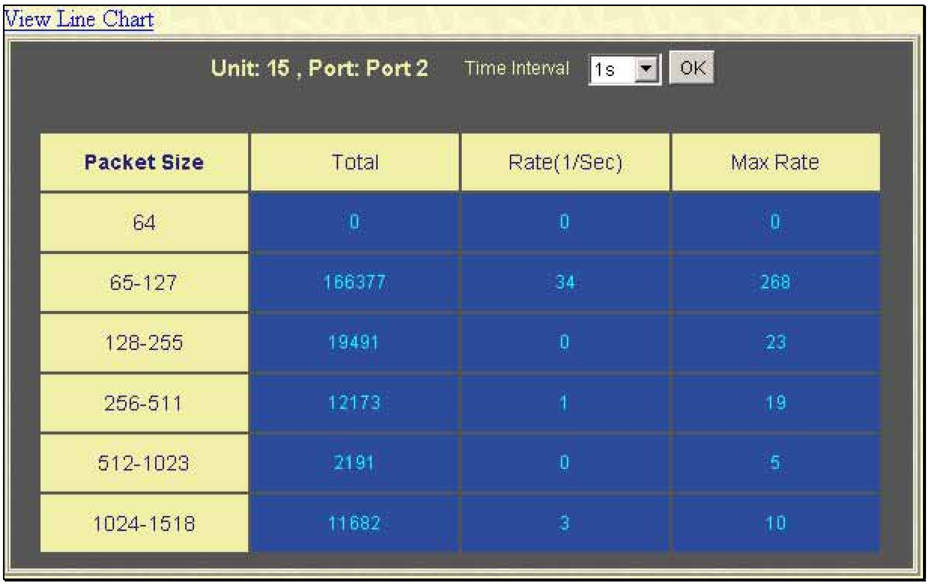
Unit: 15
Port: Port 1

Packet Size Analysis - Unit: 15 , Port: Port 2

64	0
65-127	20
128-255	3
256-511	6
512-1023	0
1024-1518	0

Time Interval: 1s
Record Number: 200
Show/Hide: ☑ 64 ☑ 65-127 ☑ 128-255 ☑ 256-511 ☑ 512-1023 ☑ 1024-1518

Figure 8- 16. Packet Size Analysis (line graph) window



View Line Chart

Unit: 15 , Port: Port 2

Time Interval 1s

Packet Size	Total	Rate(1/Sec)	Max Rate
64	0	0	0
65-127	166377	34	268
128-255	19491	0	23
256-511	12173	1	19
512-1023	2191	0	5
1024-1518	11682	3	10

Figure 8- 17. Packet Size Analysis (table) window

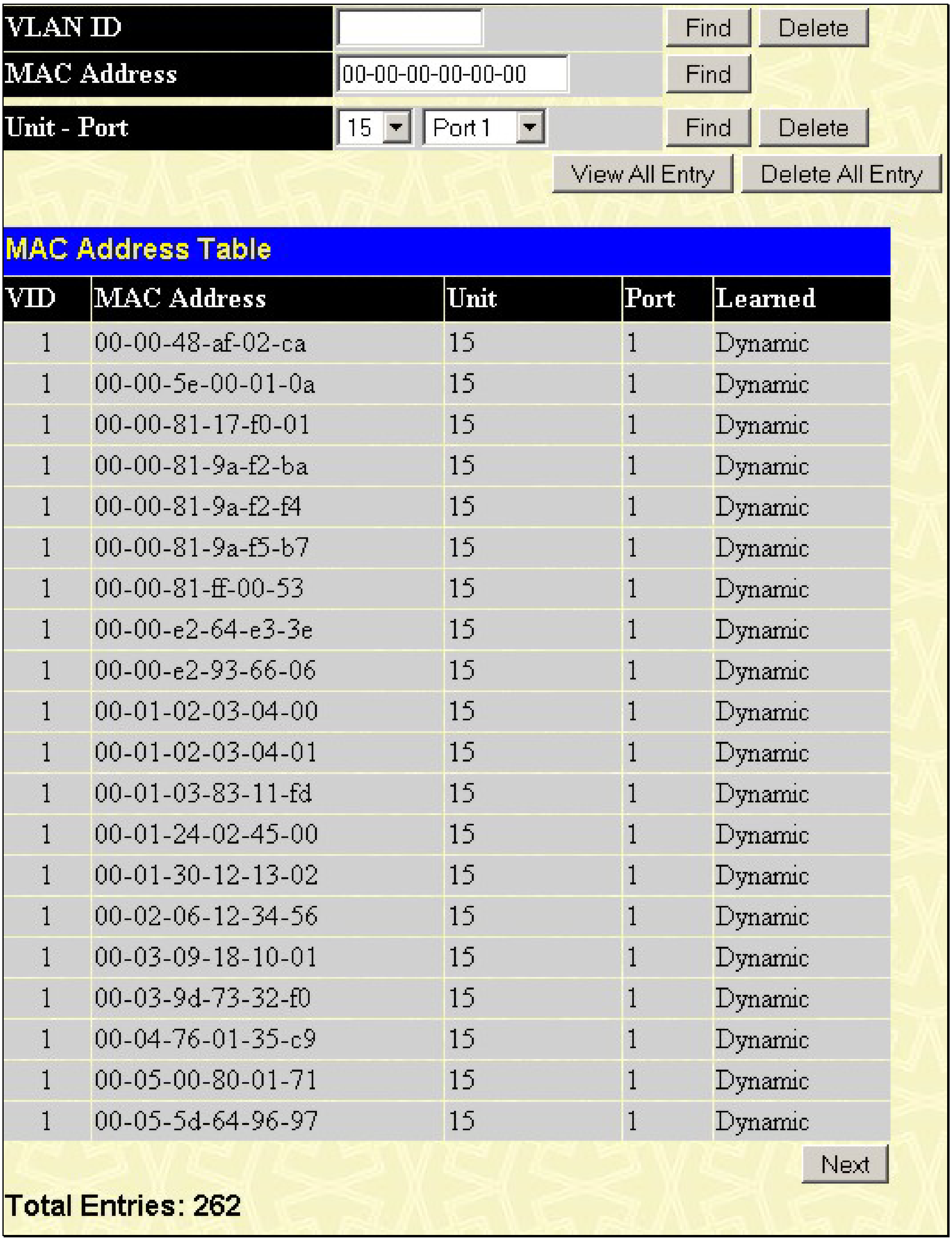
Select the desired Switch using the **Unit** drop-down menu and the desired port using the Port drop-down menu. The **Time Interval** field sets the interval at which the error statistics are updated.

The following field can be set:

Parameter	Description
Time Interval [1s]	Select the desired setting between 1s and 60s, where "s" stands for seconds. The default value is one second.
Record Number [200]	Select number of times the Switch will be polled between 20 and 200. The default value is 200.
64	The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets).
65-127	The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets).
128-255	The total number of packets (including bad packets) received that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets).
256-511	The total number of packets (including bad packets) received that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets).
512-1023	The total number of packets (including bad packets) received that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets).
1024-1518	The total number of packets (including bad packets) received that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets).
Show/Hide	Check whether or not to display 64, 65-127, 128-255, 256-511, 512-1023, and 1024-1518 packets received.
Clear	Clicking this button clears all statistics counters on this window.
View Table	Clicking this button instructs the Switch to display a table rather than a line graph.
View Line Chart	Clicking this button instructs the Switch to display a line graph rather than a table.

MAC Address

This allows the Switch's dynamic MAC address forwarding table to be viewed. When the Switch learns an association between a MAC address and a port number, it makes an entry into its forwarding table. These entries are then used to forward packets through the Switch.



VLAN ID	
MAC Address	00-00-00-00-00-00
Unit - Port	15 Port 1

MAC Address Table

VID	MAC Address	Unit	Port	Learned
1	00-00-48-af-02-ca	15	1	Dynamic
1	00-00-5e-00-01-0a	15	1	Dynamic
1	00-00-81-17-f0-01	15	1	Dynamic
1	00-00-81-9a-f2-ba	15	1	Dynamic
1	00-00-81-9a-f2-f4	15	1	Dynamic
1	00-00-81-9a-f5-b7	15	1	Dynamic
1	00-00-81-ff-00-53	15	1	Dynamic
1	00-00-e2-64-e3-3e	15	1	Dynamic
1	00-00-e2-93-66-06	15	1	Dynamic
1	00-01-02-03-04-00	15	1	Dynamic
1	00-01-02-03-04-01	15	1	Dynamic
1	00-01-03-83-11-fd	15	1	Dynamic
1	00-01-24-02-45-00	15	1	Dynamic
1	00-01-30-12-13-02	15	1	Dynamic
1	00-02-06-12-34-56	15	1	Dynamic
1	00-03-09-18-10-01	15	1	Dynamic
1	00-03-9d-73-32-f0	15	1	Dynamic
1	00-04-76-01-35-c9	15	1	Dynamic
1	00-05-00-80-01-71	15	1	Dynamic
1	00-05-5d-64-96-97	15	1	Dynamic

Total Entries: 262

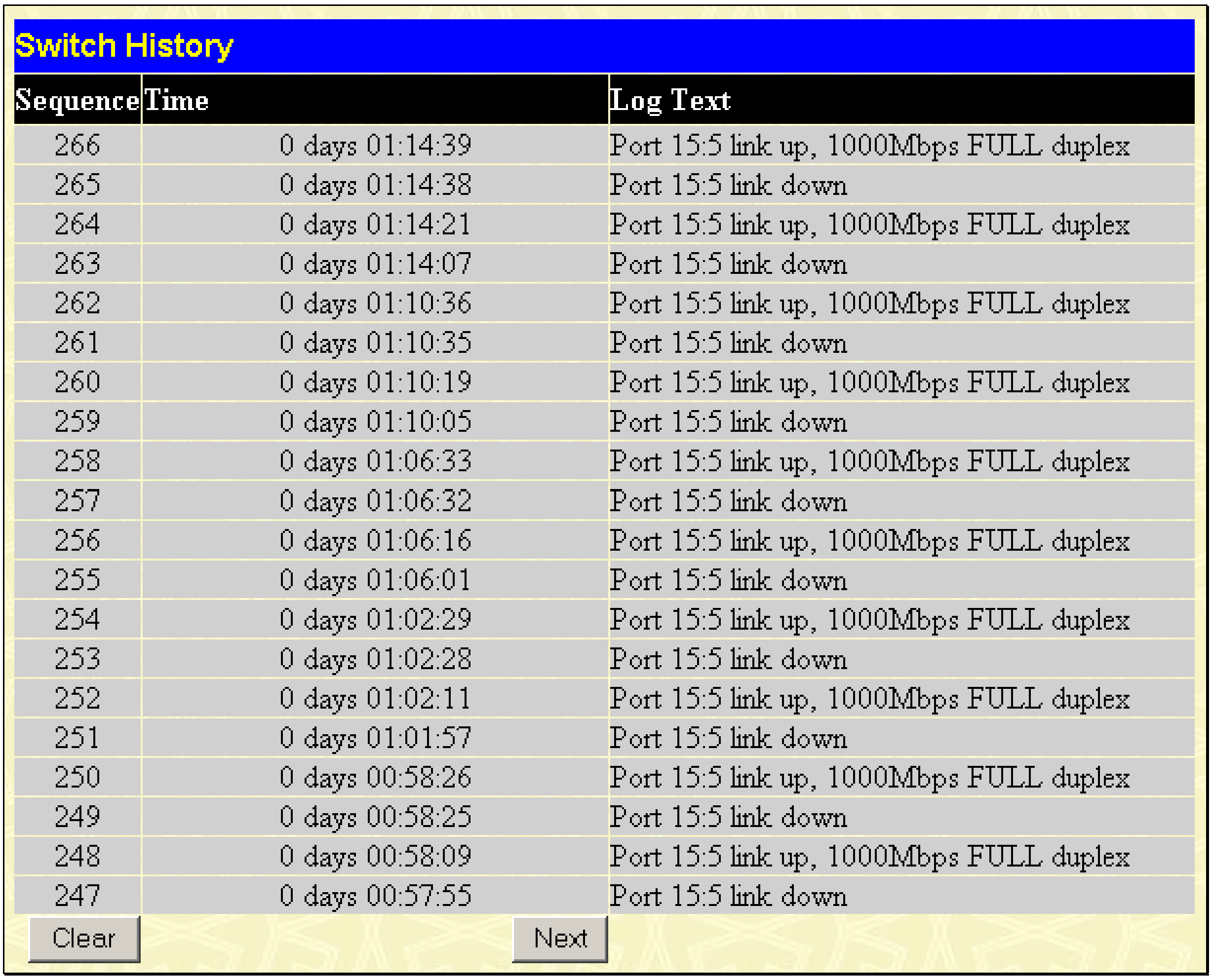
Figure 8- 18. MAC Address Table window

The following fields can be set:

Parameter	Description
VLAN Name	Enter a VLAN Name for the forwarding table to be browsed by.
MAC Address	Enter a MAC address for the forwarding table to be browsed by.
Unit – Port	Select the Switch Unit ID of the Switch in the Switch stack and then the port by using the corresponding pull-down menus.
Find	Allows the user to move to a sector of the database corresponding to a user defined port, VLAN, or MAC address.
VID	The VLAN ID of the VLAN of which the port is a member.
MAC Address	The MAC address entered into the address table.
Unit	Refers to the Unit of the Switch stack from which the MAC address was learned.
Port	The port to which the MAC address above corresponds.
Type	Describes the method which the Switch discovered the MAC address. The possible entries are Dynamic, Self, and Static.
Next	Click this button to view the next page of the address table.
Clear Dynamic Entry	Clicking this button will clear Dynamic entries learned by the Switch. This may be accomplished by VLAN Name or by Port.
View All Entry	Clicking this button will allow the user to view all entries of the address table.
Delete All Entry	Clicking this button will allow the user to delete all entries of the address table.

Switch History Log

The **Switch History** window displays the Switch's history log, as compiled by the Switch's management agent.



Switch History

Sequence	Time	Log Text
266	0 days 01:14:39	Port 15:5 link up, 1000Mbps FULL duplex
265	0 days 01:14:38	Port 15:5 link down
264	0 days 01:14:21	Port 15:5 link up, 1000Mbps FULL duplex
263	0 days 01:14:07	Port 15:5 link down
262	0 days 01:10:36	Port 15:5 link up, 1000Mbps FULL duplex
261	0 days 01:10:35	Port 15:5 link down
260	0 days 01:10:19	Port 15:5 link up, 1000Mbps FULL duplex
259	0 days 01:10:05	Port 15:5 link down
258	0 days 01:06:33	Port 15:5 link up, 1000Mbps FULL duplex
257	0 days 01:06:32	Port 15:5 link down
256	0 days 01:06:16	Port 15:5 link up, 1000Mbps FULL duplex
255	0 days 01:06:01	Port 15:5 link down
254	0 days 01:02:29	Port 15:5 link up, 1000Mbps FULL duplex
253	0 days 01:02:28	Port 15:5 link down
252	0 days 01:02:11	Port 15:5 link up, 1000Mbps FULL duplex
251	0 days 01:01:57	Port 15:5 link down
250	0 days 00:58:26	Port 15:5 link up, 1000Mbps FULL duplex
249	0 days 00:58:25	Port 15:5 link down
248	0 days 00:58:09	Port 15:5 link up, 1000Mbps FULL duplex
247	0 days 00:57:55	Port 15:5 link down

Figure 8- 19. Switch History window

The Switch can record event information in its own logs, to designated SNMP trap receiving stations, and to the PC connected to the console manager. Clicking **Next** at the bottom of the window will allow you to display all the Switch Trap Logs.

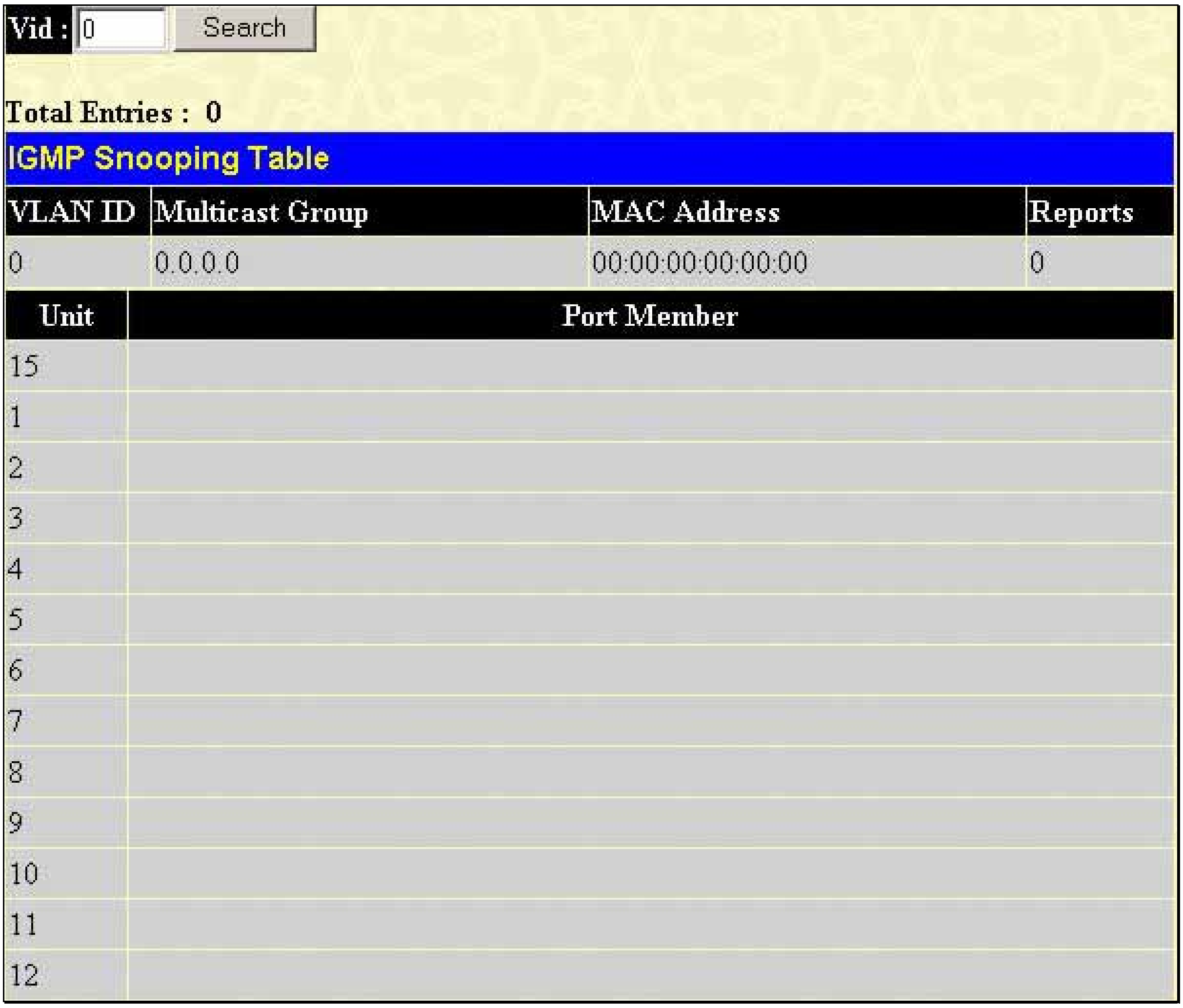
The information is described as follows:

Parameter	Description
Sequence	A counter incremented whenever an entry to the Switch's history log is made. The table displays the last entry (highest sequence number) first.
Time	Displays the time in days, hours, and minutes since the Switch was last restarted.
Log Text	Displays text describing the event that triggered the history log entry.

