D-Link ™ DES-3028/DES-3028P/DES-3052/DES-3052P

Managed 10/100Mbps Fast Ethernet Switch

Release I

Manual

February 2007 P/N 651ES3052015G

Table of Contents

Preface

The *DES-3028/DES-3028P/DES-3052/DES-3052P User Manual* is divided into sections that describe the system installation and operating instructions with examples.

Section 1, Introduction - Describes the Switch 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, Connecting the Switch - Tells how you can connect the Switch to your Ethernet/Fast Ethernet network.

Section 4, Introduction to Switch Management - Introduces basic Switch management features, including password protection, SNMP settings, IP address assignment and connecting devices to the Switch.

Section 5, Introduction to Web-based Switch Management - Talks about connecting to and using the Web-based switch management feature on the Switch.

Section 6, Administration - A detailed discussion about configuring the basic functions of the Switch, including Device Information, IP Address, Port Configuration, DHCP/BOOTP Relay, User Accounts, Port Mirroring, System Log Settings, Log Settings, SNTP Settings, MAC Notification Settings, TFTP Services, Multiple Image Services, Ping Test, Safeguard Engine, SNMP Manager, PoE System, Single IP Settings, Forwarding & Filtering, and SMTP Service.

Section 7, Layer 2 Features - A discussion of Layer 2 features of the Switch, including VLAN, Trunking, IGMP Snooping, and Spanning Tree.

Section 8, CoS - Features information on CoS, including Port Bandwidth, 802.1P Default Priority, 802.1P User Priority, CoS Scheduling Mechanism, CoS Output Scheduling, Priority Settings, TOS Priority Settings, DSCP Priority Settings, Port Mapping Priority Settings, and MAC Priority.

Section 9, ACL - Discussion on the ACL function of the Switch, including Time Range, Access Profile Table and CPU Interface Filtering.

Section 10, Security - A discussion on the Security functions on the Switch, including Traffic Control, Port Security, Port Lock Entries, SSL, SSH, 802.1X, Trusted Host, Access Authentication Control, and Traffic Segmentation.

Section 11, Monitoring - Features information on Monitoring including CPU Utilization, Port Utilization, Packets, Packet Errors, Packet Size, MAC Address, Switch Log, IGMP Snooping Group, Browse Router Port, Static ARP Settings, Session Table, and Port Access Control.

Appendix A, Technical Specifications - Technical specifications for the DES-3028/DES-3028P/DES-3052 and the DES-3052P.

Appendix B, System Log Entries - Information on the System Log Entries

Appendix C, Cable Lengths - Information on cable types and maximum distances.

Appendix D, Glossary - Lists definitions for terms and acronyms used in this document.

Intended Readers

The *DES-3028/DES-3028P/DES-3052/DES-3052P User Manual* contains information for setup and management of the Switch. The term, "the Switch" will be used when referring to all four switches. 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 document, 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 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.
- 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, regional 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. A qualified electrical inspector must inspect completed power and safety ground wiring. An energy hazard will exist if the safety ground cable is omitted or disconnected.

CAUTION: Do not replace the battery with an incorrect type. The risk of explosion exists if the replacement battery is not the correct lithium battery type. Dispose of used batteries according to the instructions.

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

DES-3028/28P/52/52P

The DES-3028, DES-3028P, DES-3052, and the DES-3052P are all members of the D-Link Switch family. These Switches provides unsurpassed performance, fault tolerance, scalable flexibility, robust security, standard-based interoperability and impressive technology to future-proof departmental and enterprise network deployments with an easy migration path.

The following manual describes the installation, maintenance, and configurations concerning the DES-3028, DES-3028P, DES-3052, and DES-3052P. These four Switches are identical in configuration and very similar in basic hardware and consequentially, most of the information in this manual will be universal to the total group of switches. Corresponding screen pictures of the web manager may be taken from any one of these switches but the configuration will be identical, except for varying port counts. For the remainder of this document, we will use the DES-3028P as the Switch in question for examples, screen shots, configurations, and explanations.

Features

- IEEE 802.3ad Link Aggregation Control Protocol support
- IEEE 802.1x Port-based and MAC-based Access Control
- IEEE 802.1Q VLAN
- IEEE 802.1D Spanning Tree, IEEE 802.1W Rapid Spanning Tree and IEEE 802.1s Multiple Spanning Tree support
- Access Control List (ACL) support
- Single IP Management support
- Access Authentication Control utilizing TACACS, XTACACS and TACACS+
- Internal Flash Drive for saving configurations and firmware
- Simple Network Time Protocol support
- MAC Notification support
- System and Port Utilization support
- System Log Support
- Support port-based enable and disable
- Address table: Supports up to 8K MAC addresses per device
- Supports a packet buffer of up to 512K bytes
- Supports Port-based VLAN Groups
- Port Trunking with flexible load distribution and fail-over function
- IGMP Snooping support
- SNMP support
- Secure Sockets Layer (SSL) and Secure Shell (SSH) support
- Port Mirroring support
- MIB support for:
- RFC1213 MIB II
- RFC1493 Bridge
- RFC2819 RMON