IGMP Snooping Table

This window allows the Switch's **IGMP Snooping Group Table** to be viewed. IGMP Snooping allows the Switch to read the Multicast Group IP address and the corresponding MAC address from IGMP packets that pass through the Switch. The number of IGMP reports that were snooped is displayed in the **Reports** field.

To view the **IGMP Snooping Group Table**, click **IGMP Snooping Group** on the **Monitoring** menu:



Vid : 0

Total Entries : 0

IGMP Snooping Table

VLAN ID	Multicast Group	MAC Address	Reports
0	0.0.0.0	00:00:00:00:00:00	0

Unit	Port Member
15	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Figure 8- 20. IGMP Snooping Table window

The user may search the **IGMP Snooping Group Table** by VLAN Name by entering it in the top left hand corner and clicking **Search**.

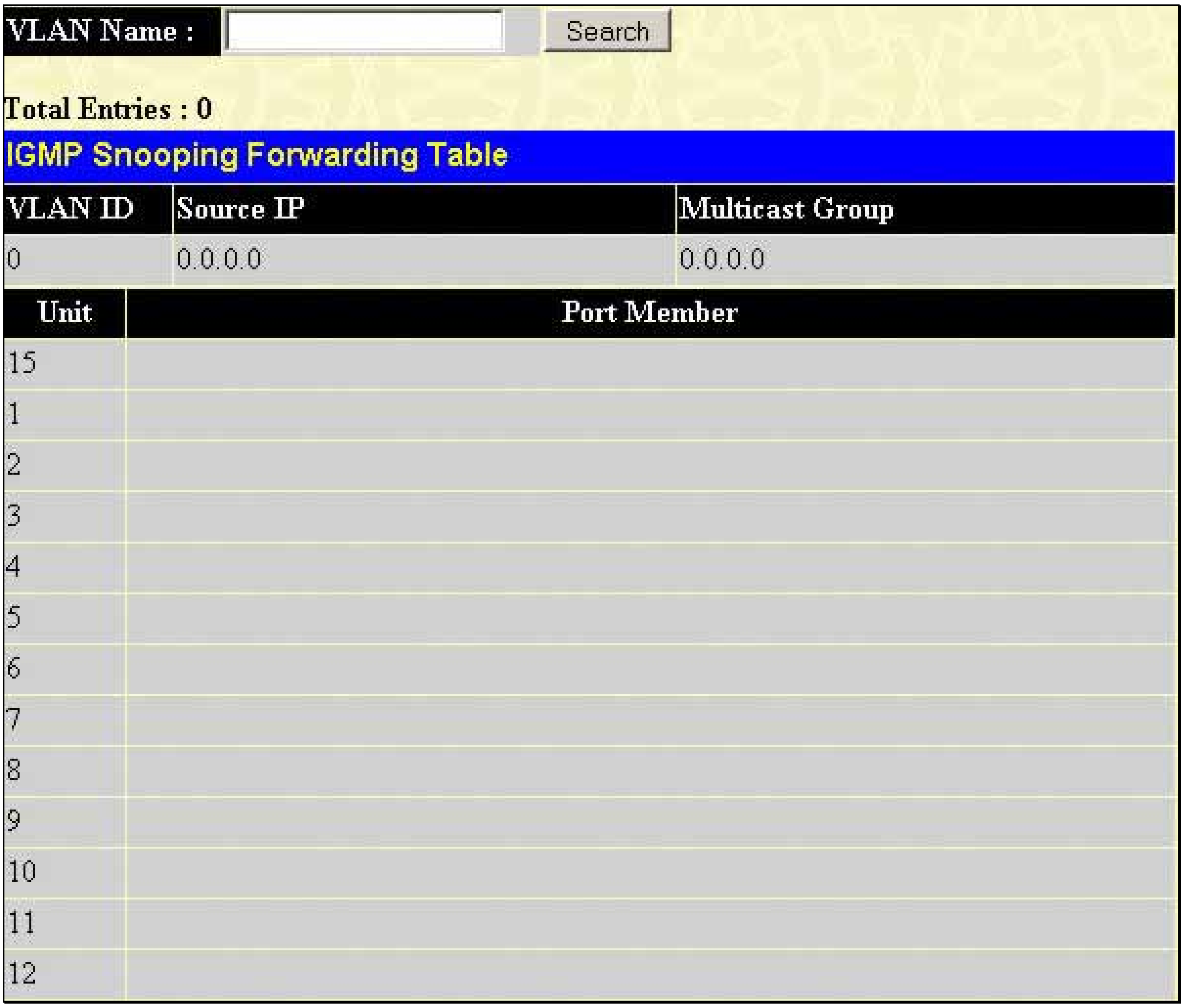
The following field can be set:

Parameter	Description
VLAN Name	The VLAN Name of the multicast group.
Multicast Group	The IP address of the multicast group.
MAC Address	The MAC address of the multicast group.
Reports	The total number of reports received for this group.
Port Member	These are the ports where the IGMP packets were snooped are displayed.

NOTE: To configure IGMP snooping for the xStack family of switches, go to the **Configuration** folder and select **IGMP Snooping**. Configuration and other information concerning IGMP snooping may be found in Section 6 of this manual under **IGMP Snooping**.

IGMP Snooping Forwarding

This window will display the current IGMP snooping forwarding table entries currently configured on the Switch. To view the following screen, open the **Monitoring** folder and click the **IGMP Snooping Forwarding** link.



Total Entries : 0

IGMP Snooping Forwarding Table

VLAN ID	Source IP	Multicast Group
0	0.0.0.0	0.0.0.0

Unit	Port Member
15	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Figure 8- 21. IGMP Snooping Forwarding Table

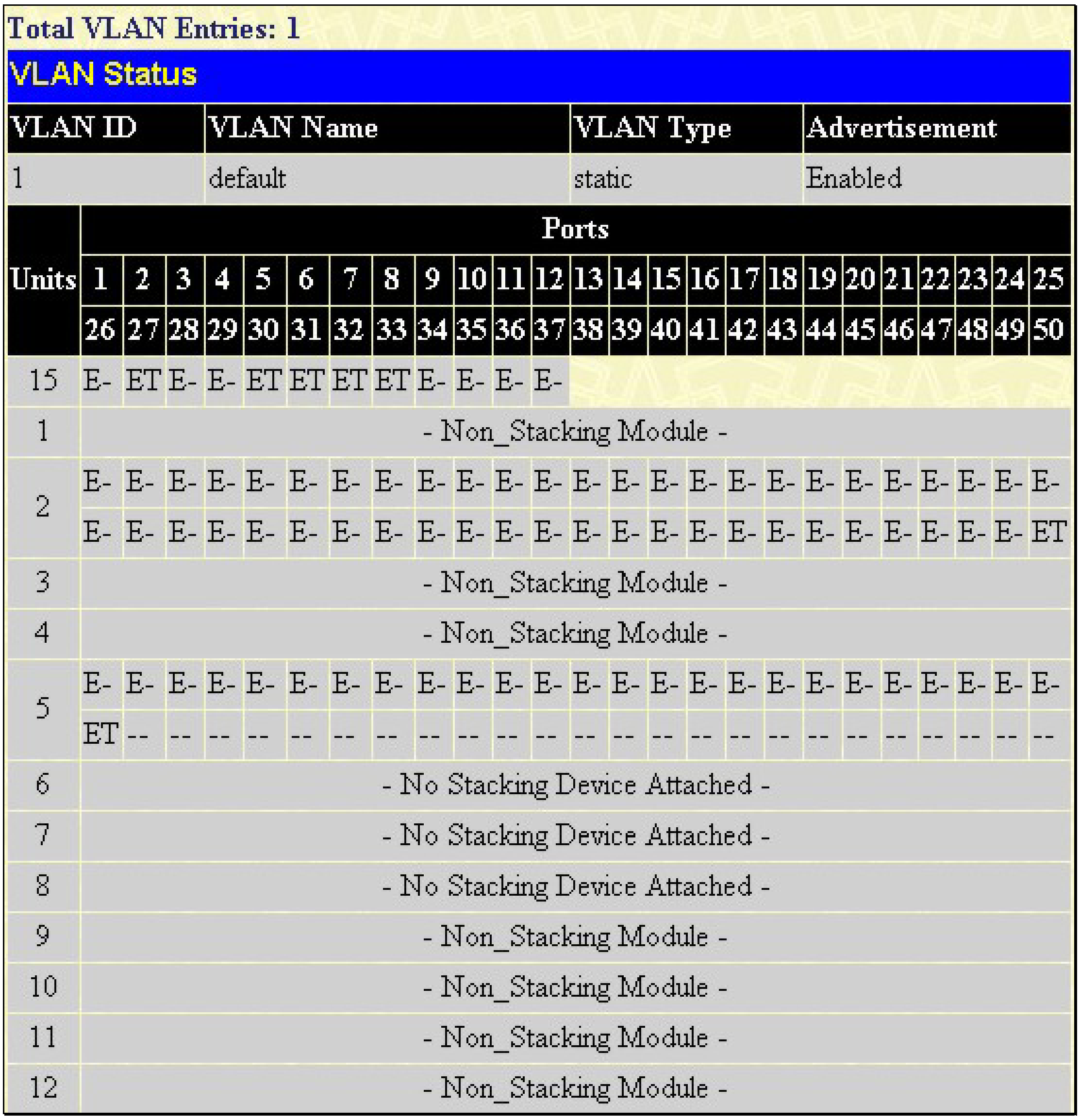
The user may search the **IGMP Snooping Forwarding Table** by VLAN Name using the top left hand corner **Search**.

The following field can be viewed:

Parameter	Description
VLAN Name	The VLAN Name of the multicast group.
Source IP	The Source IP address of the multicast group.
Multicast Group	The IP address of the multicast group.
Port Map	These are the ports where the IP multicast packets are being forwarded to.

VLAN Status

This window displays the status of VLANs on any Switch in a Switch stack managed by a DGS-3312SR.



Total VLAN Entries: 1

VLAN Status

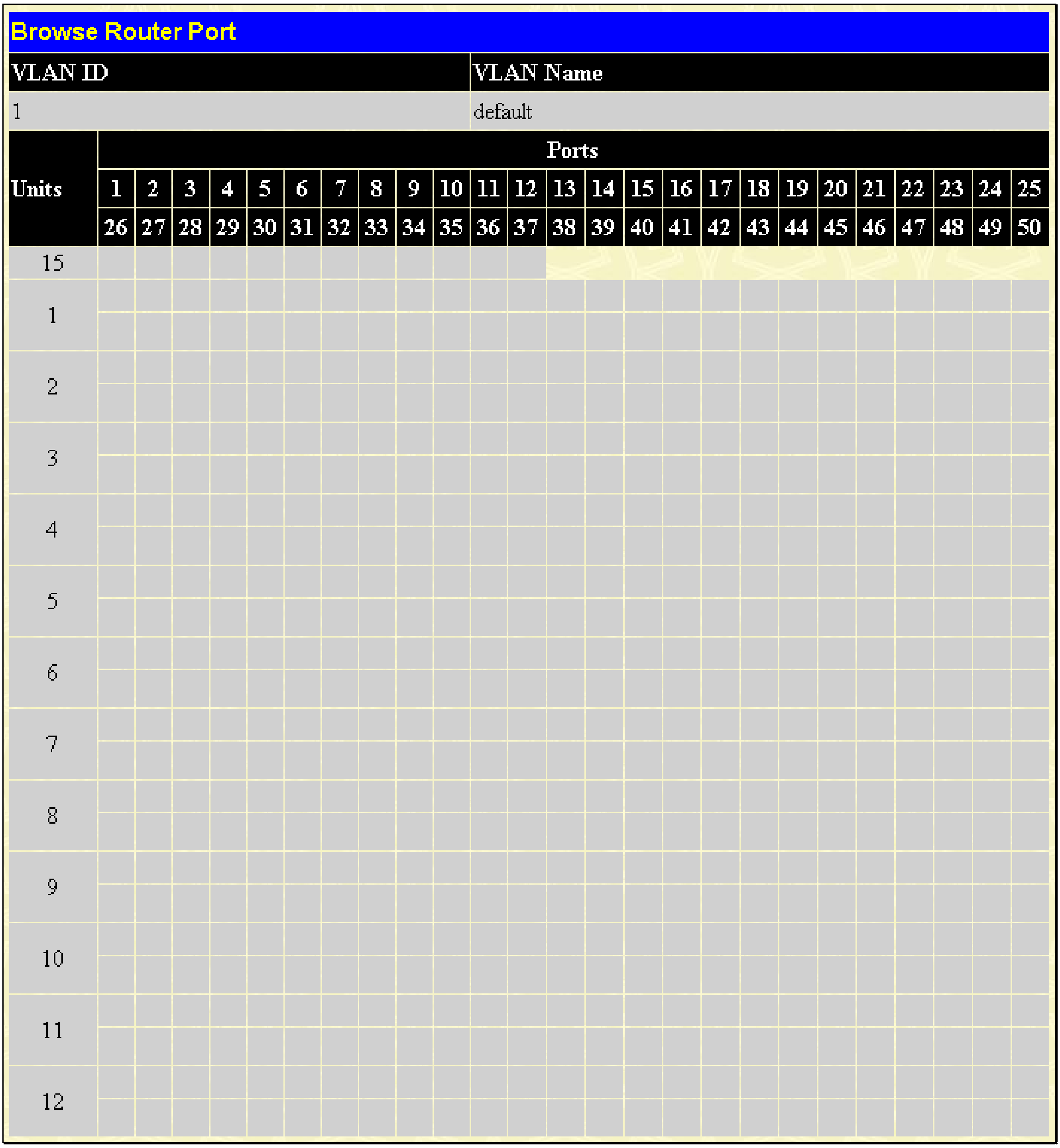
VLAN ID	VLAN Name	VLAN Type	Advertisement
1	default	static	Enabled

Units	Ports																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
15	E-	ET	E-	E-	ET	ET	ET	ET	E-	E-	E-	E-													
1	- Non_Stacking Module -																								
2	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-
	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	ET
3	- Non_Stacking Module -																								
4	- Non_Stacking Module -																								
5	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-	E-
	ET	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	- No Stacking Device Attached -																								
7	- No Stacking Device Attached -																								
8	- No Stacking Device Attached -																								
9	- Non_Stacking Module -																								
10	- Non_Stacking Module -																								
11	- Non_Stacking Module -																								
12	- Non_Stacking Module -																								

Figure 8- 22. VLAN Status window

Router Port

This displays which of the Switch's ports are currently configured as router ports. A router port configured by a user (using the console or Web-based management interfaces) is displayed as a static router port, designated by **S**. A router port that is dynamically configured by the Switch is designated by **D**.



Browse Router Port

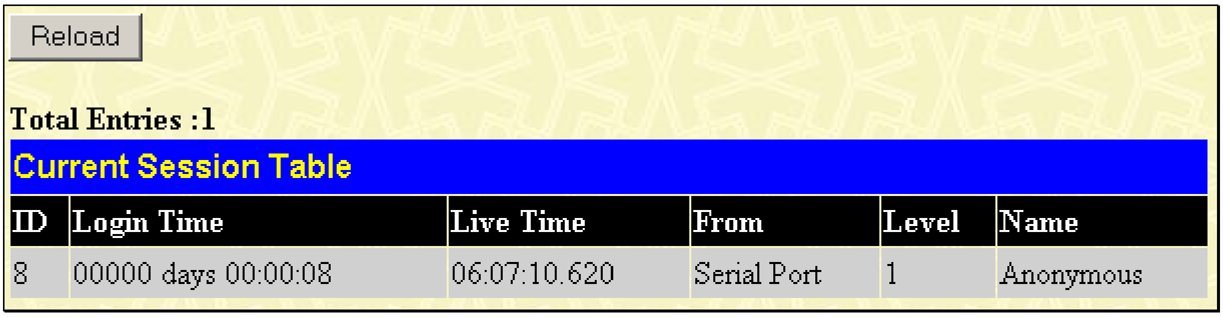
VLAN ID	VLAN Name
1	default

Units	Ports																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
15																									
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Figure 8- 23. Browse Router Port window

Session Table

This window displays the management sessions since the Switch was last rebooted.



Total Entries :1

Current Session Table

ID	Login Time	Live Time	From	Level	Name
8	00000 days 00:00:08	06:07:10.620	Serial Port	1	Anonymous

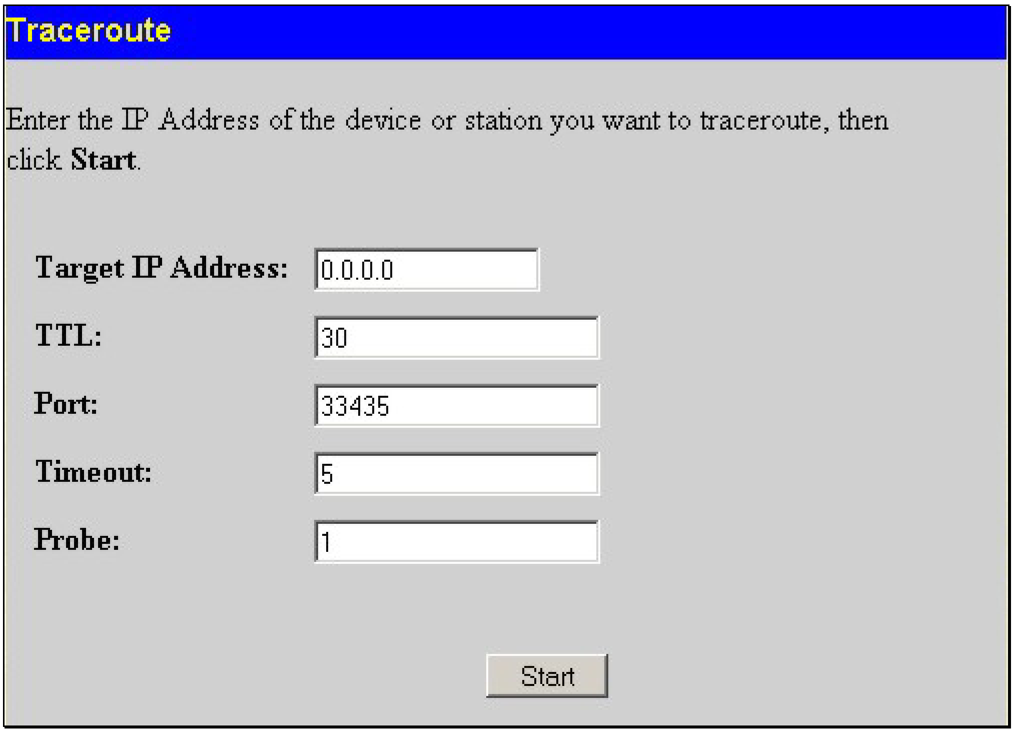
Figure 8- 24. Current Session Table window

Layer 3 Feature

The Switch’s Layer 3 monitoring windows are described below.

Traceroute

The following window will aid the user in back tracing the route taken by a packet before arriving at the Switch. When initiated, the Traceroute program will display the IP addresses of the previous hops a packet takes from the **Target IP Address** entered in the window, until it reaches the Switch.



Traceroute

Enter the IP Address of the device or station you want to traceroute, then click **Start**.

Target IP Address: 0.0.0.0

TTL: 30

Port: 33435

Timeout: 5

Probe: 1

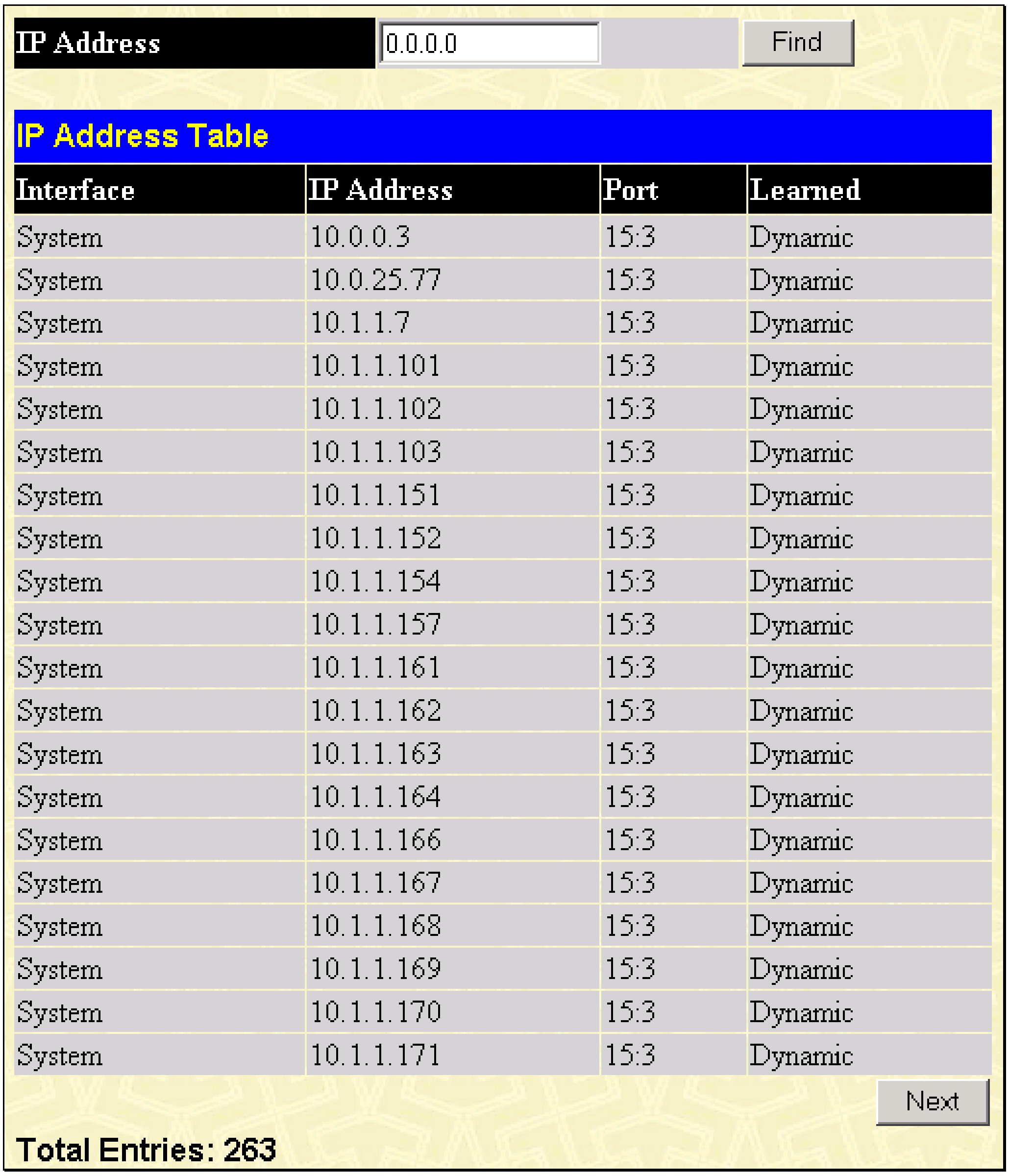
Figure 8- 25. Traceroute window

To trace the route of a packet, set the following parameters located in this window, and click **Star**t.

Parameter	Description
Target IP Address	Enter the IP address of the computer to be traced.
TTL	The time to live value of the trace route request. This is the maximum number of routers the traceroute command will cross while seeking the network path between two devices.
Port	The virtual port number. The port number must be above 1024.The value range is from 30000 to 64900.
Timeout	Defines the time-out period while waiting for a response from the remote device. The user may choose an entry between 1 and 65535 seconds.
Probe	The probe value is the number of times the Switch will send probe packets to the next hop on the intended traceroute path. The default is 1.

Browse IP Address Table

The **IP Address Table** window may be found in the **Monitoring** folder in the **Layer 3 Feature** sub-folder. This window allows the user to view IP addresses discovered by the Switch. To search a specific IP address, enter it into the field labeled IP Address at the top of the screen and click **Find** to begin your search.



IP Address: 0.0.0.0

IP Address Table

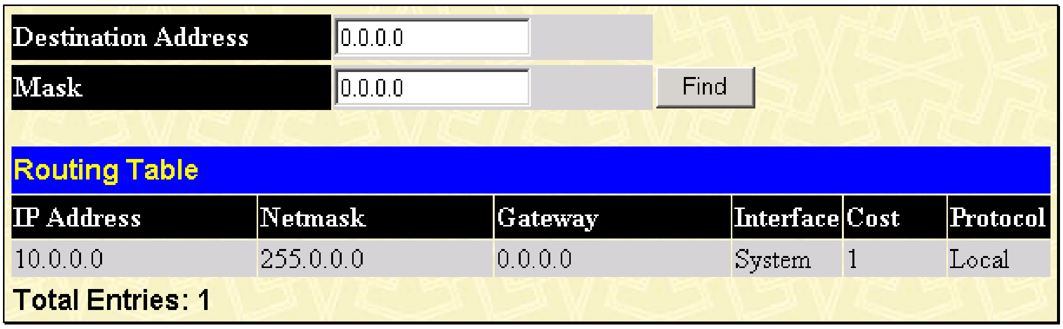
Interface	IP Address	Port	Learned
System	10.0.0.3	15:3	Dynamic
System	10.0.25.77	15:3	Dynamic
System	10.1.1.7	15:3	Dynamic
System	10.1.1.101	15:3	Dynamic
System	10.1.1.102	15:3	Dynamic
System	10.1.1.103	15:3	Dynamic
System	10.1.1.151	15:3	Dynamic
System	10.1.1.152	15:3	Dynamic
System	10.1.1.154	15:3	Dynamic
System	10.1.1.157	15:3	Dynamic
System	10.1.1.161	15:3	Dynamic
System	10.1.1.162	15:3	Dynamic
System	10.1.1.163	15:3	Dynamic
System	10.1.1.164	15:3	Dynamic
System	10.1.1.166	15:3	Dynamic
System	10.1.1.167	15:3	Dynamic
System	10.1.1.168	15:3	Dynamic
System	10.1.1.169	15:3	Dynamic
System	10.1.1.170	15:3	Dynamic
System	10.1.1.171	15:3	Dynamic

Total Entries: 263

Figure 8- 26. IP Address window

Browse Routing Table

The **Routing Table** window may be found in the **Monitoring** folder in the **Layer 3 Feature** sub-folder. This window shows the current IP routing table of the Switch. To find a specific IP route, enter an IP address into the **Destination Address** field along with a proper subnet mask into the **Mask** field.



Destination Address	0.0.0.0
Mask	0.0.0.0

Routing Table

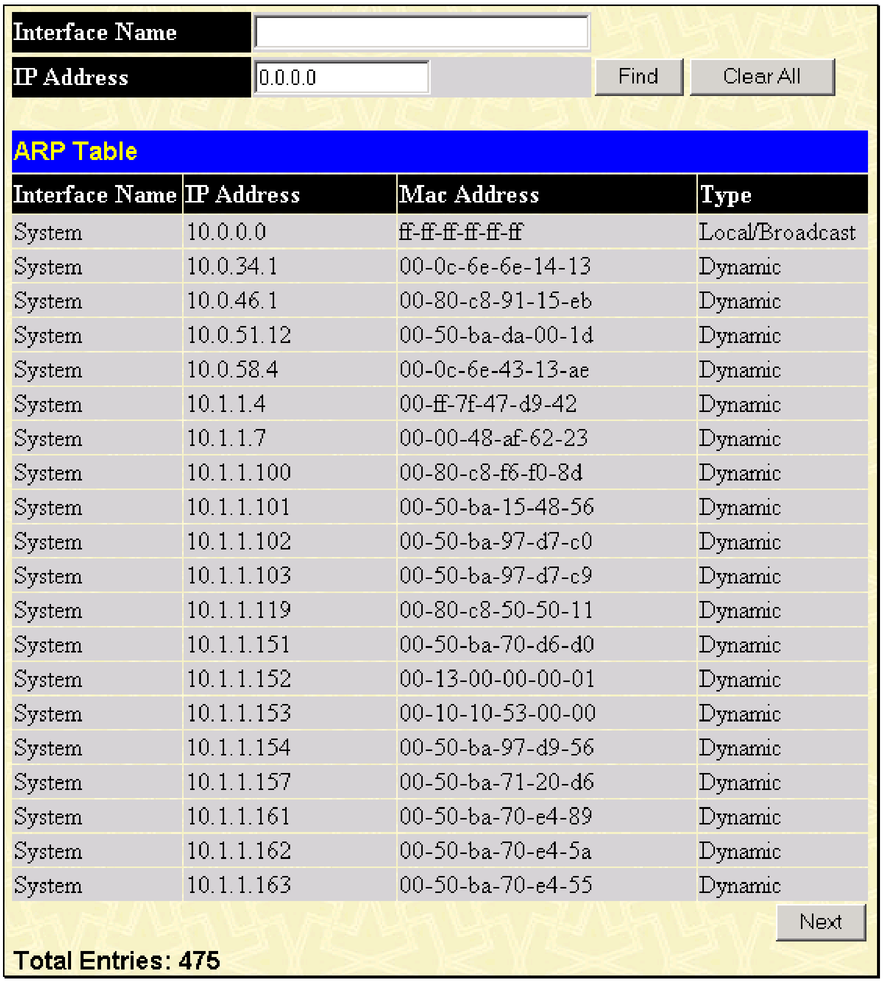
IP Address	Netmask	Gateway	Interface	Cost	Protocol
10.0.0.0	255.0.0.0	0.0.0.0	System	1	Local

Total Entries: 1

Figure 8- 27. Routing Table window

Browse ARP Table

The **ARP Table** window may be found in the **Monitoring** folder in the **Layer 3 Feature** sub-folder. This window will show current ARP entries on the Switch. To search a specific ARP entry, enter an interface name into the Interface Name or an IP address and click **Find**.



Interface Name	
IP Address	0.0.0.0

ARP Table

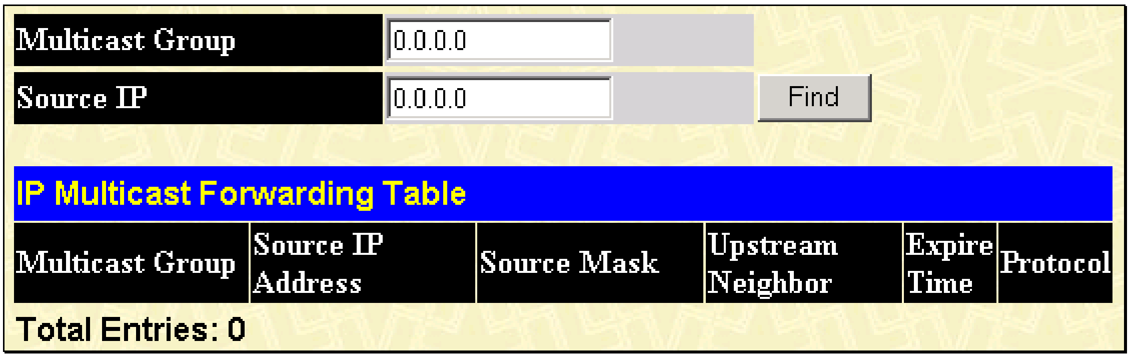
Interface Name	IP Address	Mac Address	Type
System	10.0.0.0	ff-ff-ff-ff-ff-ff	Local/Broadcast
System	10.0.34.1	00-0c-6e-6e-14-13	Dynamic
System	10.0.46.1	00-80-c8-91-15-eb	Dynamic
System	10.0.51.12	00-50-ba-da-00-1d	Dynamic
System	10.0.58.4	00-0c-6e-43-13-ae	Dynamic
System	10.1.1.4	00-ff-7f-47-d9-42	Dynamic
System	10.1.1.7	00-00-48-af-62-23	Dynamic
System	10.1.1.100	00-80-c8-f6-f0-8d	Dynamic
System	10.1.1.101	00-50-ba-15-48-56	Dynamic
System	10.1.1.102	00-50-ba-97-d7-c0	Dynamic
System	10.1.1.103	00-50-ba-97-d7-c9	Dynamic
System	10.1.1.119	00-80-c8-50-50-11	Dynamic
System	10.1.1.151	00-50-ba-70-d6-d0	Dynamic
System	10.1.1.152	00-13-00-00-00-01	Dynamic
System	10.1.1.153	00-10-10-53-00-00	Dynamic
System	10.1.1.154	00-50-ba-97-d9-56	Dynamic
System	10.1.1.157	00-50-ba-71-20-d6	Dynamic
System	10.1.1.161	00-50-ba-70-e4-89	Dynamic
System	10.1.1.162	00-50-ba-70-e4-5a	Dynamic
System	10.1.1.163	00-50-ba-70-e4-55	Dynamic

Total Entries: 475

Figure 8- 28. ARP Table window

Browse IP Multicast Forwarding Table

The **Browse IP Multicast Forwarding Table** window may be found in the **Monitoring** folder in the **Layer 3 Feature** sub-folder. This window will show current IP multicasting information on the Switch. To search a specific entry, enter an multicast group IP address into the Multicast Group field or a Source IP address and click **Find**.



Multicast Group	0.0.0.0
Source IP	0.0.0.0

IP Multicast Forwarding Table

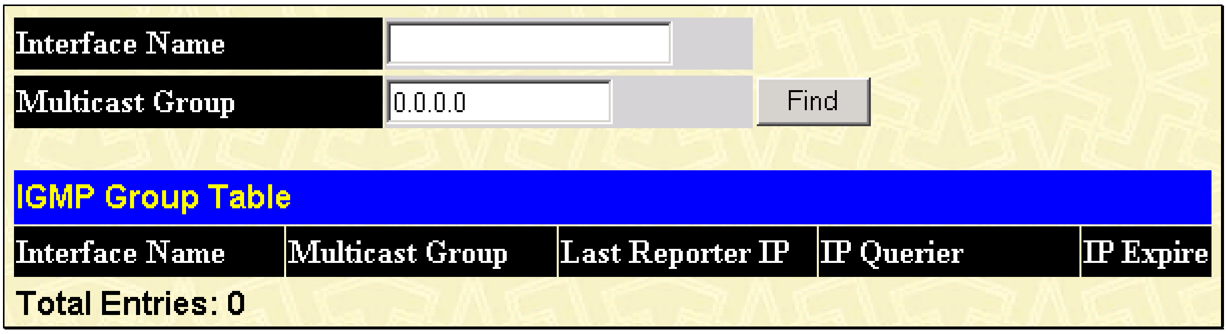
Multicast Group	Source IP Address	Source Mask	Upstream Neighbor	Expire Time	Protocol

Total Entries: 0

Figure 8- 29. IP Multicast Forwarding Table window

Browse IGMP Group Table

The **IGMP Group Table** window may be found in the **Monitoring** folder in the **Layer 3 Feature** sub-folder. This window will show current IGMP group entries on the Switch. To search a specific IGMP group entry, enter an interface name into the **Interface Name** field or a **Multicast Group** IP address and click **Find**.



Interface Name	
Multicast Group	0.0.0.0

IGMP Group Table

Interface Name	Multicast Group	Last Reporter IP	IP Querier	IP Expire

Total Entries: 0

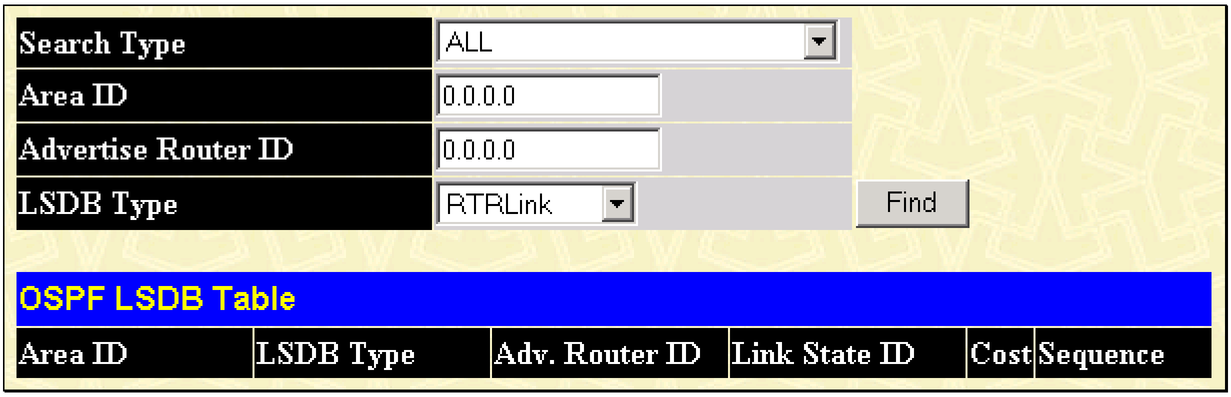
Figure 8- 30. IGMP Group Table window

OSPF Monitor

This section offers windows regarding OSPF (Open Shortest Path First) information on the Switch, including the **OSPF LSDB Table**, **OSPF Neighbor Table** and the **OSPF Virtual Neighbor Table**. To view these tables, open the **Monitoring** folder, go to the **Layer 3 Feature** sub-folder, and then click **OSPF Monitor**.

Browse OSPF LSDB Table

This table can be found in the **OSPF Monitor** folder by clicking on the **Browse OSPF LSDB Table** link. The Link-State Database table displays the current link-state database in use by the OSPF routing protocol on a per-OSPF area basis.



Search Type	ALL
Area ID	0.0.0.0
Advertise Router ID	0.0.0.0
LSDB Type	RTRLink

OSPF LSDB Table

Area ID	LSDB Type	Adv. Router ID	Link State ID	Cost	Sequence

Figure 8- 31. OSPF LSDB Table window

The user may search for a specific entry by entering the following information into the fields at the top of the window:

To browse the OSPF LSDB Table, you first must select which browse method you want to use. The choices are *Area ID*, *Advertise Router ID*, *LSDB*, *Area ID & Advertise Router ID*, *Area ID & LSDB*, *Advertise Router ID & LSDB*, and *ALL*.

If *Area ID* is selected as the browse method, you must enter the IP address in the Area ID field, and then click **Find**.

If *Advertise Router ID* is selected, you must enter the IP address in the Advertise Router ID field, and then click **Find**.

If *LSDB* is selected, you must select the type of link state (*RTRLink*, *NETLink*, *Summary*, *ASSummary*, and *ASExtLink*) in the LSDB Type field, and then click **Find**.

If *Area ID & Advertise Router ID* is selected as the browse method, you must enter the IP address in the Area ID field and the IP address in the Advertise Router ID field, and then click **Find**.

If *Area ID & LSDB* is selected as the browse method, you must enter the IP address in the Area ID field and select the type of link state (*RTRLink*, *NETLink*, *Summary*, *ASSummary*, and *ASExtLink*) in the LSDB Type field, and then click **Find**.

If *Advertise Router ID & LSDB* is selected as the browse method, you must enter the IP address in the Advertise Router ID field and select the type of link state (*RTRLink*, *NETLink*, *Summary*, *ASSummary*, and *ASExtLink*) in the LSDB Type field, and then click **Find**.

If *ALL* is selected, you must enter the IP address in the Area ID field and the IP address in the Advertise Router ID field and select the type of link state (*RTRLink*, *NETLink*, *Summary*, *ASSummary*, and *ASExtLink*) in the LSDB Type field, and then click **Find**.