- RFC2665 Ether-like MIB
- RFC2863 Interface MIB
- Private MIB
- RFC2674 for 802.1p
- IEEE 802.1x MIB
- IEEE 802.3x flow control in full duplex mode
- IEEE 802.1p Priority Queues
- IEEE 802.3u 100BASE-TX compliant
- RS-232 DCE console port for Switch management
- Provides parallel LED display for port status such as link/act, speed, etc.
- IEEE 802.3 10BASE-T compliant
- High performance switching engine performs forwarding and filtering at wire speed, maximum 14,881 packets/sec on each 10Mbps Ethernet port, maximum 148,810 packet/sec on 100Mbps Fast Ethernet port and 1,488,100 for each Gigabit port
- Full and half-duplex for both 10Mbps and 100Mbps connections. Full duplex allows the switch port to simultaneously transmit and receive data. It only works with connections to full-duplex-capable end stations and switches. Connections to a hub must take place at half-duplex
- Support Broadcast/Multicast storm control
- Non-blocking store and forward switching scheme capability to support rate adaptation and protocol conversion
- Supports by-port Egress/Ingress rate control
- Efficient self-learning and address recognition mechanism enables forwarding rate at wire speed

Ports

The following table lists the relative ports that are present within each switch:

DES-3028 and DES-3028P	DES-3052 and DES-3052P
Twenty-four 10/100BASE-T Two 1000Base-T/SFP Combo Ports Two 1000Base-T Ports One female DCE RS-232 DB-9 console port	Forty-eight 10/100Mbps Ports Two 1000Base-T/SFP Combo Ports Two 1000Base-T Ports One female DCE RS-232 DB-9 console port

The following table lists the features and compatibility for each type of port present in the DES-3028/28P/52/52P.

10/100/1000BASE-T	SFP Combo	1000BASE-T Combo
IEEE 802.3 compliant IEEE 802.3u compliant IEEE 802.3x flow control support in full-duplex Auto MDI-X/MDI-II cross over support	SFP Transceivers Supported: DEM-310GT (1000BASE-LX) DEM-311GT (1000BASE-SX) DEM-314GT (1000BASE-LH) DEM-315GT (1000BASE-ZX) DEM-210 (Single Mode 100BASE-FX) DEM-211 (Multi Mode 100BASE-FX) WDM Transceiver Supported: DEM-330T (TX-1550/RX-1310nm), up to 10km,Single-Mode DEM-330R (TX-1310/RX-1550nm), up to 10km,Single-Mode DEM-331T (TX-1550/RX-1310nm), up to 40km, Single-Mode DEM-331R (TX-1310/RX-1550nm), up to 40km, Single-Mode Compliant to the following standards: 1. IEEE 802.3z compliance 2.IEEE 802.3u compliance	IEEE 802.3 compliant IEEE 802.3u compliant IEEE 802.3ab compliant IEEE 802.3z compliant IEEE 802.3x flow control support in full-duplex

NOTE: The SFP combo ports on the Switch cannot be used simultaneously with the corresponding 1000BASE-T ports. If both ports are in use at the same time (ex. port 25 of the SFP and port 25 of the 1000BASE-T), the SFP ports will take priority over the combo ports and render the 1000BASE-T ports inoperable.

Front-Panel Components

DES-3028P

- Twenty-four 10/100Mbps BASE-T ports
- Two Combo 1000BASE-T/SFP ports located to the right
- Two 1000BASE-T ports located to the right
- One female DCE RS-232 DB-9 console port
- LEDs for Power, Console, PoE, Link/Act/Speed for each port

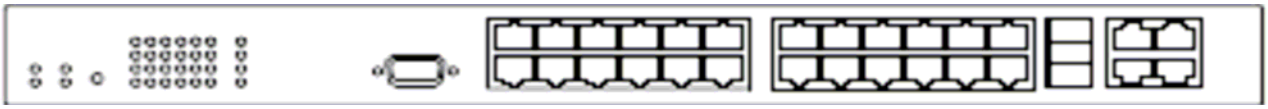


Figure 1- 1. Front Panel of the DES-3028P

DES-3052P

- Forty-eight 10/100Mbps BASE-T ports
- Two Combo 1000BASE-T/SFP ports located to the right
- Two 1000BASE-T ports located to the right
- One female DCE RS -232 DB-9 console port
- LEDs for Power, Console, PoE, Link/Act/Speed for each port

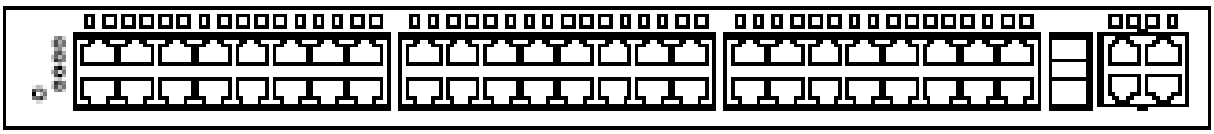


Figure 1- 2. Front Panel of the DES-3052P

LEDs

The following table lists the LEDs located on models of the DES-30xx Switches along with their corresponding description:

Location	LED Indicative	Color	Status	Description
Per Device	**Power**	Green	Solid Light	Power On
			Light off	Power Off
	Console	Green	Solid Light	Console on
			Blinking	POST is in progress/ POST is failure.
			Light off	Console off
"Mode Select Button"	**Link/Act/ Speed**	Green	Solid Light	Link/Act/Speed Mode
	PoE	Green	Solid Light	PoE Mode
LED Per 10/100 Mbps Port	**Link/Act/Speed**	Green/Amber	Solid Green	When there is a secure 100Mbps Fast Ethernet connection (or link) at any of the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity—Act) of data occurring at a Fast Ethernet connected port.
			Solid Amber	When there is a secure 10Mbps Ethernet connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at an Ethernet connected port.
			Light off	No link
	PoE	Green	Solid Green	Powered device is connected.
			Blinking	Port has detected a error condition
			Light off	Powered Device may receive power from an AC power source or no 802.3af PD is found
LED Per GE Port	**Link/Act/Speed mode for 1000BASE-T ports**	Green/Amber	Solid Green	When there is a secure 1000Mbps connection (or link) at any of the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity--Act) of data occurring at a 1000Mbps connected port.
			Solid Amber	When there is a secure 10/100Mbps Fast Ethernet connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at a Fast Ethernet connected port.
			Light off	No link