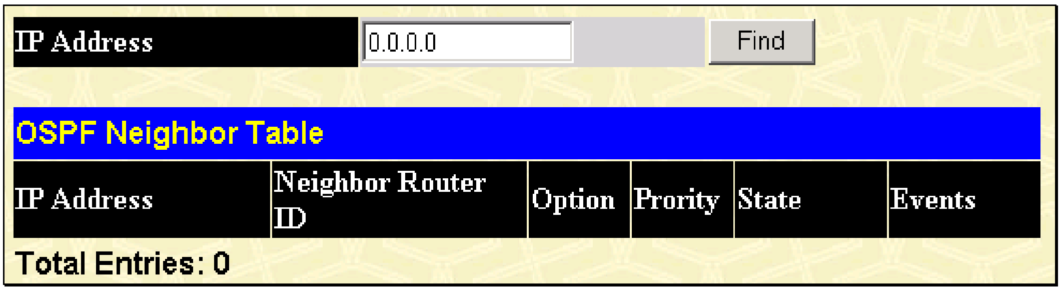
The following fields are displayed:

Parameter	Description
Area ID	Allows the entry of an OSPF Area ID. This Area ID will then be used to search the table, and display an entry – if there is one.
Search Type	Select the browse method you want to use: *Area ID*, *Advertise Router ID*, *LSDB, Area ID & Advertise Router ID*, *Area ID & LSDB*, *Advertise Router ID & LSDB*, or *ALL*.

LSDB Type	Displays which one of eight types of link advertisements by which the current link was discovered by the Switch: Router link (*RTRLink*), Network link (*NETLink*), Summary link (*Summary*), Autonomous System link (*ASSummary*), and Autonomous System external link (*ASExtLink*).
Adv. Router ID	Displays the Advertising Router's ID.
Link State ID	This field identifies the portion of the Internet environment that is being described by the advertisement. The contents of this field depend on the advertisement's LS type. LS Type Link State ID 1 The originating router's Router ID. 2 The IP interface address of the network's Designated Router. 3 The destination network's IP address. 4 The Router ID of the described AS boundary router.
Cost	Displays the cost of the table entry.
Sequence	Displays a sequence number corresponding to number of times the current link has been advertised as changed.

Browse OSPF Neighbor Table

This table can be found in the **OSPF Monitor** folder by clicking on the **Browse OSPF Neighbor Table** link. Routers that are connected to the same area or segment become neighbors in that area. Neighbors are elected via the Hello protocol. IP multicast is used to send out Hello packets to other routers on the segment. Routers become neighbors when they see themselves listed in a Hello packet sent by another router on the same segment. In this way, two-way communication is guaranteed to be possible between any two neighbor routers. This table displays OSPF neighbors of the Switch.



IP Address: 0.0.0.0

OSPF Neighbor Table

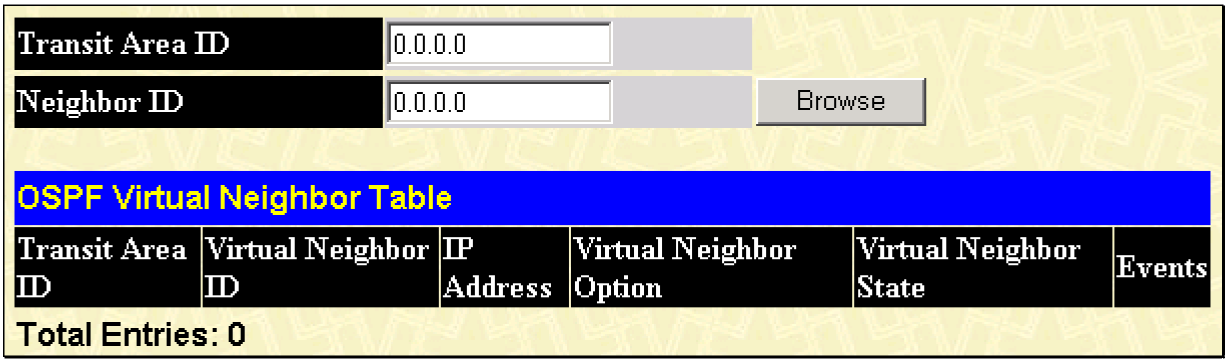
IP Address	Neighbor Router ID	Option	Prority	State	Events

Total Entries: 0

Figure 8- 32. OSPF Neighbor Table window

Browse OSPF Virtual Neighbor Table

This table can be found in the **OSPF Monitor** folder by clicking on the **Browse OSPF Virtual Neighbor Table** link. This table displays a list of Virtual OSPF neighbors of the Switch. The user may choose specifically search a virtual neighbor by using one of the two search options at the top of the window:



Transit Area ID	0.0.0.0
Neighbor ID	0.0.0.0

OSPF Virtual Neighbor Table

Transit Area ID	Virtual Neighbor ID	IP Address	Virtual Neighbor Option	Virtual Neighbor State	Events

Total Entries: 0

Figure 8- 33. OSPF Virtual Neighbor Table window

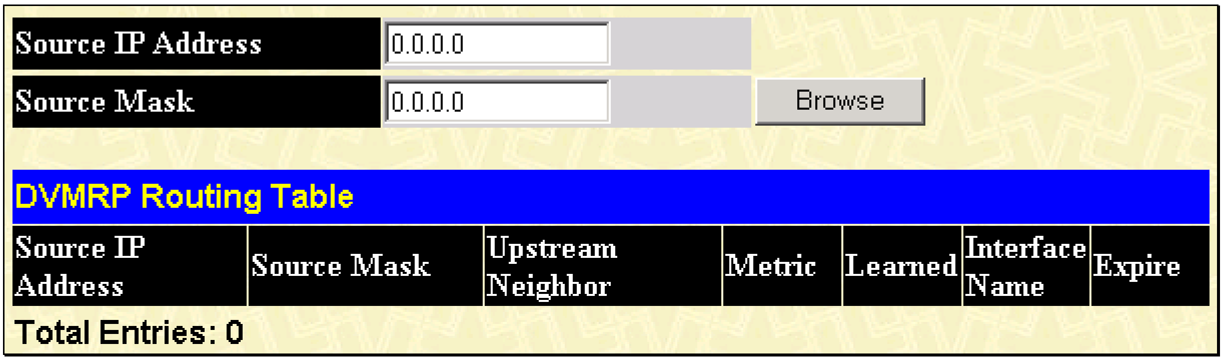
Parameter	Description
Transit Area ID	Allows the entry of an OSPF Area ID – previously defined on the Switch – that allows a remote area to communicate with the backbone (area 0). A Transit Area cannot be a Stub Area or a Backbone Area.
Neighbor ID	The OSPF router ID for the remote router. This IP address uniquely identifies the remote area’s Area Border Router.

DVMRP Monitor

This menu allows the **DVMRP** (Distance-Vector Multicast Routing Protocol) to be monitored for each IP interface defined on the Switch. This folder, found in the **Monitoring** folder, offers three screens for monitoring; **Browse DVMRP Routing Table**, **Browse DVMRP Neighbor Address Table** and **Browse DVMRP Routing Next Hop Table.** Information on DVMRP and its features in relation to the DGS-3312SR can be found in Section 6, under **IP Multicast Routing Protocol**.

Browse DVMRP Routing Table

Multicast routing information is gathered and stored by DVMRP in the DVMRP Routing Table, which may be found in the **Monitoring** folder, in the **Layer 3 Feature** sub-folder, under **DVMRP Monitor**, contains one row for each port in a DVMRP mode. Each routing entry contains information about the source and multicast group, and incoming and outgoing interfaces. You may define your search by entering a Source IP Address and its subnet mask into the fields at the top of the window and clicking **Browse**.



Source IP Address	0.0.0.0	
Source Mask	0.0.0.0	Browse

DVMRP Routing Table

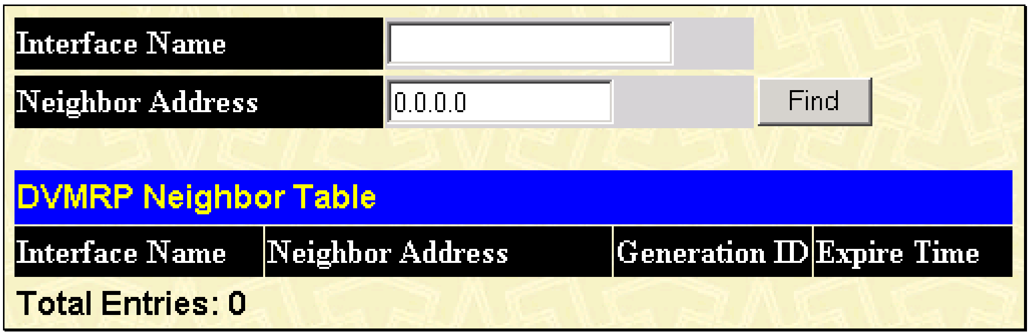
Source IP Address	Source Mask	Upstream Neighbor	Metric	Learned	Interface Name	Expire

Total Entries: 0

Figure 8- 34. DVMRP Routing Table window

Browse DVMRP Neighbor Address Table

This table, found in the **Monitoring** folder, in the **Layer 3 Feature** sub-folder, under **DVMRP Monitor** contains information about DVMRP neighbors of the Switch. You may define your search by entering an Interface Name and Neighbor Address in the fields at the top of the window and clicking **Find**.



Interface Name		
Neighbor Address	0.0.0.0	Find

DVMRP Neighbor Table

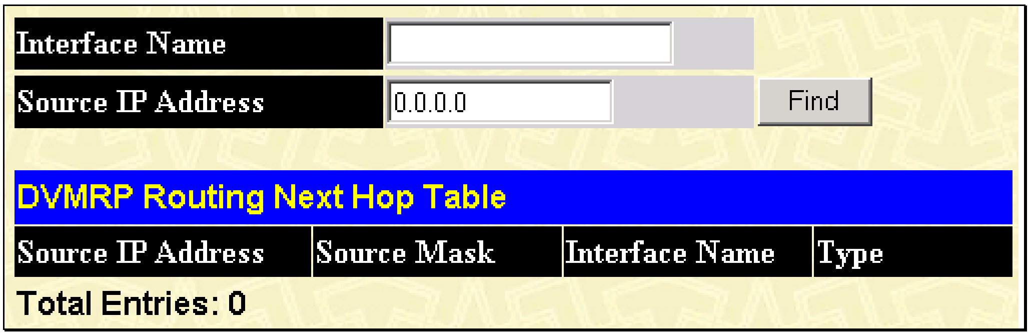
Interface Name	Neighbor Address	Generation ID	Expire Time

Total Entries: 0

Figure 8- 35. DVMRP Neighbor Table window

Browse DVMRP Routing Next Hop Table

This table contains information regarding the next-hop for forwarding multicast packets on outgoing interfaces. Each entry in the **DVMRP Routing Next Hop Table** window refers to the next-hop of a specific source to a specific multicast group address. This table is found in the **Monitoring** window, in the **Layer 3 Feature** sub-folder, under **DVMRP Monitor**. You may define your search by entering an Interface Name and Source IP Address in the fields at the top of the window and clicking **Find**.



Interface Name	
Source IP Address	0.0.0.0

DVMRP Routing Next Hop Table

Source IP Address	Source Mask	Interface Name	Type

Total Entries: 0

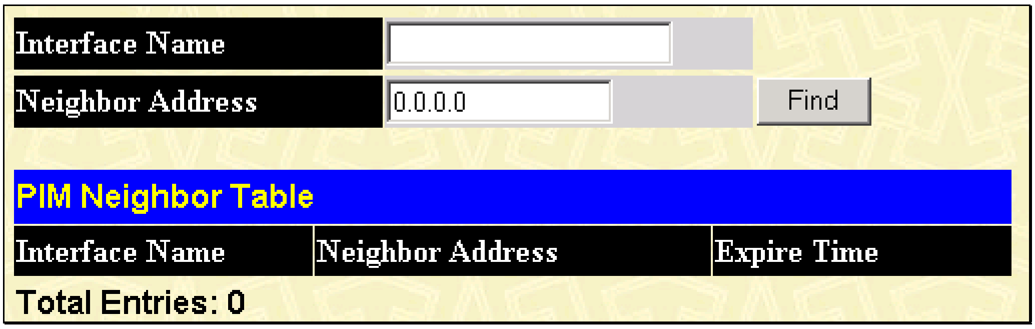
Figure 8- 36. DVMRP Routing Next Hop Table window

PIM Monitor

Multicast routers use **Protocol Independent Multicast (PIM)** to determine which other multicast routers should receive multicast packets. To find out more information concerning PIM and its configuration on the Switch, see the **IP Multicast Routing Protocol** chapter of Section 6, **Configuration**.

Browse PIM Neighbor Address Table

The **PIM Neighbor Address Table** contains information regarding each of a router's PIM neighbors. This screen may be found in the **Monitoring** folder under the heading **PIM Monitor**. To search this table, enter either an **Interface Name** or **Neighbor Address** into the respective field and click the **Find** button. PIM neighbors of that entry will appear in the **PIM Neighbor Table** below.



Interface Name	
Neighbor Address	0.0.0.0

PIM Neighbor Table

Interface Name	Neighbor Address	Expire Time

Total Entries: 0

Figure 8- 37. PIM Neighbor Table window

Section 9

Maintenance

TFTP Services

PING Test

Save Changes

Factory Reset

Restart System

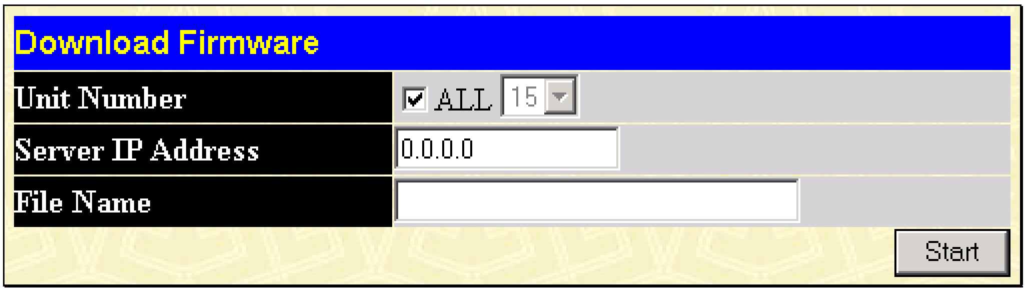
Logout

TFTP Services

Trivial File Transfer Protocol (TFTP) services allow the Switch firmware to be upgraded by transferring a new firmware file from a TFTP server to the Switch. A configuration file can also be loaded into the Switch from a TFTP server, Switch settings can be saved to the TFTP server, and a history log can be uploaded from the Switch to the TFTP server.

Download Firmware

To update the Switch's firmware, click on the **Maintenance** folder and then the **TFTP Services** folder and then the **Download Firmware** link:



Download Firmware

Unit Number	☑ ALL 15
Server IP Address	0.0.0.0
File Name	

Figure 9- 1. Download Firmware window

Use the **Unit** Number drop-down menu to select which Switch of a Switch stack on which you want to update the firmware. This allows the selection of a particular Switch from a Switch stack if you have installed the optional stacking module and have properly interconnected the Switches. The number 15 indicates a Switch in standalone mode.

Enter the IP address of the TFTP server in the **Server IP Address** field.

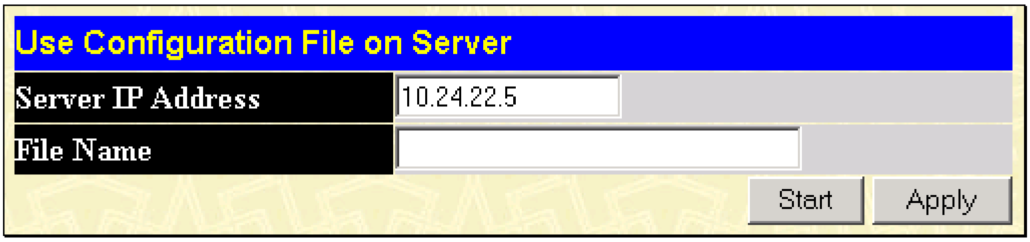
The TFTP server must be on the same IP subnet as the Switch.

Enter the path and the filename to the firmware file on the TFTP server. The TFTP server must be running TFTP server software to perform the file transfer. TFTP server software is a part of many network management software packages – such as NetSight, or can be obtained as a separate program.

Click **Start** to record the IP address of the TFTP server.

Download Configuration File

To download a configuration file from a TFTP server, click on the **Maintenance** folder and then the **TFTP Service** folder and then the **Download Configuration File** link:



Use Configuration File on Server

Server IP Address	10.24.22.5
File Name	

Figure 9- 2. Use Configuration File on Server window

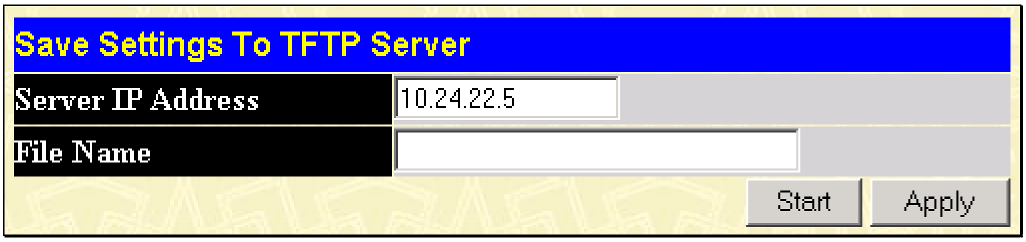
Enter the IP address of the TFTP server and specify the location of the Switch configuration file on the TFTP server.

Click **Apply** to record the IP address of the TFTP server.

Click **Start** to initiate the file transfer.

Upload Configuration

To upload the Switch settings to a TFTP server, click on the **Maintenance** folder and then the **TFTP Service** folder and then the **Save Settings** link:



Save Settings To TFTP Server

Server IP Address	10.24.22.5
File Name	

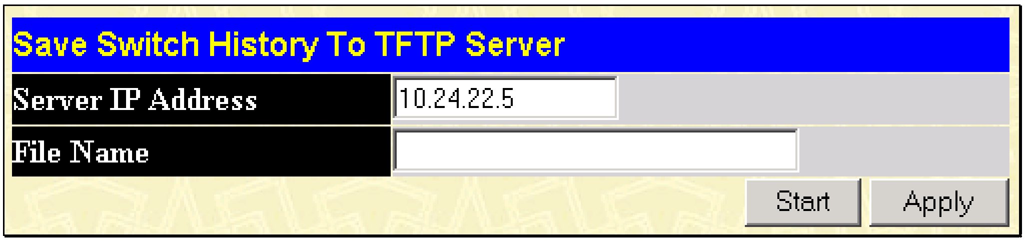
Figure 9- 3. Save Settings to TFTP Server window

Enter the IP address of the TFTP server and the path and filename for the history log on the TFTP server. Click **Apply** to make the changes current.

Click **Start** to initiate the file transfer.