	Link/Act/Speed mode for SFP ports	Green/Amber	Solid Green	When there is a secure 1000Mbps connection (or link) at the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity--Act) of data occurring at a 1000Mbps connected port.
			Solid Amber	When there is a secure 100Mbps connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at the ports.
			Light off	No link

Installing the SFP ports

The DES-3028/28P/52/52P Switches are equipped with SFP (Small Form Factor Portable) ports, which are to be used with fiber-optical transceiver cabling in order to uplink various other networking devices for a gigabit link that may span great distances. These SFP ports support full-duplex transmissions, have auto-negotiation and can be used with the DEM-310GT (1000BASE-LX), DEM-311GT (1000BASE-SX), DEM-210 (Single Mode 100BASE-FX), DEM-211 (Multi Mode 100BASE-FX), DEM-314GT (1000BASE-LH), DEM-315GT (1000BASE-ZX), DEM-330T/R (WDM) and DEM-331T/R (WDM) transceivers. See the figure below for installing the SFP ports in the Switch.

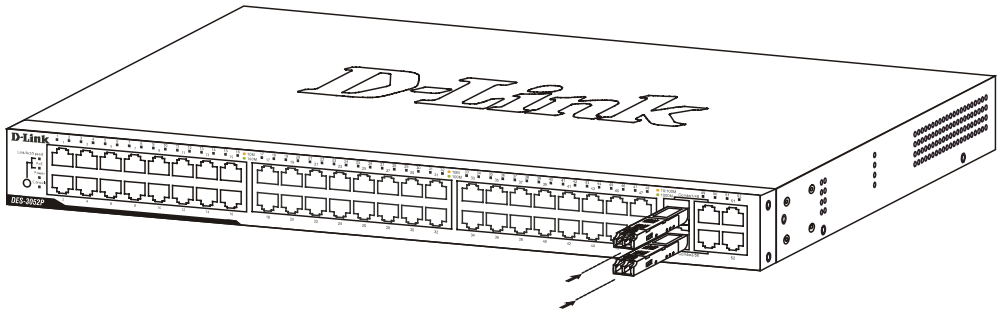


Figure 1- 3. Inserting the fiber-optic transceivers into the DES-3028/28P/52/52P Switch

SECTION 2

Installation

Package Contents

Open the shipping carton of the Switch and carefully unpack its contents. The carton should contain the following items:

- One Stand-alone Switch
- One AC power cord
- This Manual on CD
- Mounting kit (two brackets and screws)
- Four rubber feet with adhesive backing
- DCE RS-232 console cable

If any item is missing or damaged, please contact your local D-Link Reseller for replacement.

Before You Connect to the Network

The site where you install the Switch may greatly affect its performance. Please follow these guidelines for setting up the Switch.

- Install the Switch on a sturdy, level surface that can support at least 4.24kg (9.35lbs) of weight. Do not place heavy objects on the Switch.
- The power outlet should be within 1.82 meters (6 feet) of the Switch.
- Visually inspect the power cord and see that it is fully secured to the AC/DC power port.
- Make sure that there is proper heat dissipation from and adequate ventilation around the Switch. Leave at least 10 cm (4 inches) of space at the front and rear of the Switch for ventilation.
- Install the Switch in a fairly cool and dry place for the acceptable temperature and humidity operating ranges.
- Install the Switch in a site free from strong electromagnetic field generators (such as motors), vibration, dust, and direct exposure to sunlight.
- When installing the Switch on a level surface, attach the rubber feet to the bottom of the device. The rubber feet cushion the Switch, protect the casing from scratches and prevent it from scratching other surfaces.

Installing the Switch without the Rack

When installing the Switch on a desktop or shelf, the rubber feet included with the Switch should first be attached. Attach these cushioning feet on the bottom at each corner of the device. Allow enough ventilation space between the Switch and any other objects in the vicinity.

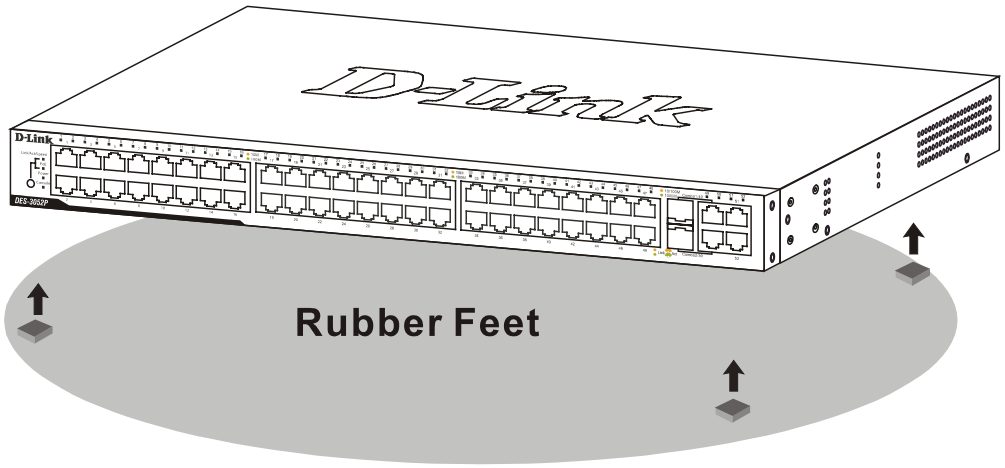


Figure 2 - 1. Prepare Switch for installation on a desktop or shelf

Installing the Switch in a Rack

The Switch can be mounted in a standard 19" rack. Use the following diagrams to guide you.

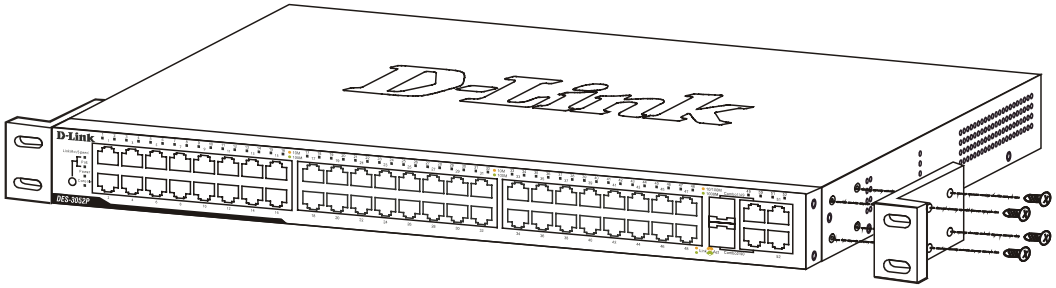


Figure 2 - 2. Fasten mounting brackets to Switch

Fasten the mounting brackets to the Switch using the screws provided. With the brackets attached securely, users can mount the Switch in a standard rack as shown in the next figure.

Mounting the Switch in a Standard 19" Rack

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 components in a rack, do not 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 injury.

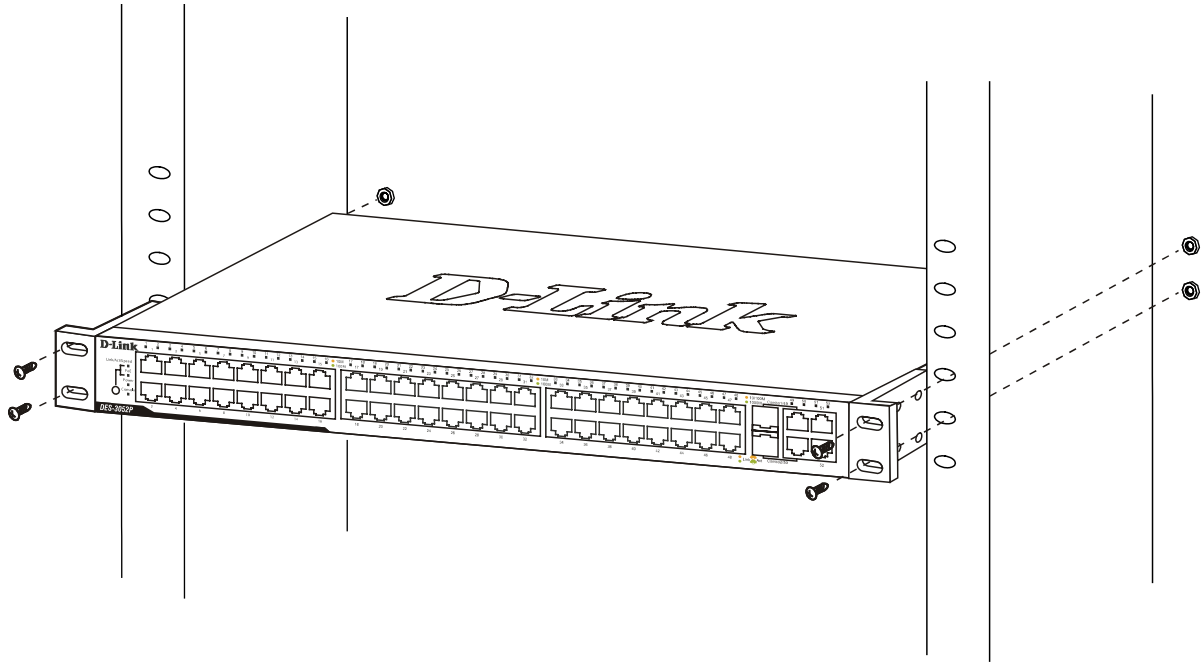


Figure 2 - 3. Installing Switch in a rack

Power on AC Power

Plug one end of the AC power cord into the power connector of the Switch and the other end into the local power source outlet.

After the Switch is powered on, the LED indicators will momentarily blink. This blinking of the LED indicators represents a reset of the system.

Power Failure

For AC power supply units, as a precaution, in the event of a power failure, unplug the Switch. When power has resumed, plug the Switch back in.

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 components in a rack, do not 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 injury.

.

Section 3

Connecting the Switch

Switch to End Node

Switch to Hub or Switch

Connecting to Network Backbone or Server

NOTE: All 10/100/1000Mbps NWay Ethernet ports can support both MDI-II and MDI-X connections.

Switch to End Node

End nodes include PCs outfitted with a 10, 100 or 1000 Mbps RJ 45 Ethernet/Fast Ethernet Network Interface Card (NIC) and most routers. An end node can be connected to the Switch via a twisted-pair Category 3, 4, or 5 UTP/STP cable. The end node should be connected to any of the ports of the Switch.