Upload Log

To upload the Switch history log file to a TFTP server, click on the **Maintenance** folder and then the **TFTP Service** folder and then the **Save History Log** link:



Save Switch History To TFTP Server

Server IP Address	10.24.22.5
File Name	

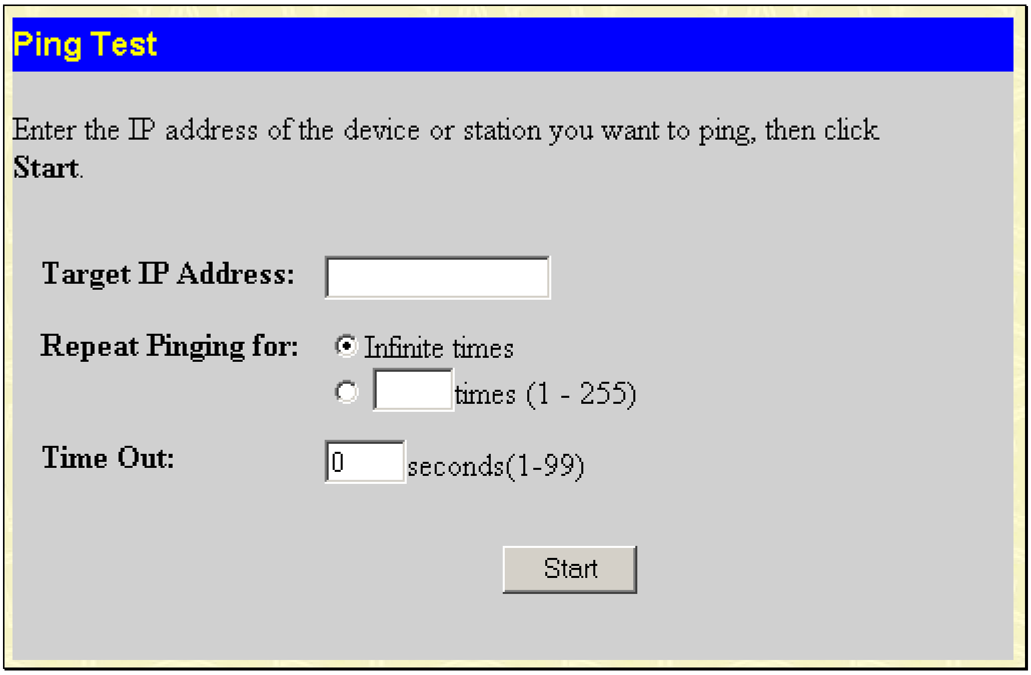
Figure 9- 4. Save Switch History To TFTP Server window

Enter the IP address of the TFTP server and the path and filename for the history log on the TFTP server. Click **Apply** to make the changes current.

Click **Start** to initiate the file transfer

Ping Test

PING is a small program that sends data packets to the IP address you specify. The destination node then returns the packets to the Switch. This is very useful to verify connectivity between the Switch and other nodes on the network.



Ping Test

Enter the IP address of the device or station you want to ping, then click **Start**.

Target IP Address:

Repeat Pinging for: ● Infinite times
○ times (1 - 255)

Time Out: 0 seconds(1-99)

Figure 9- 5. Ping Test window

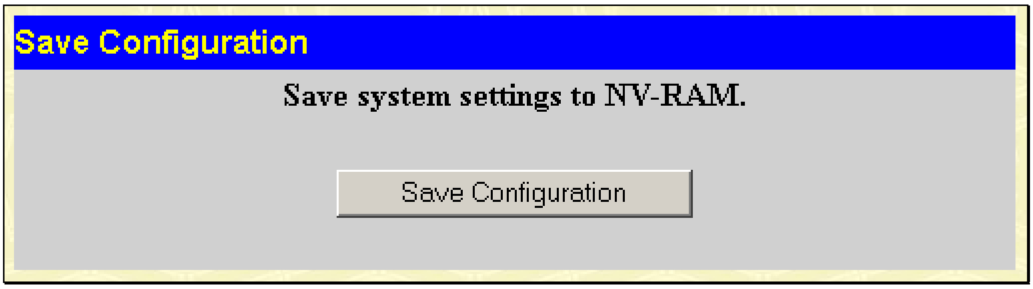
The **Infinite times** checkbox, in the **Repeat Pinging for** field, tells PING to keep sending data packets to the specified IP address until the program is stopped.

Save Changes

The DGS-3312SR has two levels of memory; normal RAM and non-volatile or NV-RAM. Configuration changes are made effective clicking the **Apply** button. When this is done, the settings will be immediately applied to the Switching software in RAM, and will immediately take effect.

Some settings, though, require you to restart the Switch before they will take effect. Restarting the Switch erases all settings in RAM and reloads the stored settings from the NV-RAM. Thus, it is necessary to save all setting changes to NV-RAM before rebooting the Switch.

To retain any configuration changes permanently, click the **Save Configuration** button in window below.



Save Configuration

Save system settings to NV-RAM.

Figure 9- 6. Save Configuration window

Once the Switch configuration settings have been saved to NV-RAM, they become the default settings for the Switch. These settings will be used every time the Switch is rebooted.

Factory Reset

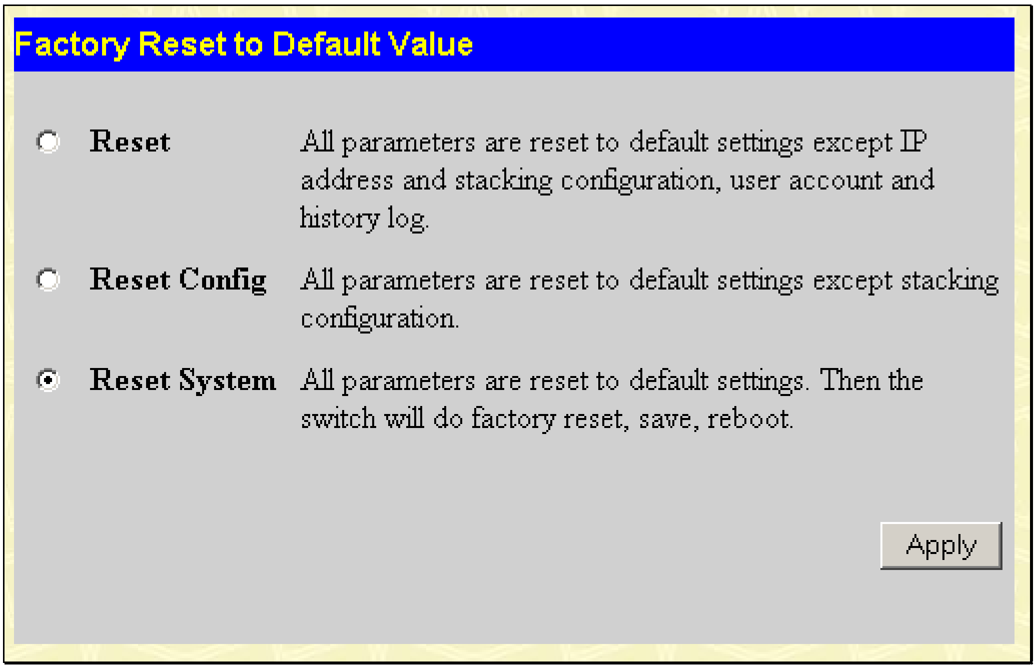
The **Factory Reset** function has several options when resetting the Switch. Some of the current configuration parameters can be retained while resetting all other configuration parameters to their factory defaults.

Please note that the Reset System option will enter the factory default parameters into the Switch's non-volatile RAM, and then restart the Switch. All other options enter the factory defaults into the current configuration, but do not save this configuration. Reset System will return the Switch's configuration to the state it was when it left the factory.

Reset gives the option of retaining the Switch's User Accounts and History Log while resetting all other configuration parameters to their factory defaults. If the Switch is reset with this option enabled, and Save Changes is not executed, the Switch will return to the last saved configuration when rebooted.

The Reset Config option will reset all of the Switch's configuration parameters to their factory defaults, without saving these default values to the Switch's non-volatile RAM. If the Switch is reset with this option enabled, and Save Changes is not executed, the Switch will return to the last saved configuration when rebooted.

In addition, the Reset System option is added to reset all configuration parameters to their factory defaults, save these parameters to the Switch's non-volatile RAM, and then restart the Switch. This option is equivalent to Reset Config (above) followed by Save Changes.



Factory Reset to Default Value

○ **Reset** All parameters are reset to default settings except IP address and stacking configuration, user account and history log.

○ **Reset Config** All parameters are reset to default settings except stacking configuration.

● **Reset System** All parameters are reset to default settings. Then the switch will do factory reset, save, reboot.

Figure 9- 7. Factory Reset to Default Value window

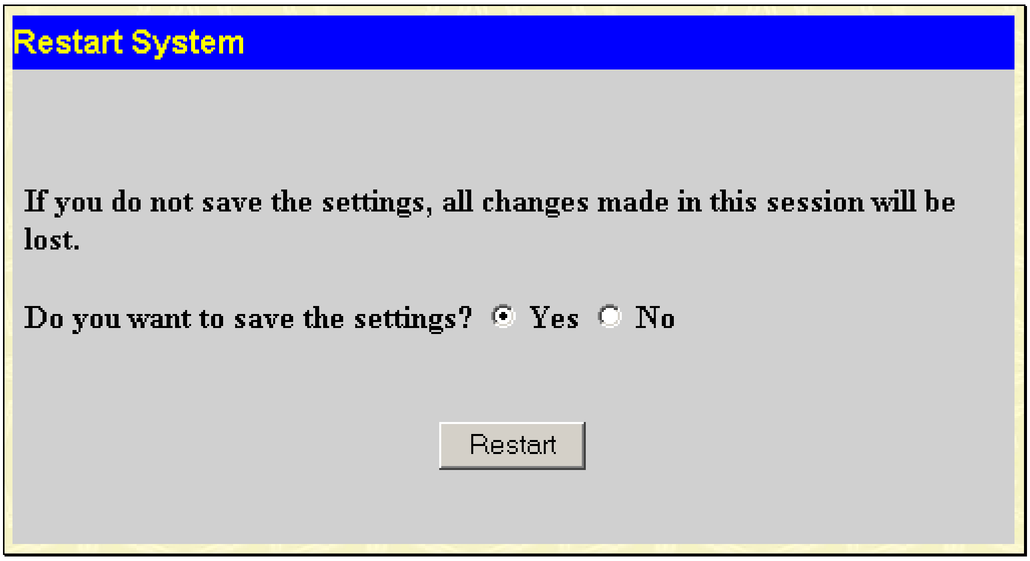
Restart System

The following window is used to restart the Switch.

Clicking the **Yes** click-box will instruct the Switch to save the current configuration to non-volatile RAM before restarting the Switch.

Clicking the **No** click-box instructs the Switch not to save the current configuration before restarting the Switch. All of the configuration information entered from the last time **Save Changes** was executed will be lost.

Click the **Restart** button to restart the Switch.



Restart System

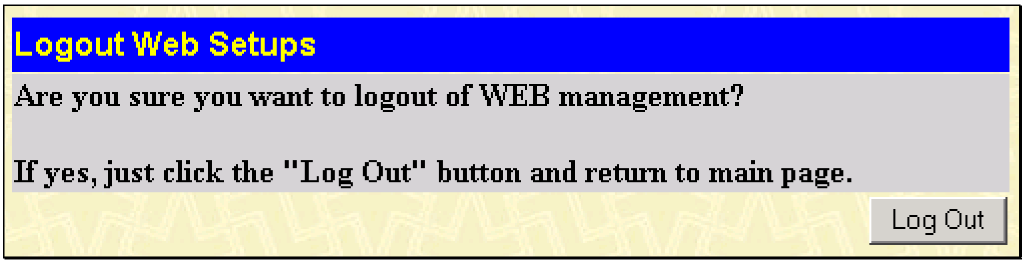
If you do not save the settings, all changes made in this session will be lost.

Do you want to save the settings? ● Yes ○ No

Figure 9- 8. Restart System window

Logout

Use this window to logout of the Switch’s Web-based management agent by clicking on the **Log Out** button.



Logout Web Setups

Are you sure you want to logout of WEB management?

If yes, just click the "Log Out" button and return to main page.

Figure 9- 9. Logout Web Setups window

Section 10

Single IP Management

SIM Settings

Topology

Firmware Upgrade

Configuration Backup/Restore

Simply put, Single IP Management is a concept that will stack switches together over Ethernet instead of using stacking ports or modules. There are some advantages to implement “Single IP Management” feature:

1. SIM can simplify management of small workgroups or wiring closets while scaling the network to handle increased bandwidth demand.

2. SIM can reduce the number of IP address needed in your network.

3. SIM can eliminate any specialized cables for stacking connectivity and remove the distance barriers that typically limit your topology options when using other stacking technology.

Switches using Single IP Management (labeled here as SIM) must conform to the following rules:

→ SIM is an optional feature on the Switch and can easily be enabled or disabled through the Command Line Interface. SIM grouping has no effect on the normal operation of the Switch in the user’s network.

→ There are three classifications for switches using SIM. The Commander Switch (CS), which is the master switch of the group, Member Switch (MS), which is a switch that is recognized by the CS a member of a SIM group, and a Candidate Switch (CaS), which is a Switch that has a physical link to the SIM group but has not been recognized by the CS as a member of the SIM group.

→ A SIM group can only have one Commander Switch (CS).

→ All switches in a particular SIM group must be in the same IP subnet (broadcast domain). Members of a SIM group cannot cross a router.

→ A SIM group accepts up to 32 switches (numbered 0-31), including the Commander Switch (numbered 0).

→ There is no limit to the number of SIM groups in the same IP subnet (broadcast domain), however a single switch can only belong to one group.

→ If multiple VLANs are configured, the SIM group will only utilize the default VLAN on any switch.

→ SIM allows intermediate devices that do not support SIM. This enables the user to manage a switch that is more than one hop away from the CS.

The SIM group is a group of switches that are managed as a single entity. The DGS-3312SR may take on three different roles:

→ **Commander Switch (CS)** – This is a switch that has been manually configured as the controlling device for a group, and takes on the following characteristics:

It has an IP Address.

It is not a command switch or member switch of another Single IP group.

It is connected to the member switches through its management VLAN.

→ **Member Switch (MS)** – This is a switch that has joined a single IP group and is accessible from the CS, and it takes on the following characteristics:

It is not a CS or MS of another IP group.

It is connected to the CS through the CS management VLAN.

→ **Candidate Switch (CaS)** – This is a switch that is ready to join a SIM group but is not yet a member of the SIM group. The Candidate Switch may join the SIM group through an automatic function of the DGS-3312SR, or by manually configuring it to be a MS of a SIM group. A switch configured as a CaS is not a member of a SIM group and will take on the following characteristics:

It is not a CS or MS of another Single IP group.

It is connected to the CS through the CS management VLAN

The following rules also apply to the above roles:

→ Each device begins in a Commander state.

→ CS's must change their role to CaS and then to MS, to become a MS of a SIM group. Thus the CS cannot directly be converted to a MS.

→ The user can manually configure a CS to become a CaS.

A MS can become a CaS by:

→ Being configured as a CaS through the CS.

→ If report packets from the CS to the MS time-out.

→ The user can manually configure a CaS to become a CS

→ The CaS can be configured through the CS to become a MS.

After configuring one switch to operate as the CS of a SIM group, additional DGS-3312SR switches may join the group either by an automatic method or by manually configuring the Switch to be a MS. The CS will then serve as the in band entry point for access to the MS. The CS's IP address will become the path to all MS's of the group and the CS's Administrator's password, and/or authentication will control access to all MS's of the SIM group.

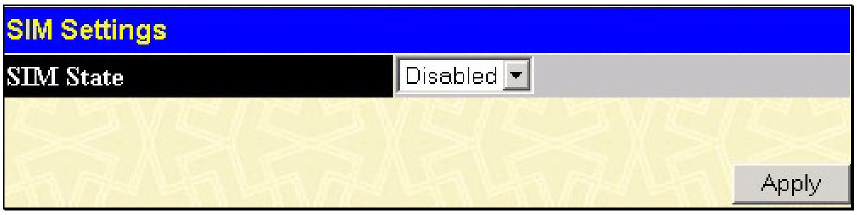
With SIM enabled, the applications in the CS will redirect the packet instead of executing the packets. The applications will decode the packet from the administrator, modify some data, and then send it to the MS. After execution, the CS may receive a response packet from the MS, which it will encode and send it back to the administrator.

When a CaS becomes a MS, it automatically becomes a member of the first SNMP community (include read/write and read only) to which the CS belongs. However, if a MS has its own IP address, it can belong to SNMP communities to which other switches in the group, including the CS, do not belong.

All DGS-3312SR switches are set as Candidate (CaS) switches, as their factory default configuration and the Single IP Management feature will be disabled. To enable SIM for the Switch using the Web interface, go to the **Single IP Management** folder and click the **SIM Settings** link, revealing the following window.

SIM Settings

The DGS-3312SR is set as a Candidate (CaS) switch as its factory default configuration and Single IP Management will be disabled. To enable SIM for the Switch using the Web interface, go to the **Single IP Management** folder and click the **SIM Settings** link, revealing the following window.

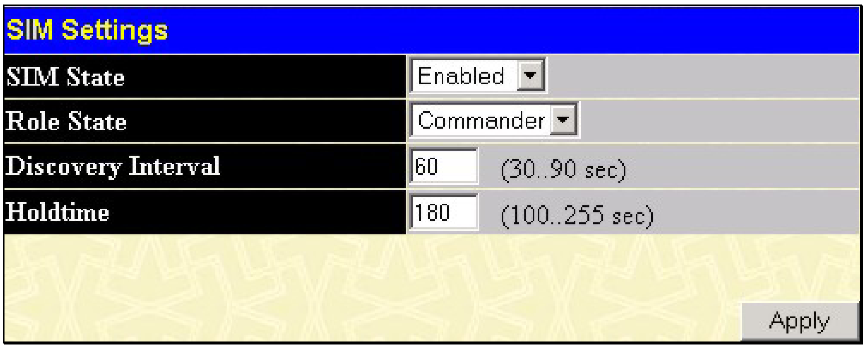


SIM Settings

SIM State: Disabled

Figure 10- 1. SIM Settings window (disabled)

Change the SIM State to *Enabled* using the pull down menu and click **Apply**. The window will then refresh and the **SIM Settings** window will look like this:



SIM Settings

SIM State	Enabled
Role State	Commander
Discovery Interval	60 (30..90 sec)
Holdtime	180 (100..255 sec)

Figure 10- 2. SIM Settings window (enabled)

The following parameters can be set:

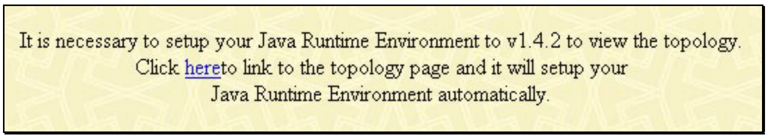
Parameters	Description
SIM State	Use the pull down menu to either enable or disable the SIM state on the Switch. *Disabled* will render all SIM functions on the Switch inoperable.
Role State	Use the pull down menu to change the SIM role of the Switch. The two choices are: *Candidate* - A Candidate Switch (CaS) is not the member of a SIM group but is connected to a Commander Switch. This is the default setting for the SIM role of the DGS-3312SR. *Commander* - Choosing this parameter will make the Switch a Commander Switch (CS). The user may join other switches to this Switch, over Ethernet, to be part of its SIM group. Choosing this option will also enable the Switch to be configured for SIM.
Discovery Interval	The user may set the discovery protocol interval, in seconds, that the Switch will send out discovery packets. Returning information to a Commander Switch will include information about other switches connected to it. (Ex. MS, CaS). The user may set the Discovery Interval from 30 to 90 seconds.
Holdtime	This parameter may be set for the time, in seconds, the Switch will hold information sent to it from other switches, utilizing the Discovery Interval. The user may set the hold time from 100 to 255 seconds.

Click **Apply** to implement the settings changed.

After enabling the Switch to be a Commander Switch (CS), the **Single IP Management** folder will then contain three added links to aid the user in configuring SIM through the web, including **Topology**, **Firmware Upgrade** and **Configuration Backup/Restore**.