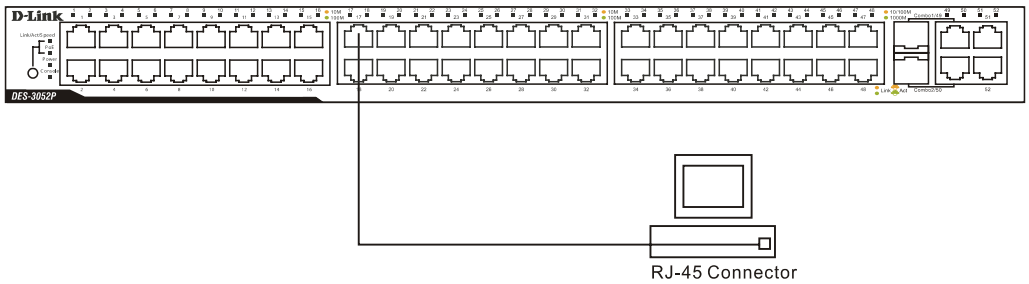


Figure 3- 1. Switch connected to an end node

The Link/Act LEDs for each UTP port will light green or amber when the link is valid. A blinking LED indicates packet activity on that port.

Switch to Hub or Switch

These connections can be accomplished in a number of ways using a normal cable.

- A 10BASE-T hub or switch can be connected to the Switch via a twisted-pair Category 3, 4 or 5 UTP/STP cable.
- A 100BASE-TX hub or switch can be connected to the Switch via a twisted-pair Category 5 UTP/STP cable.
- A 1000BASE-T switch can be connected to the Switch via a twisted pair Category 5e UTP/STP cable.
- A switch supporting a fiber-optic uplink can be connected to the Switch's SFP ports via fiber-optic cabling.

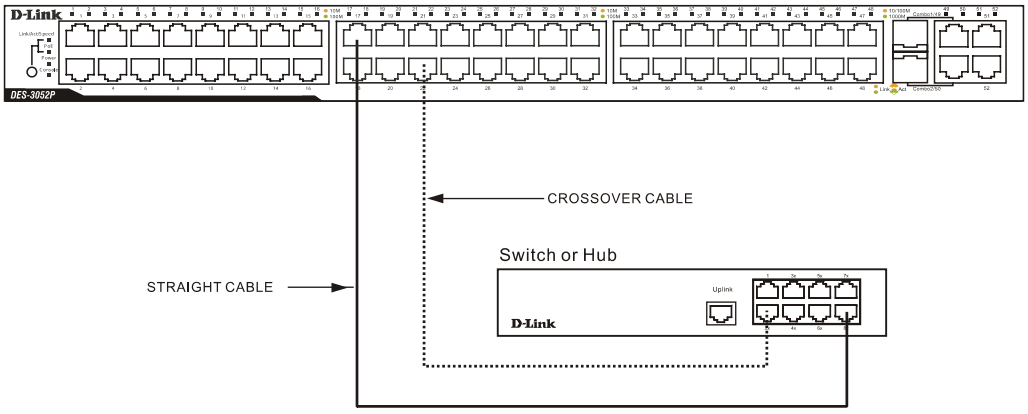


Figure 3- 2. Switch connected to a normal (non-Uplink) port on a hub or switch using a straight or crossover cable

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

Section 4

Introduction to Switch Management

Management Options

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

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 Netscape Navigator (version 6.2.3 and higher) or Microsoft® Internet Explorer (version 6.0).

SNMP-Based Management

You can manage the Switch with an SNMP-compatible console program. The Switch 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.

Connecting the Console Port (RS-232 DCE)

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 female 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:
3. Select the appropriate serial port (COM port 1 or COM port 2).
4. Set the data rate to **9600 baud**.
5. Set the data format to **8 data bits**, **1 stop bit**, and **no parity**.
6. Set flow control to **none**.

7. Under **Properties**, select **VT100** for Emulation mode.
8. Select **Terminal** keys for **Function**, **Arrow**, and **Ctrl** keys. Ensure that you select Terminal keys (not Windows keys).

NOTE: 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.

9. 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.
10. After the boot sequence completes, the console login screen displays.
11. 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. The administrator must first create user names and passwords. If you have previously set up user accounts, log in and continue to configure the Switch.
12. 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 ***DES-3028/28P/52/52P CLI Manual*** on the documentation CD for a list of all commands and additional information on using the CLI.
13. When you have completed your tasks, exit the session with the logout command or close the emulator program.
14. Make sure the terminal or PC you are using to make this connection is configured to match these settings.

If you are having problems making this connection on a PC, make sure the emulation is set to VT-100. You will be able to set the emulation by clicking on the **File** menu in you HyperTerminal window, clicking on **Properties** in the drop-down menu, and then clicking the **Settings** tab. This is where you will find the **Emulation** options. If you still do not see anything, try rebooting the Switch by disconnecting its power supply.

Once connected to the console, the screen below will appear on your console screen. This is where the user will enter commands to perform all the available management functions. The Switch will prompt the user to enter a user name and a password. Upon the initial connection, there is no user name or password and therefore just press enter twice to access the command line interface.