Topology

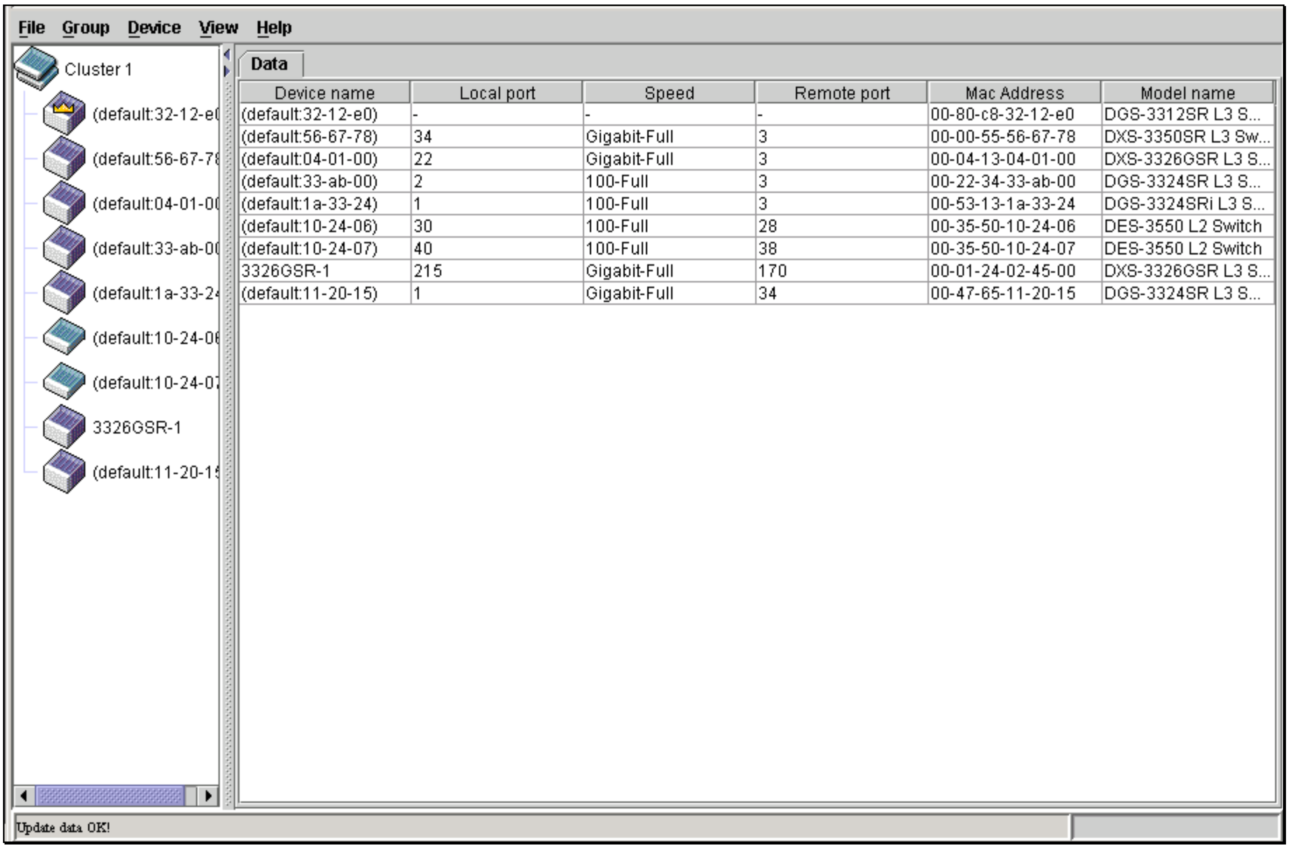
The **Topology** window will be used to configure and manage the Switch within the SIM group and requires Java script to function properly on your computer. The following message should appear the first time the user clicks the **Topology** link in the **Single IP Management** folder.



It is necessary to setup your Java Runtime Environment to v1.4.2 to view the topology.
Click hereto link to the topology page and it will setup your
Java Runtime Environment automatically.

Figure 10- 3. Java window

Clicking the here link will setup the Java Runtime Environment on your server and lead you to the topology window, as seen below.



Device name	Local port	Speed	Remote port	Mac Address	Model name
(default:32-12-e0)	-	-	-	00-80-c8-32-12-e0	DGS-3312SR L3 S...
(default:56-67-78)	34	Gigabit-Full	3	00-00-55-56-67-78	DXS-3350SR L3 Sw...
(default:04-01-00)	22	Gigabit-Full	3	00-04-13-04-01-00	DXS-3326GSR L3 S...
(default:33-ab-00)	2	100-Full	3	00-22-34-33-ab-00	DGS-3324SR L3 S...
(default:1a-33-24)	1	100-Full	3	00-53-13-1a-33-24	DGS-3324SRi L3 S...
(default:10-24-06)	30	100-Full	28	00-35-50-10-24-06	DES-3550 L2 Switch
(default:10-24-07)	40	100-Full	38	00-35-50-10-24-07	DES-3550 L2 Switch
3326GSR-1	215	Gigabit-Full	170	00-01-24-02-45-00	DXS-3326GSR L3 S...
(default:11-20-15)	1	Gigabit-Full	34	00-47-65-11-20-15	DGS-3324SR L3 S...

Update data OK!

Figure 10- 4. Single IP Management window-Tree View

The **Tree View** window holds the following information under the Data tab:

Parameter	Description
Device Name	This field will display the Device Name of the Switches in the SIM group configured by the user. If no Device Name is configured by the name, it will be given the name default and tagged with the last six digits of the MAC Address to identify it.
Local Port	Displays the number of the physical port on the CS that the MS or CaS is connected to. The CS will have no entry in this field.
Speed	Displays the connection speed between the CS and the MS or CaS.

Remote Port	Displays the number of the physical port on the MS or CaS that the CS is connected to. The CS will have no entry in this field.
MAC Address	Displays the MAC Address of the corresponding Switch.
Model Name	Displays the full Model Name of the corresponding Switch.

To view the **Topology Map**, click the **View** menu in the toolbar and then **Topology**, which will produce the following screen. The Topology View will refresh itself periodically (20 seconds by default).

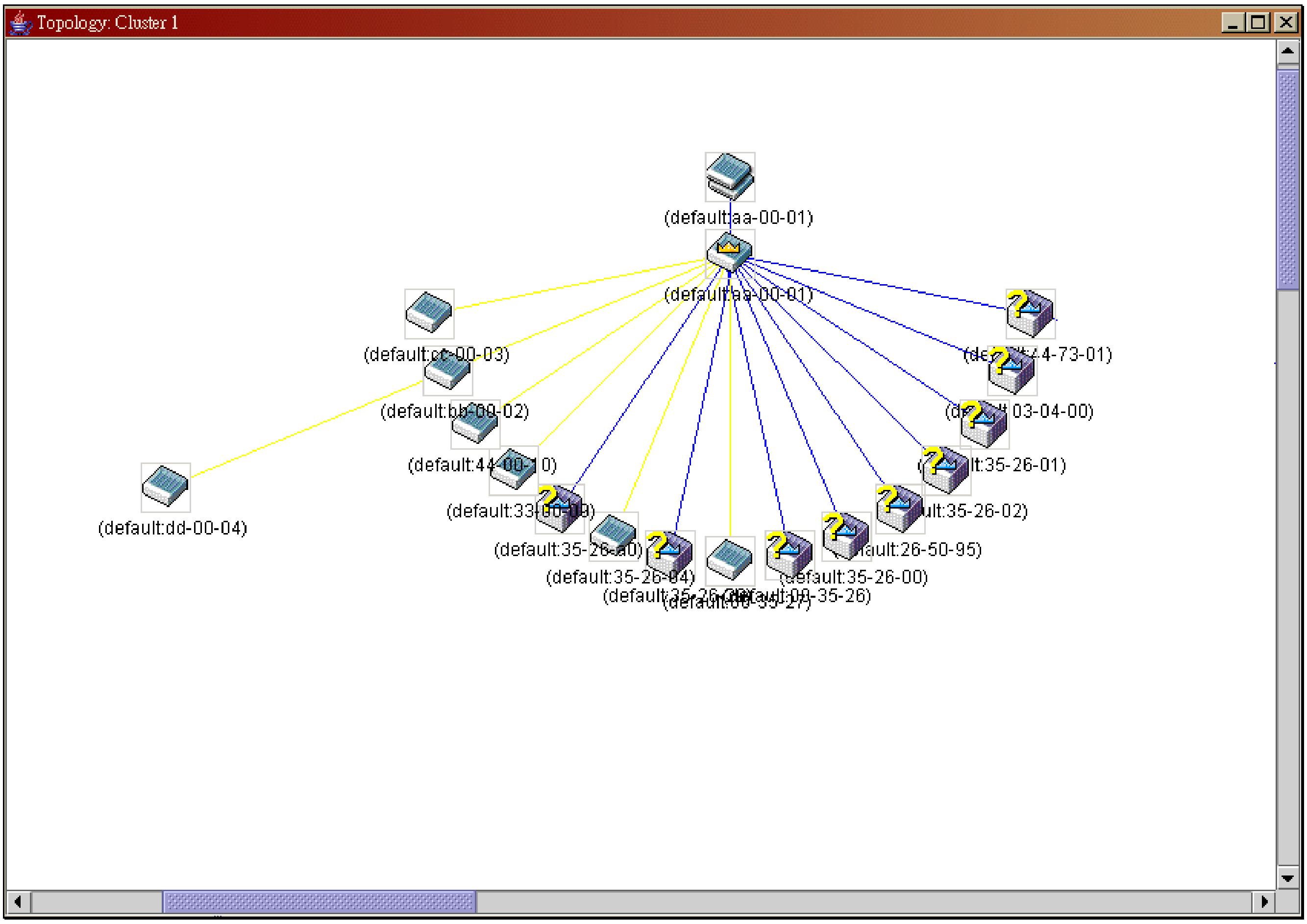
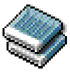
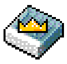
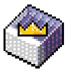
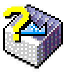
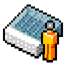
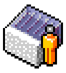
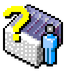
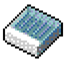
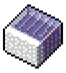
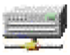
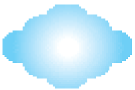


Figure 10- 5. Topology view

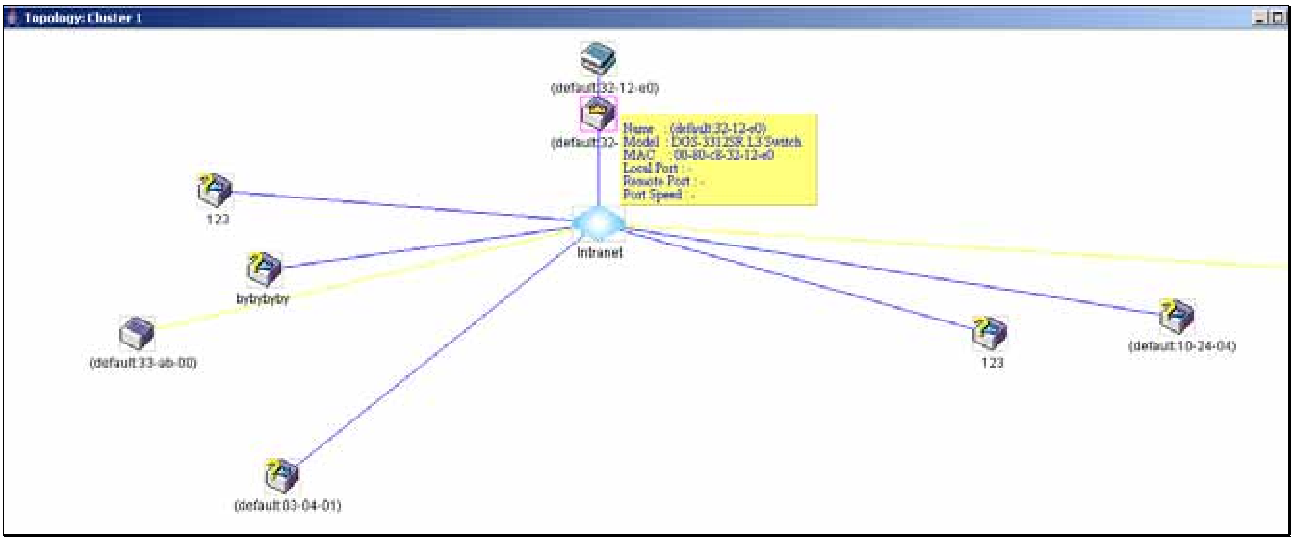
This screen will display how the devices within the Single IP Management Group are connected to other groups and devices. Possible icons in this screen are as follows:

Icon	Description
	Group
	Layer 2 commander switch
	Layer 3 commander switch

	Commander switch of other group
	Layer 2 member switch.
	Layer 3 member switch
	Member switch of other group
	Layer 2 candidate switch
	Layer 3 candidate switch
	Unknown device
	Non-SIM devices

Tool Tips

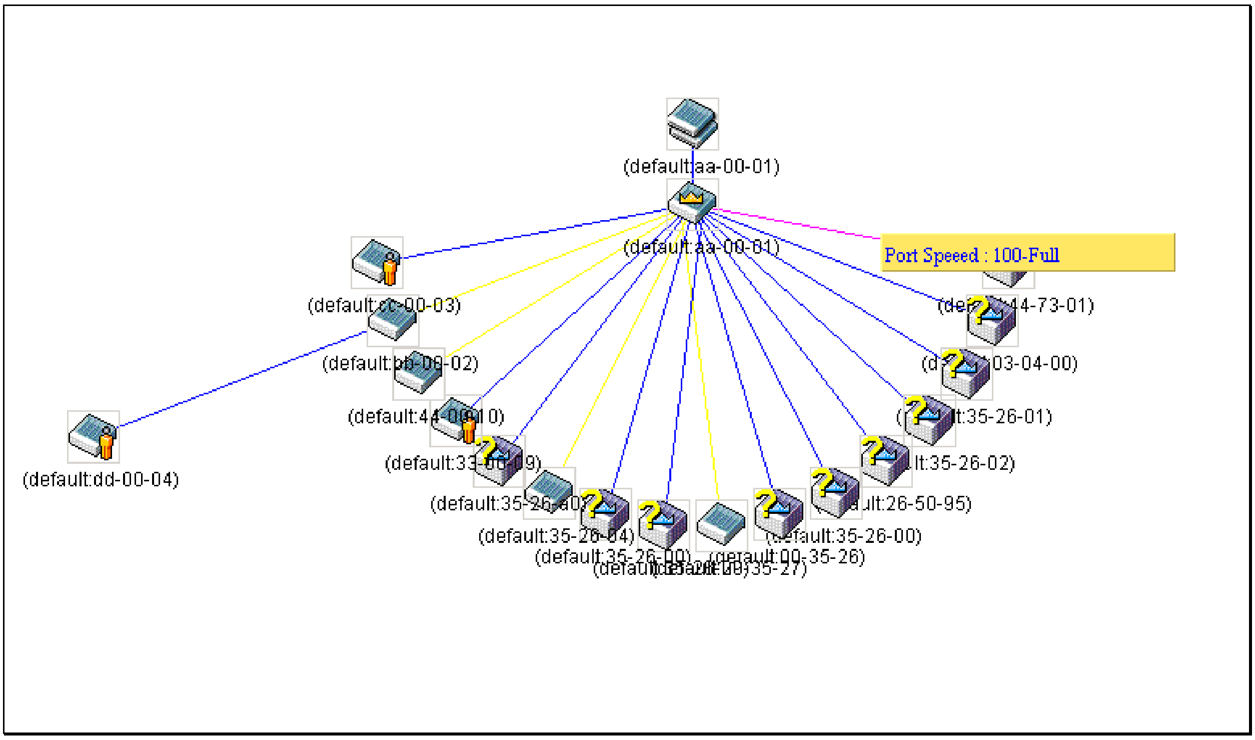
In the Topology view window, the mouse plays an important role in configuration and in viewing device information. Setting the mouse cursor over a specific device in the topology window (tool tip) will display the same information about a specific device as the Tree view does. See the window below for an example.



Name : (default:32-12-e0)
Model : DGS-3312SR L3 Switch
MAC : 00-80-c8-32-12-e0
Local Port : -
Remote Port : -
Port Speed : -

Figure 10- 6. Device Information Utilizing the Tool Tip

Setting the mouse cursor over a line between two devices will display the connection speed between the two devices, as shown below.



Port Speeed : 100-Full

Figure 10- 7. Port Speed Utilizing the Tool Tip

Right-click

Right clicking on a device will allow the user to perform various functions, depending on the role of the Switch in the SIM group and the icon associated with it.

Group Icon

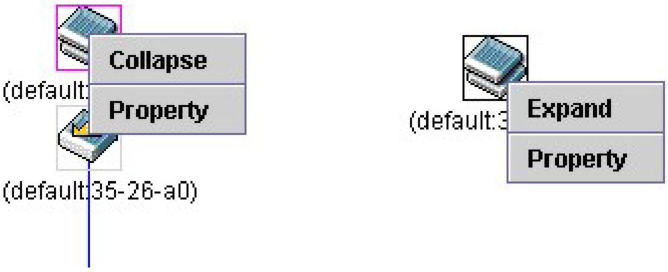
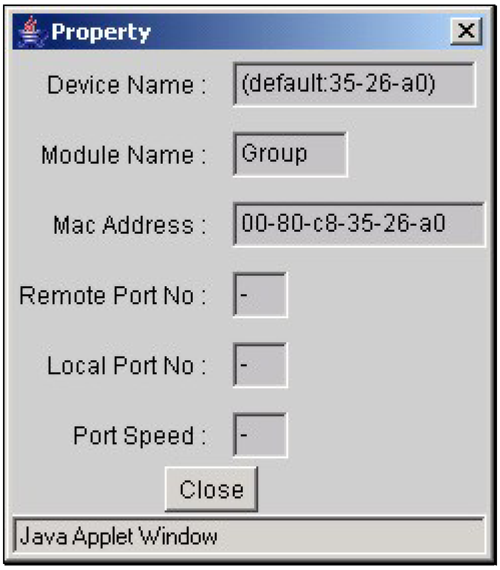


Figure 10- 8. Right-clicking a Group Icon

The following options may appear for the user to configure:

- **Collapse** - to collapse the group that will be represented by a single icon.
- **Expand** - to expand the SIM group, in detail.
- **Property** - to pop up a window to display the group information.



Device Name : (default:35-26-a0)

Module Name : Group

Mac Address : 00-80-c8-35-26-a0

Remote Port No : -

Local Port No : -

Port Speed : -

Figure 10- 9. Property dialog box

This window holds the following information:

Parameter	Description
Device Name	This field will display the Device Name of the Switches in the SIM group configured by the user. If no Device Name is configured by the name, it will be given the name default and tagged with the last six digits of the MAC Address to identify it.
Module Name	Displays the full module name of the Switch that was right-clicked.
MAC Address	Displays the MAC Address of the corresponding Switch.

Remote Port No.	Displays the number of the physical port on the MS or CaS that the CS is connected to. The CS will have no entry in this field.
Local Port No.	Displays the number of the physical port on the CS that the MS or CaS is connected to. The CS will have no entry in this field.
Port Speed	Displays the connection speed between the CS and the MS or CaS

Commander Switch Icon

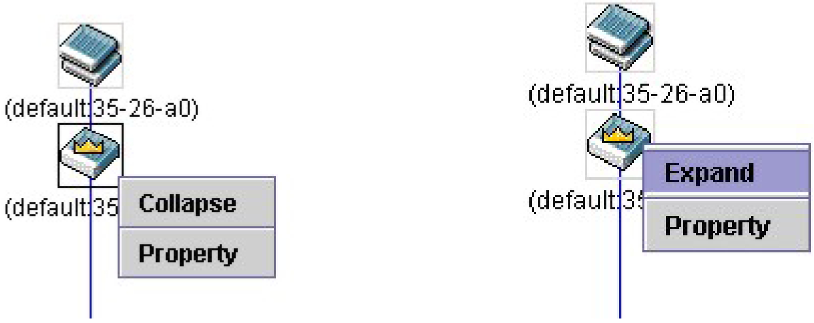
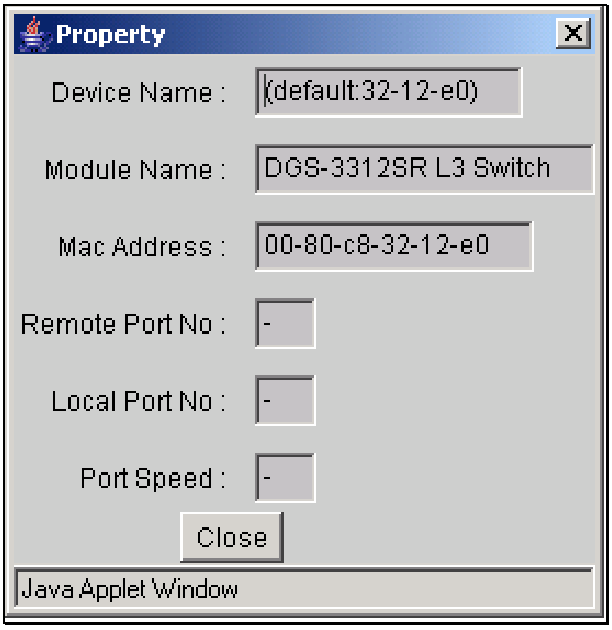


Figure 10- 10. Right-clicking a Commander Icon

The following options may appear for the user to configure:

- **Collapse** - to collapse the group that will be represented by a single icon.
- **Expand** - to expand the SIM group, in detail.
- **Property** - to pop up a window to display the group information.



Device Name : (default:32-12-e0)

Module Name : DGS-3312SR L3 Switch

Mac Address : 00-80-c8-32-12-e0

Remote Port No : -

Local Port No : -

Port Speed : -

Java Applet Window

Figure 10- 11. Property dialog box

Member Switch Icon

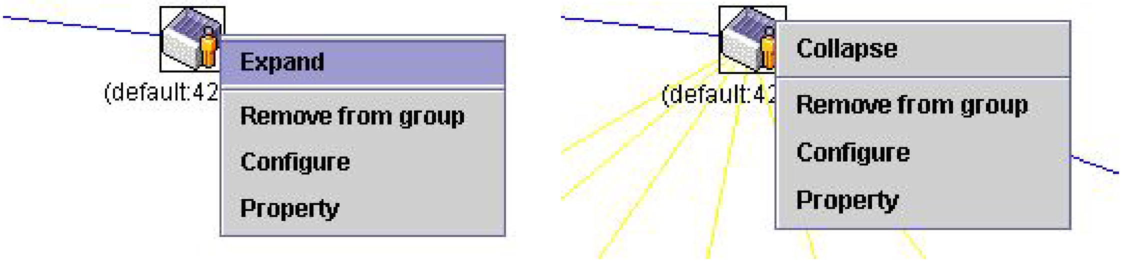
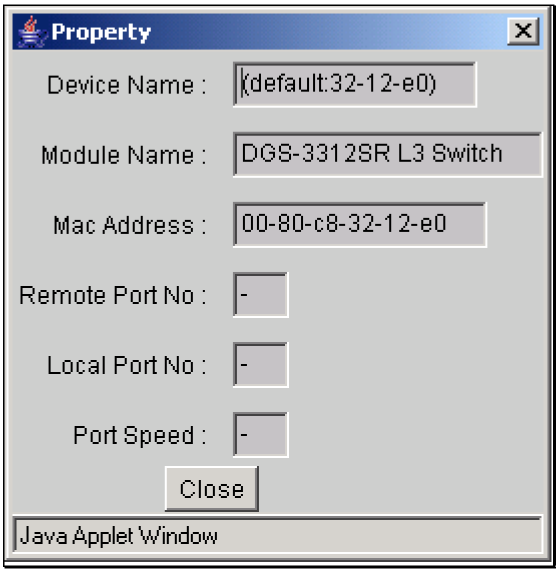


Figure 10- 12. Right-clicking a Member icon

The following options may appear for the user to configure:

- **Collapse** - to collapse the group that will be represented by a single icon.
- **Expand** - to expand the SIM group, in detail.
- **Remove from group** - remove a member from a group.
- **Configure** - launch the web management to configure the Switch.
- **Property** - to pop up a window to display the device information.



Property

Device Name : (default:32-12-e0)

Module Name : DGS-3312SR L3 Switch

Mac Address : 00-80-c8-32-12-e0

Remote Port No : -

Local Port No : -

Port Speed : -

Figure 10- 13. Property window

Candidate Switch Icon

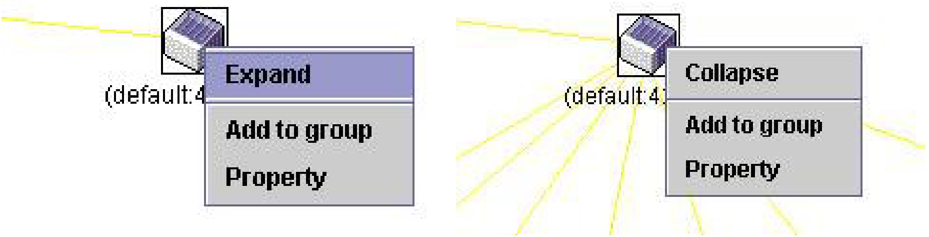


Figure 10- 14. Right-clicking a Candidate icon

The following options may appear for the user to configure:

- **Collapse** - to collapse the group that will be represented by a single icon.
- **Expand** - to expand the SIM group, in detail.
- **Add to group** - add a candidate to a group. Clicking this option will reveal the following screen for the user to enter a password for authentication from the Candidate Switch before being added to the SIM group. Click OK to enter the password or Cancel to exit the window.

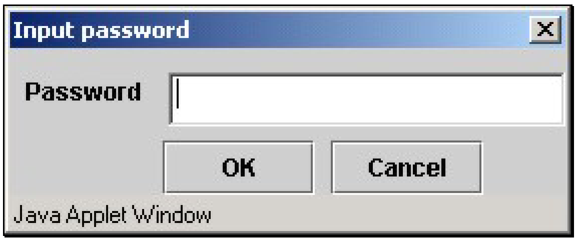
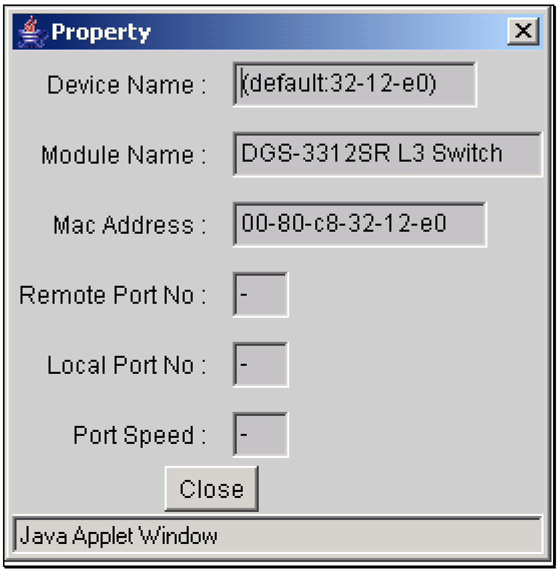


Figure 10- 15. Input Password dialog box

- **Property** - to pop up a window to display the device information, as shown below.



Device Name : (default:32-12-e0)

Module Name : DGS-3312SR L3 Switch

Mac Address : 00-80-c8-32-12-e0

Remote Port No : -

Local Port No : -

Port Speed : -

Figure 10- 16. Device Property dialog box

Click **Close** to close the **Property** window.

Menu Bar

The **Single IP Management** window contains a menu bar for device configurations, as seen below.

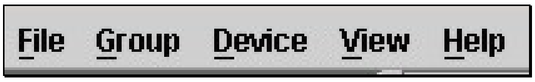


Figure 10- 17. Menu Bar of the Topology View

The five menus on the menu bar are as follows.

File

- **Print Setup** - will view the image to be printed.
- **Print Topology** - will print the topology map.
- **Preference** - will set display properties, such as polling interval, and the views to open at SIM startup.

Group

- **Add to group** - add a candidate to a group. Clicking this option will reveal the following screen for the user to enter a password for authentication from the Candidate Switch before being added to the SIM group. Click OK to enter the password or Cancel to exit the window.

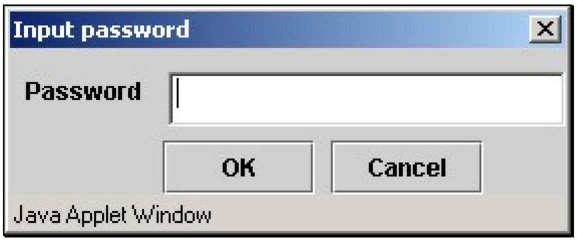


Figure 10- 18. Input Password window

- **Remove from Group** - remove an MS from the group.

Device

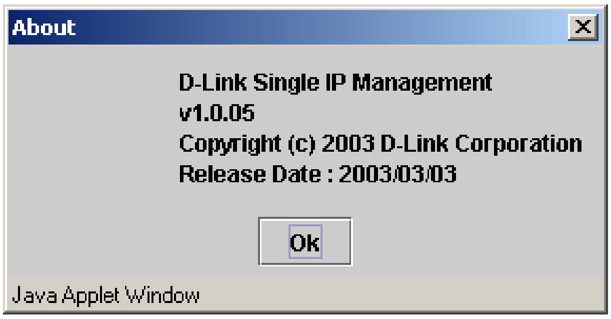
- **Configure** - will open the web manager for the specific device.

View

- **Refresh** - update the views with the latest status.
- **Topology** - display the Topology view.

Help

- **About** - Will display the SIM information, including the current SIM version.



About

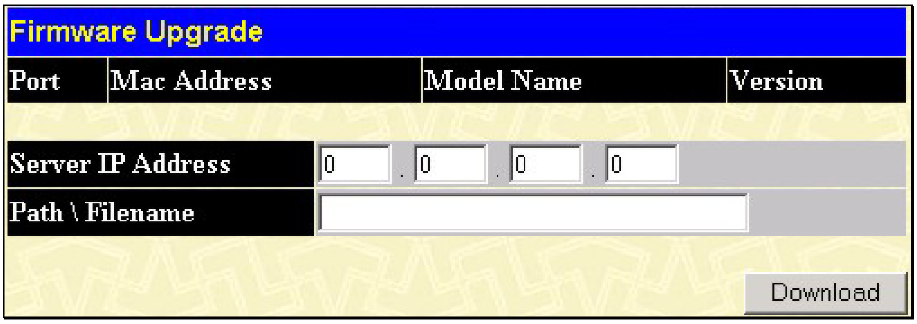
D-Link Single IP Management
v1.0.05
Copyright (c) 2003 D-Link Corporation
Release Date : 2003/03/03

Figure 10- 19. About window

NOTE: Upon this firmware release, some functions of the SIM can only be configured through the Command Line Interface. See the ***DGS-3312SR Command Line Interface Reference Manual*** for more information on SIM and its configurations.

Firmware Upgrade

This screen is used to upgrade firmware from the Commander Switch to the Member Switch. Member Switches will be listed in the table and will be specified by Port (port on the CS where the MS resides), MAC Address, Model Name and Version. To specify a certain Switch for firmware download, click its corresponding check box under the Port heading. To update the firmware, enter the Server IP Address where the firmware resides and enter the Path/Filename of the firmware. Click **Download** to initiate the file transfer.



Firmware Upgrade

Port	Mac Address	Model Name	Version

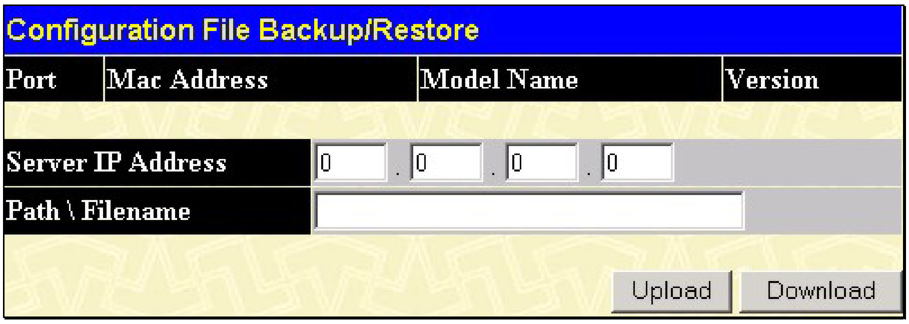
Server IP Address: 0 . 0 . 0 . 0

Path \ Filename:

Figure 10- 20. Firmware Upgrade window

Configuration File Backup/Restore

This screen is used to upgrade configuration files from the Commander Switch to the Member Switch. Member Switches will be listed in the table and will be specified by Port (port on the CS where the MS resides), MAC Address, Model Name and Version. To specify a certain Switch for upgrading configuration files, click its corresponding radio button under the Port heading. To update the configuration file, enter the Server IP Address where the firmware resides and enter the Path/Filename of the firmware. Click **Download** to initiate the file transfer.



Configuration File Backup/Restore

Port	Mac Address	Model Name	Version

Server IP Address: 0 . 0 . 0 . 0

Path \ Filename:

Figure 10- 21. Configuration File Backup/Restore window

Appendix A

Technical Specifications

General

Standard	IEEE 802.3 10BASE-T Ethernet IEEE 802.3u 100BASE-TX Fast Ethernet IEEE 802.3ab 1000BASE-T Gigabit Ethernet IEEE 802.1 P/Q VLAN IEEE 802.3x Full-duplex Flow Control IEEE 802.3 Nway auto-negotiation	
Protocols	CSMA/CD	
Data Transfer Rates:	Half-duplex	Full-duplex
Ethernet	10 Mbps	20Mbps
Fast Ethernet	100Mbps	200Mbps
Gigabit Ethernet	N/A	2000Mbps
Fiber Optic	IEC 793-2:1992 Type A1a - 50/125um multimode Type A1b - 62.5/125um multimode Both types use LC optical connector	
Topology	Star	
Network Cables	UTP Cat. 5 for 100Mbps UTP Cat. 3, 4, 5 for 10Mbps EIA/TIA-568 100-ohm screened twisted-pair (STP)(100m)	

Performance

Transmission Method:	Store-and-forward
RAM Buffer:	1 MB per device
Filtering Address Table:	16 K MAC address per device
Packet Filtering/ Forwarding Rate:	Full-wire speed for all connections. 148,800 pps per port (for 100Mbps) 1,488,000 pps per port (for 1000Mbps)

MAC Address Learning:	Automatic update.
Forwarding Table Age Time:	Max age: 10 - 1000000 seconds. Default = 300.

Physical & Environmental

AC inputs:	100 - 240 VAC, 50/60 Hz (internal universal power supply)
Power Consumption:	30 watts maximum
DC fans:	1 built-in 75 x 75 x30 mm fan
Operating Temperature:	0 to 40 degrees Celsius (32 to 104 degrees Fahrenheit)
Storage Temperature:	-25 to 55 degrees Celsius (-13 to 131 degrees Fahrenheit)
Humidity:	Operating: 5% to 95% RH, non-condensing Storage: 0% to 95% RH, non-condensing
Dimensions:	441 mm x 309 mm x 44 mm (17.36 x 12.16 x 1.73 inches), 1UHeight, 19 inch rack-mount width
Weight:	4.4 kg (9.7 lbs.)
EMI:	FCC Class A, CE Mark, C-Tick
Safety:	CSA International

Appendix B

Cables and Connectors

When connecting the Switch to another switch, a bridge or hub, a normal cable is necessary. Please review these products for matching cable pin assignment.

The following diagrams and tables show the standard RJ-45 receptacle/connector and their pin assignments.

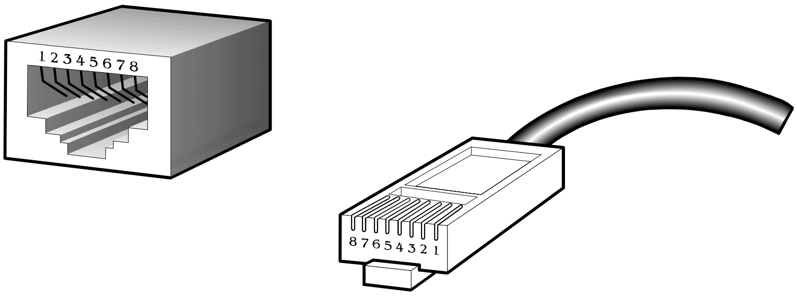


Figure B- 1. The standard RJ-45 port and connector

RJ-45 Pin Assignments		
Contact	MDI-X Port	MDI-II Port
1	RD+ (receive)	TD+ (transmit)
2	RD- (receive)	TD- (transmit)
3	TD+ (transmit)	RD+ (receive)
4	Not used	Not used
5	Not used	Not used
6	TD- (transmit)	RD- (receive)
7	Not used	Not used
8	Not used	Not used

Figure B- 2. The standard RJ-45 pin assignments

Appendix C

Cable Lengths

Use the following table to as a guide for the maximum cable lengths.

Standard	Media Type	Maximum Distance
Mini-GBIC	1000BASE-LX, Single-mode fiber module 1000BASE-SX, Multi-mode fiber module 1000BASE-LHX, Single-mode fiber module 1000BASE-ZX, Single-mode fiber module	10km 550m 40km 80km
1000BASE-T	Category 5e UTP Cable Category 5 UTP Cable (1000 Mbps)	100m
100BASE-TX	Category 5 UTP Cable (100 Mbps)	100m
10BASE-T	Category 3 UTP Cable (10 Mbps)	100m

Glossary

1000BASE-LX: A short laser wavelength on multimode fiber optic cable for a maximum length of 550 meters

1000BASE-SX: A long wavelength for a "long haul" fiber optic cable for a maximum length of 10 kilometers

100BASE-FX: 100Mbps Ethernet implementation over fiber.

100BASE-TX: 100Mbps Ethernet implementation over Category 5 and Type 1 Twisted Pair cabling.

10BASE-T: The IEEE 802.3 specification for Ethernet over Unshielded Twisted Pair (UTP) cabling.

ageing: The automatic removal of dynamic entries from the Switch Database which have timed-out and are no longer valid.

ATM: Asynchronous Transfer Mode. A connection oriented transmission protocol based on fixed length cells (packets). ATM is designed to carry a complete range of user traffic, including voice, data and video signals.

auto-negotiation: A feature on a port which allows it to advertise its capabilities for speed, duplex and flow control. When connected to an end station that also supports auto-negotiation, the link can self-detect its optimum operating setup.

backbone port: A port which does not learn device addresses, and which receives all frames with an unknown address. Backbone ports are normally used to connect the Switch to the backbone of your network. Note that backbone ports were formerly known as designated downlink ports.

backbone: The part of a network used as the primary path for transporting traffic between network segments.

bandwidth: Information capacity, measured in bits per second, that a channel can transmit. The bandwidth of Ethernet is 10Mbps, the bandwidth of Fast Ethernet is 100Mbps.

baud rate: The switching speed of a line. Also known as line speed between network segments.

BOOTP: The BOOTP protocol allows you to automatically map an IP address to a given MAC address each time a device is started. In addition, the protocol can assign the subnet mask and default gateway to a device.

bridge: A device that interconnects local or remote networks no matter what higher level protocols are involved. Bridges form a single logical network, centralizing network administration.

broadcast: A message sent to all destination devices on the network.

broadcast storm: Multiple simultaneous broadcasts that typically absorb available network bandwidth and can cause network failure.

console port: The port on the Switch accepting a terminal or modem connector. It changes the parallel arrangement of data within computers to the serial form used on data transmission links. This port is most often used for dedicated local management.

CSMA/CD: Channel access method used by Ethernet and IEEE 802.3 standards in which devices transmit only after finding the data channel clear for some period of time. When two devices transmit simultaneously, a collision occurs and the colliding devices delay their retransmissions for a random amount of time.

data center switching: The point of aggregation within a corporate network where a switch provides high-performance access to server farms, a high-speed backbone connection and a control point for network management and security.

Ethernet: A LAN specification developed jointly by Xerox, Intel and Digital Equipment Corporation. Ethernet networks operate at 10Mbps using CSMA/CD to run over cabling.