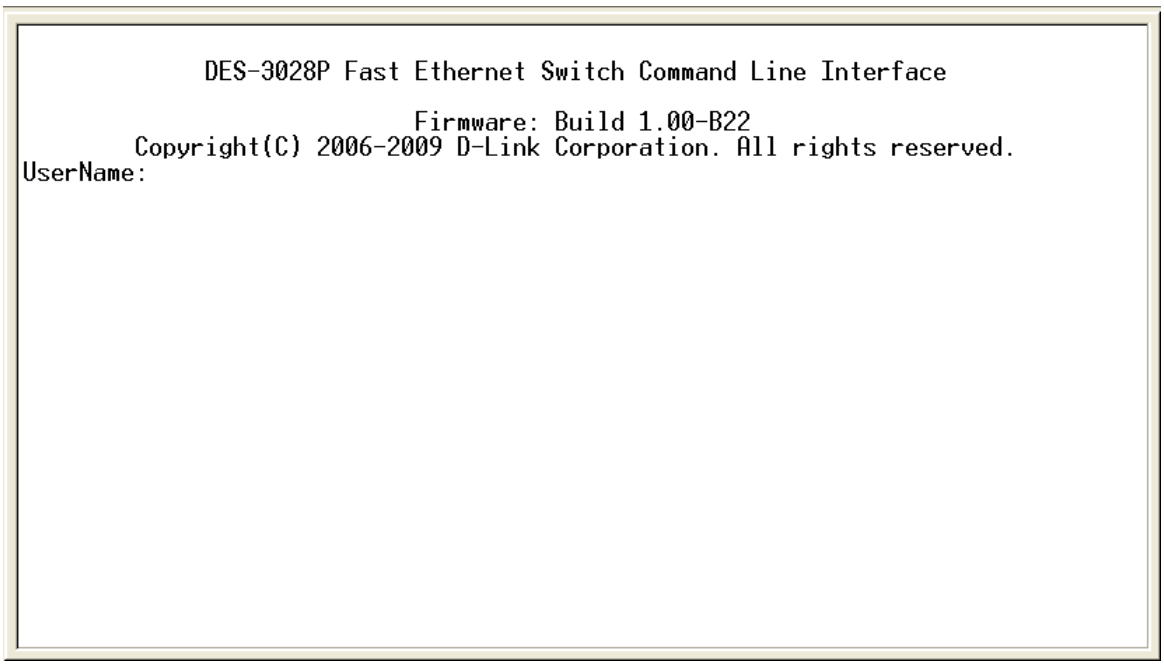


Figure 4- 1. Initial screen after first connection

First Time Connecting to the Switch

The Switch supports user-based security that can allow you to prevent unauthorized users from accessing the Switch or changing its settings. This section tells how to log onto the Switch.

NOTE: The passwords used to access the Switch are case-sensitive; therefore, "S" is not the same as "s."

When you first connect to the Switch, you will be presented with the first login screen.

NOTE: Press Ctrl+R to refresh the screen. This command can be used at any time to force the console program in the Switch to refresh the console screen.

Press **Enter** in both the Username and Password fields. You will be given access to the command prompt **DES-3028P:4#** shown below:

There is no initial username or password. Leave the Username and Password fields blank.

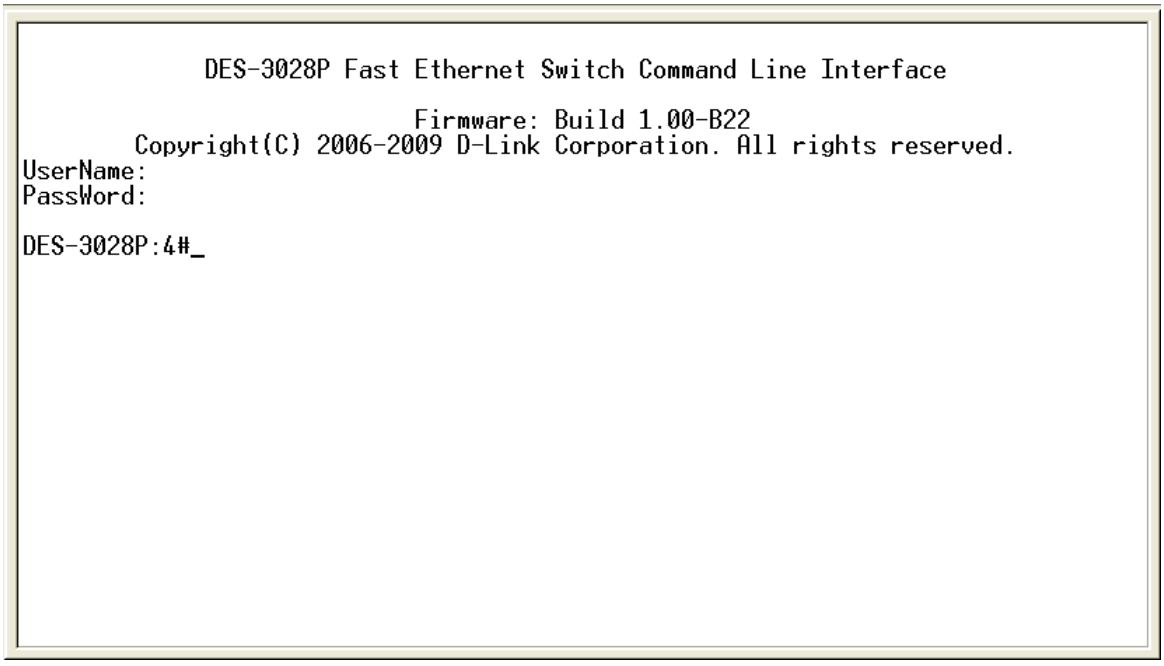


Figure 4- 2. Command Prompt

NOTE: The first user automatically gets Administrator level privileges. It is recommended to create at least one Admin-level user account for the Switch.

Password Protection

The Switch does not have a default user name and password. One of the first tasks when settings up the Switch is to create user accounts. Once logged in using a predefined administrator-level user name, users will 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, follow these steps:

- At the CLI login prompt, enter **create account admin** followed by the <*user name*> and press the **Enter** key.