Fast Ethernet: 100Mbps technology based on the Ethernet/CD network access method.

Flow Control: (IEEE 802.3z) A means of holding packets back at the transmit port of the connected end station. Prevents packet loss at a congested switch port.

forwarding: The process of sending a packet toward its destination by an internetworking device.

full duplex: A system that allows packets to be transmitted and received at the same time and, in effect, doubles the potential throughput of a link.

half duplex: A system that allows packets to be transmitted and received, but not at the same time. Contrast with full duplex.

IP address: Internet Protocol address. A unique identifier for a device attached to a network using TCP/IP. The address is written as four octets separated with full-stops (periods), and is made up of a network section, an optional subnet section and a host section.

IPX: Internetwork Packet Exchange. A protocol allowing communication in a NetWare network.

LAN - Local Area Network: A network of connected computing resources (such as PCs, printers, servers) covering a relatively small geographic area (usually not larger than a floor or building). Characterized by high data rates and low error rates.

latency: The delay between the time a device receives a packet and the time the packet is forwarded out of the destination port.

line speed: See baud rate.

main port: The port in a resilient link that carries data traffic in normal operating conditions.

MDI - Medium Dependent Interface: An Ethernet port connection where the transmitter of one device is connected to the receiver of another device.

MDI-X - Medium Dependent Interface Cross-over: An Ethernet port connection where the internal transmit and receive lines are crossed.

MIB - Management Information Base: Stores a device's management characteristics and parameters. MIBs are used by the Simple Network Management Protocol (SNMP) to contain attributes of their managed systems. The Switch contains its own internal MIB.

multicast: Single packets copied to a specific subset of network addresses. These addresses are specified in the destination-address field of the packet.

protocol: A set of rules for communication between devices on a network. The rules dictate format, timing, sequencing and error control.

resilient link: A pair of ports that can be configured so that one will take over data transmission should the other fail. See also main port and standby port.

RJ-45: Standard 8-wire connectors for IEEE 802.3 10BASE-T networks.

RMON: Remote Monitoring. A subset of SNMP MIB II that allows monitoring and management capabilities by addressing up to ten different groups of information.

RPS - Redundant Power System: A device that provides a backup source of power when connected to the Switch.

server farm: A cluster of servers in a centralized location serving a large user population.

SLIP - Serial Line Internet Protocol: A protocol which allows IP to run over a serial line connection.

SNMP - Simple Network Management Protocol: A protocol originally designed to be used in managing TCP/IP internets. SNMP is presently implemented on a wide range of computers and networking equipment and may be used to manage many aspects of network and end station operation.

Spanning Tree Protocol (STP): A bridge-based system for providing fault tolerance on networks. STP works by allowing you to implement parallel paths for network traffic, and ensure that redundant paths are disabled when the main paths are operational and enabled if the main paths fail.

stack: A group of network devices that are integrated to form a single logical device.

standby port: The port in a resilient link that will take over data transmission if the main port in the link fails.

switch: A device which filters, forwards and floods packets based on the packet's destination address. The switch learns the addresses associated with each switch port and builds tables based on this information to be used for the Switching decision.

TCP/IP: A layered set of communications protocols providing Telnet terminal emulation, FTP file transfer, and other services for communication among a wide range of computer equipment.

telnet: A TCP/IP application protocol that provides virtual terminal service, letting a user log in to another computer system and access a host as if the user were connected directly to the host.

TFTP - Trivial File Transfer Protocol: Allows you to transfer files (such as software upgrades) from a remote device using your switch's local management capabilities.

UDP - User Datagram Protocol: An Internet standard protocol that allows an application program on one device to send a datagram to an application program on another device.

VLAN - Virtual LAN: A group of location- and topology-independent devices that communicate as if they are on a common physical LAN.

VLT - Virtual LAN Trunk: A Switch-to-Switch link which carries traffic for all the VLANs on each Switch.

VT100: A type of terminal that uses ASCII characters. VT100 screens have a text-based appearanc

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IN NO EVENT WILL D-LINK BE LIABLE FOR ANY DAMAGES, INCLUDING LOSS OF DATA, LOSS OF PROFITS, COST OF COVER OR OTHER INCIDENTAL, CONSEQUENTIAL OR INDIRECT DAMAGES ARISING OUT THE INSTALLATION, MAINTENANCE, USE, PERFORMANCE, FAILURE OR INTERRUPTION OF A D- LINK PRODUCT, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY. THIS LIMITATION WILL APPLY EVEN IF D-LINK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

IF YOU PURCHASED A D-LINK PRODUCT IN THE UNITED STATES, SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

Limited Warranty

Hardware:

D-Link warrants each of its hardware products to be free from defects in workmanship and materials under normal use and service for a period commencing on the date of purchase from D-Link or its Authorized Reseller and extending for the length of time stipulated by the Authorized Reseller or D-Link Branch Office nearest to the place of purchase.

This Warranty applies on the condition that the product Registration Card is filled out and returned to a D-Link office within ninety (90) days of purchase. A list of D-Link offices is provided at the back of this manual, together with a copy of the Registration Card.

If the product proves defective within the applicable warranty period, D-Link will provide repair or replacement of the product. D-Link shall have the sole discretion whether to repair or replace, and replacement product may be new or reconditioned. Replacement product shall be of equivalent or better specifications, relative to the defective product, but need not be identical. Any product or part repaired by D-Link pursuant to this warranty shall have a warranty period of not less than 90 days, from date of such repair, irrespective of any earlier expiration of original warranty period. When D-Link provides replacement, then the defective product becomes the property of D-Link.

Warranty service may be obtained by contacting a D-Link office within the applicable warranty period, and requesting a Return Material Authorization (RMA) number. If a Registration Card for the product in question has not been returned to D-Link, then a proof of purchase (such as a copy of the dated purchase invoice) must be provided. If Purchaser's circumstances require special handling of warranty correction, then at the time of requesting RMA number, Purchaser may also propose special procedure as may be suitable to the case.

After an RMA number is issued, the defective product must be packaged securely in the original or other suitable shipping package to ensure that it will not be damaged in transit, and the RMA number must be prominently marked on the outside of the package. The package must be mailed or otherwise shipped to D-Link with all costs of mailing/shipping/insurance prepaid. D-Link shall never be responsible for any software, firmware, information, or memory data of Purchaser contained in, stored on, or integrated with any product returned to D-Link pursuant to this warranty.

Any package returned to D-Link without an RMA number will be rejected and shipped back to Purchaser at Purchaser's expense, and D-Link reserves the right in such a case to levy a reasonable handling charge in addition mailing or shipping costs.

Software:

Warranty service for software products may be obtained by contacting a D-Link office within the applicable warranty period. A list of D-Link offices is provided at the back of this manual, together with a copy of the Registration Card. If a Registration Card for the product in question has not been returned to a D-Link office, then a proof of purchase (such as a copy of the dated purchase invoice) must be provided when requesting warranty service. The term "purchase" in this software warranty refers to the purchase transaction and resulting license to use such software.

D-Link warrants that its software products will perform in substantial conformance with the applicable product documentation provided by D-Link with such software product, for a period of ninety (90) days from the date of purchase from D-Link or its Authorized Reseller. D-Link warrants the magnetic media, on which D-Link provides its software product, against failure during the same warranty period. This warranty applies to purchased software, and to replacement software provided by D-Link pursuant to this warranty, but shall not apply to any update or replacement which may be provided for download via the Internet, or to any update which may otherwise be provided free of charge.

D-Link's sole obligation under this software warranty shall be to replace any defective software product with product which substantially conforms to D-Link's applicable product documentation. Purchaser assumes responsibility for the selection of appropriate application and system/platform software and associated reference materials. D-Link makes no warranty that its software products will work in combination with any hardware, or any application or system/platform software product provided by any third party, excepting only such products as are expressly represented, in D-Link's applicable product documentation as being compatible. D-Link's obligation under this warranty shall be a reasonable effort to provide compatibility, but D-Link shall have no obligation to provide compatibility when there is fault in the third-party hardware or software. D-Link makes no warranty that operation of its software products will be uninterrupted or absolutely error-free, and no warranty that all defects in the software product, within or without the scope of D-Link's applicable product documentation, will be corrected.

D-Link Offices for Registration and Warranty Service

The product's Registration Card, provided at the back of this manual, must be sent to a D-Link office. To obtain an RMA number for warranty service as to a hardware product, or to obtain warranty service as to a software product, contact the D-Link office nearest you. An address/telephone/fax/e-mail/Web site list of D-Link offices is provided in the back of this manual.

D-Link
Building Networks for People

Limited Warranty
(USA Only)

Subject to the terms and conditions set forth herein, D-Link Systems, Inc. (“D-Link”) provides this Limited warranty for its product only to the person or entity that originally purchased the product from:

- D-Link or its authorized reseller or distributor and
- Products purchased and delivered within the fifty states of the United States, the District of Columbia, U.S. Possessions or Protectorates, U.S. Military Installations, addresses with an APO or FPO.

Limited Warranty: D-Link warrants that the hardware portion of the D-Link products described below will be free from material defects in workmanship and materials from the date of original retail purchase of the product, for the period set forth below applicable to the product type (“Warranty Period”), except as otherwise stated herein.

Limited Lifetime Warranty for the Product(s) is defined as follows:

- Hardware for as long as the original customer/end user owns the product, or five years after product discontinuance, whichever occurs first (excluding power supplies and fans)
- Power Supplies and Fans Three (3) Year
- Spare parts and spare kits Ninety (90) days

D-Link’s sole obligation shall be to repair or replace the defective Hardware during the Warranty Period at no charge to the original owner or to refund at D-Link’s sole discretion. Such repair or replacement will be rendered by D-Link at an Authorized D-Link Service Office. The replacement Hardware need not be new or have an identical make, model or part. D-Link may in its sole discretion replace the defective Hardware (or any part thereof) with any reconditioned product that D-Link reasonably determines is substantially equivalent (or superior) in all material respects to the defective Hardware. Repaired or replacement Hardware will be warranted for the remainder of the original Warranty Period from the date of original retail purchase. If a material defect is incapable of correction, or if D-Link determines in its sole discretion that it is not practical to repair or replace the defective Hardware, the price paid by the original purchaser for the defective Hardware will be refunded by D-Link upon return to D-Link of the defective Hardware. All Hardware (or part thereof) that is replaced by D-Link, or for which the purchase price is refunded, shall become the property of D-Link upon replacement or refund.

Limited Software Warranty: D-Link warrants that the software portion of the product (“Software”) will substantially conform to D-Link’s then current functional specifications for the Software, as set forth in the applicable documentation, from the date of original retail purchase of the Software for a period of ninety (90) days (“Warranty Period”), provided that the Software is properly installed on approved hardware and operated as contemplated in its documentation. D-Link further warrants that, during the Warranty Period, the magnetic media on which D-Link delivers the Software will be free of physical defects. D-Link’s sole obligation shall be to replace the non-conforming Software (or defective media) with software that substantially conforms to D-Link’s functional specifications for the Software or to refund at D-Link’s sole discretion. Except as otherwise agreed by D-Link in writing, the replacement Software is provided only to the original licensee, and is subject to the terms and conditions of the license granted by D-Link for the Software. Software will be warranted for the remainder of the original Warranty Period from the date or original retail purchase. If a material non-conformance is incapable of correction, or if D-Link determines in its sole discretion that it is not practical to replace the non-conforming Software, the price paid by the original licensee for the non-conforming Software will be refunded by D-Link; provided that the non-conforming Software (and all copies thereof) is first returned to D-Link. The license granted respecting any Software for which a refund is given automatically terminates.

Non-Applicability of Warranty: The Limited Warranty provided hereunder for hardware and software of D-Link's products will not be applied to and does not cover any refurbished product and any product purchased through the inventory clearance or liquidation sale or other sales in which D-Link, the sellers, or the liquidators expressly disclaim their warranty obligation pertaining to the product and in that case, the product is being sold "As-Is" without any warranty whatsoever including, without limitation, the Limited Warranty as described herein, notwithstanding anything stated herein to the contrary.

Submitting A Claim: The customer shall return the product to the original purchase point based on its return policy. In case the return policy period has expired and the product is within warranty, the customer shall submit a claim to D-Link as outlined below:

- The customer must submit with the product as part of the claim a written description of the Hardware defect or Software nonconformance in sufficient detail to allow D-Link to confirm the same.

The original product owner must obtain a Return Material Authorization (“RMA”) number from the Authorized D-Link Service Office and, if requested, provide written proof of purchase of the product (such as a copy of the dated purchase invoice for the product) before the warranty service is provided.

After an RMA number is issued, the defective product must be packaged securely in the original or other suitable shipping package to ensure that it will not be damaged in transit, and the RMA number must be prominently marked on the outside of the package. Do not include any manuals or accessories in the shipping package. D-Link will only replace the defective portion of the Product and will not ship back any accessories.

The customer is responsible for all in-bound shipping charges to D-Link. No Cash on Delivery (“COD”) is allowed. Products sent COD will either be rejected by D-Link or become the property of D-Link. Products shall be fully insured by the customer and shipped to **D-Link Systems, Inc., 17595 Mt. Herrman Street, Fountain Valley, CA 92708**. D-Link will not be held responsible for any packages that are lost in transit to D-Link. The repaired or replaced packages will be shipped to the customer via UPS Ground or any common carrier selected by D-Link, with shipping charges prepaid. Expedited shipping is available if shipping charges are prepaid by the customer and upon request.

D-Link may reject or return any product that is not packaged and shipped in strict compliance with the foregoing requirements, or for which an RMA number is not visible from the outside of the package. The product owner agrees to pay D-Link's reasonable handling and return shipping charges for any product that is not packaged and shipped in accordance with the foregoing requirements, or that is determined by D-Link not to be defective or non-conforming.

What Is Not Covered: This limited warranty provided by D-Link does not cover: Products, if in D-Link's judgment, have been subjected to abuse, accident, alteration, modification, tampering, negligence, misuse, faulty installation, lack of reasonable care, repair or service in any way that is not contemplated in the documentation for the product, or if the model or serial number has been altered, tampered with, defaced or removed; Initial installation, installation and removal of the product for repair, and shipping costs; Operational adjustments covered in the operating manual for the product, and normal maintenance; Damage that occurs in shipment, due to act of God, failures due to power surge, and cosmetic damage; Any hardware, software, firmware or other products or services provided by anyone other than D-Link; Products that have been purchased from inventory clearance or liquidation sales or other sales in which D-Link, the sellers, or the liquidators expressly disclaim their warranty obligation pertaining to the product. Repair by anyone other than D-Link or an Authorized D-Link Service Office will void this Warranty.

Disclaimer of Other Warranties: EXCEPT FOR THE LIMITED WARRANTY SPECIFIED HEREIN, THE PRODUCT IS PROVIDED "AS-IS" WITHOUT ANY WARRANTY OF ANY KIND WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. IF ANY IMPLIED WARRANTY CANNOT BE DISCLAIMED IN ANY TERRITORY WHERE A PRODUCT IS SOLD, THE DURATION OF SUCH IMPLIED WARRANTY SHALL BE LIMITED TO NINETY (90) DAYS. EXCEPT AS EXPRESSLY COVERED UNDER THE LIMITED WARRANTY PROVIDED HEREIN, THE ENTIRE RISK AS TO THE QUALITY, SELECTION AND PERFORMANCE OF THE PRODUCT IS WITH THE PURCHASER OF THE PRODUCT.

Limitation of Liability: TO THE MAXIMUM EXTENT PERMITTED BY LAW, D-LINK IS NOT LIABLE UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR ANY LOSS OF USE OF THE PRODUCT, INCONVENIENCE OR DAMAGES OF ANY CHARACTER, WHETHER DIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL (INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF GOODWILL, LOSS OF REVENUE OR PROFIT, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, FAILURE OF OTHER EQUIPMENT OR COMPUTER PROGRAMS TO WHICH D-LINK'S PRODUCT IS CONNECTED WITH, LOSS OF INFORMATION OR DATA CONTAINED IN, STORED ON, OR INTEGRATED WITH ANY PRODUCT RETURNED TO D-LINK FOR WARRANTY SERVICE) RESULTING FROM THE USE OF THE PRODUCT, RELATING TO WARRANTY SERVICE, OR ARISING OUT OF ANY BREACH OF THIS LIMITED WARRANTY, EVEN IF D-LINK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE SOLE REMEDY FOR A BREACH OF THE FOREGOING LIMITED WARRANTY IS REPAIR, REPLACEMENT OR REFUND OF THE DEFECTIVE OR NON-CONFORMING PRODUCT. THE MAXIMUM LIABILITY OF D-LINK UNDER THIS WARRANTY IS LIMITED TO THE PURCHASE PRICE OF THE PRODUCT COVERED BY THE WARRANTY. THE FOREGOING EXPRESS WRITTEN WARRANTIES AND REMEDIES ARE EXCLUSIVE AND ARE IN LIEU OF ANY OTHER WARRANTIES OR REMEDIES, EXPRESS, IMPLIED OR STATUTORY

Governing Law: This Limited Warranty shall be governed by the laws of the State of California. Some states do not allow exclusion or limitation of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the foregoing limitations and exclusions may not apply. This limited warranty provides specific legal rights and the product owner may also have other rights which vary from state to state.

Trademarks: D-Link is a registered trademark of D-Link Systems, Inc. Other trademarks or registered trademarks are the property of their respective manufacturers or owners.

CE Mark Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

FCC Statement: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For detailed warranty outside the United States, please contact corresponding local D-Link office.

Register online your D-Link product at
http://support.dlink.com/register/

Registration Card

Print, type or use block letters.

Your name: Mr./Ms____
Organization: ______________________________ Dept. ________________
Your title at organization: ____
Telephone:________________________ Fax:_________________________
Organization's full address: ____
____
Country: ____
Date of purchase (Month/Day/Year): ____________________________________

Product Model	Product Serial No.	* Product installed in type of computer (e.g., Compaq 486)	* Product installed in computer serial No.

(* Applies to adapters only)

Product was purchased from:

Reseller's name: ____
Telephone:________________________ Fax:_________________________
Reseller's full address: ____
____
____

Answers to the following questions help us to support your product:

1. Where and how will the product primarily be used?
□Home □Office □Travel □Company Business □Home Business □Personal Use

2. How many employees work at installation site?
□1 employee □2-9 □10-49 □50-99 □100-499 □500-999 □1000 or more

3. What network protocol(s) does your organization use ?
□XNS/IPX □TCP/IP □DECnet □Others___________________

4. What network operating system(s) does your organization use ?
□D-Link LANsmart □Novell NetWare □NetWare Lite □SCO Unix/Xenix □PC NFS □3Com 3+Open
□Banyan Vines □DECnet Pathwork □Windows NT □Windows NTAS □Windows '95
□Others____________________________

5. What network management program does your organization use ?
□D-View □HP OpenView/Windows □HP OpenView/Unix □SunNet Manager □Novell NMS
□NetView 6000 □Others____________________________

6. What network medium/media does your organization use ?
□Fiber-optics □Thick coax Ethernet □Thin coax Ethernet □10BASE-T UTP/STP
□100BASE-TX □100BASE-T4 □100VGAnyLAN □Others____________

7. What applications are used on your network?
□Desktop publishing □Spreadsheet □Word processing □CAD/CAM
□Database management □Accounting □Others______________

8. What category best describes your company?
□Aerospace □Engineering □Education □Finance □Hospital □Legal □Insurance/Real Estate □Manufacturing
□Retail/Chainstore/Wholesale □Government □Transportation/Utilities/Communication □VAR
□System house/company □Other______________________

9. Would you recommend your D-Link product to a friend?
□Yes □No □Don't know yet

10.Your comments on this product?

____

PLEASE
PLACE STAMP
HERE

TO: ____________________
____
____

D-Link®