- The switch will then prompt the user for a password. Type the <*password*> used for the administrator account being created and press the **Enter** key.
- Again, the user will be prompted to enter the same password again to verify it. Type the same password and press the **Enter** key.
- Successful creation of the new administrator account will be verified by a Success message.

NOTE: Passwords are case sensitive. 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".

```
DES-3028:4# create account admin newmanager
Command: create account admin newmanager

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

Success.

DES-3028:4#
```

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 DES-3028/28P/52/52P supports SNMP versions 1, 2c, and 3. You can specify which version of 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 section entitled 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

The Switch in the Management Information Base (MIB) stores management and counter information. 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. Specifying the MIB Object Identifier may also retrieve the proprietary MIB. 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 by entering the command "**show switch**" into the command line interface, as shown below.

```
Device Type         : DES-3028P Fast Ethernet Switch
MAC Address         : 00-50-BA-30-28-00
IP Address          : 10.90.90.91 (Manual)
VLAN Name           : default
Subnet Mask         : 255.0.0.0
Default Gateway     : 0.0.0.0
Boot PROM Version   : Build 1.00-B04
Firmware Version    : Build 1.00-B22
Hardware Version    : 1A1G
System Name         :
System Location     :
System Contact      :
Spanning Tree       : Disabled
GVRP                : Disabled
IGMP Snooping       : Disabled
802.1x              : Disabled
TELNET              : Enabled(TCP  23)
WEB                 : Enabled(TCP  80)
RMON                : Disabled
SSH                 : Disabled
SSL                 : Disabled
Clipaging           : Enabled
 CTRL+C ESC q Quit SPACE n Next Page ENTER Next Entry a All
```

Figure 4- 3. Show switch command

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:

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, and then be used to connect a management station to the Switch's Telnet or Web-based management agent.

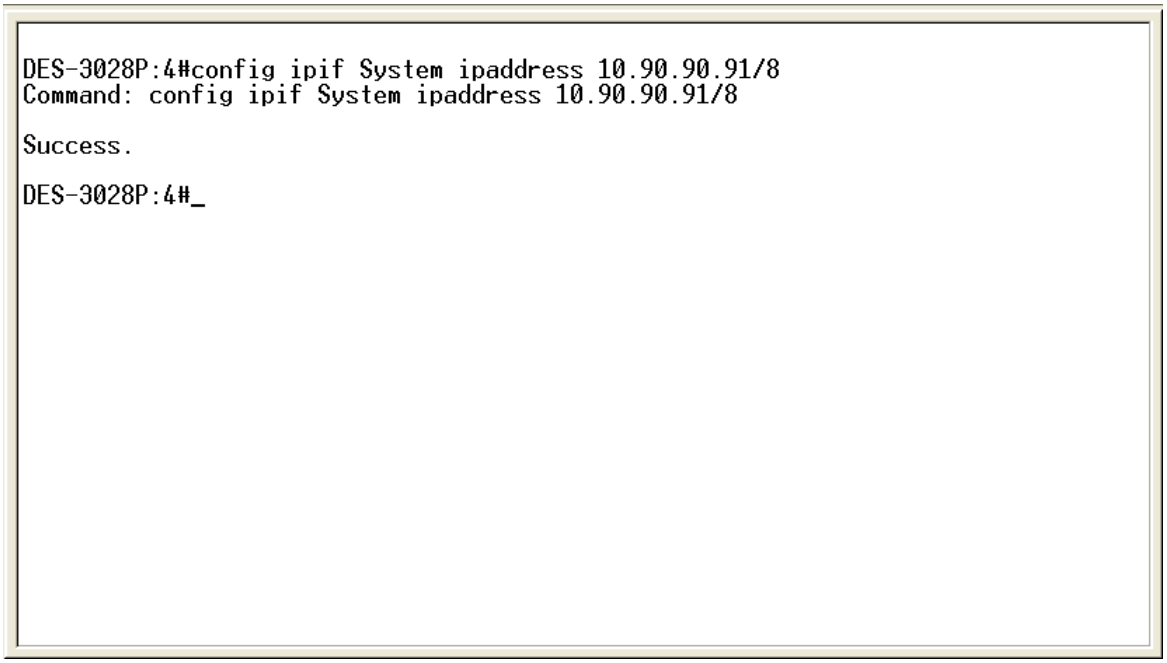


Figure 4- 4. Assigning the Switch an IP Address

In the above example, the Switch was assigned an IP address of 10.90.90.91 with a subnet mask of 255.0.0.0. (the CIDR form was used to set the address (10.90.90.91/8). 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.

Section 5

Web-based Switch Configuration

Introduction

All software functions of the Switch can be 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.

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.

This opens the management module's user authentication window, as seen below.

Figure 5- 1. Enter Network Password dialog

Enter "admin" in both the User Name and Password fields and click **OK**. This will open the Web-based user interface. The Switch management features available in the web-based manager are explained below.

Web-based User Interface

The user interface provides access to various Switch configuration and management windows, 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.

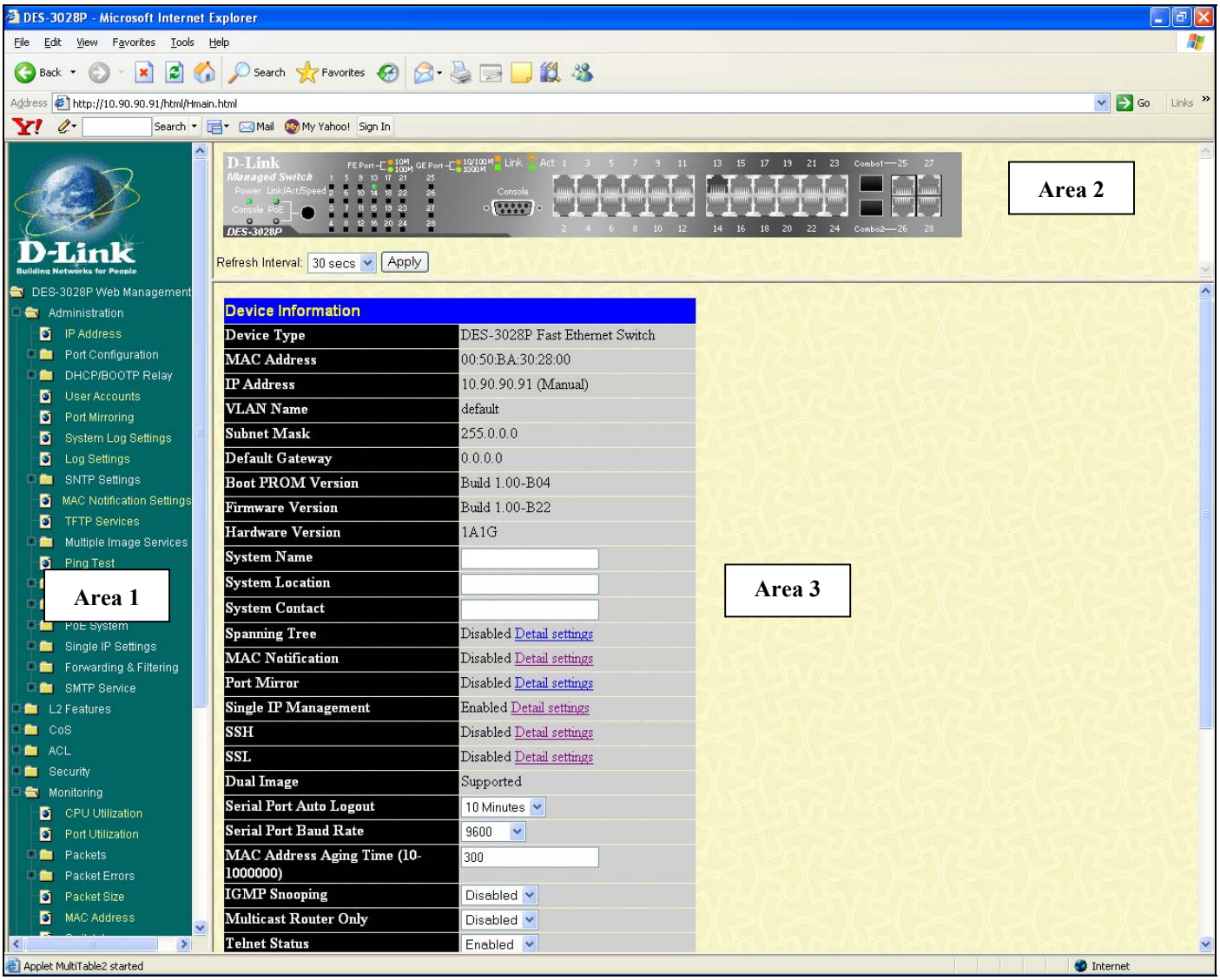


Figure 5- 2. Main Web-Manager page

Area	Function
Area 1	Select the folder or window to be displayed. The folder icons can be opened to display the hyper-linked window buttons and subfolders contained within them. Click the D-Link logo to go to the D-Link website.
Area 2	Presents a graphical near real-time image of the front panel of the Switch. This area displays the Switch's ports and expansion modules, showing port activity, duplex mode, or flow control, depending on the specified mode. Various areas of the graphic can be selected for performing management functions, including port configuration.
Area 3	Presents switch information based on your selection and the entry of configuration data.

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

Web Pages

When you connect to the management mode of the Switch with a web browser, a login window is displayed. Enter a user name and password to access the Switch's management mode.

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

Administration – Contains windows concerning configuring the basic functions of the Switch, including Device Information, IP Address, Port Configuration, DHCP/BOOTP Relay, User Accounts, Port Mirroring, System Log Settings, Log Settings, SNTP Settings, MAC Notification Settings, TFTP Services, Multiple Image Services, Ping Test, Safeguard Engine, SNMP Manager, PoE System, Single IP Settings, Forwarding & Filtering, and SMTP Service.

Layer 2 Features – Contains windows concerning Layer 2 features of the Switch, including VLAN, Trunking, IGMP Snooping, and Spanning Tree.

CoS – Contains windows concerning Port Bandwidth, 802.1P Default Priority, 802.1P User Priority, CoS Scheduling Mechanism, CoS Output Scheduling, Priority Settings, TOS Priority Settings, Port Mapping Priority Settings, and MAC Priority.

ACL – Contains the window for the Time Range, Access Profile Table, and CPU Interface Filtering.

Security – Contains windows for Traffic Control, Port Security, Port Lock Entries, SSL, SSH, 802.1x, Trusted Host, Access Authentication Control, and Traffic Segmentation.

Monitoring – Contains windows for CPU Utilization, Port Utilization, Packets, Packet Errors, Packet Size, MAC Address, Switch Log, IGMP Snooping Group, Browse Router Port, Static ARP Settings, Session Table, and Port Access Control.

Switch Maintenance – Contains information regarding Reset, Reboot System, Save Changes, and Logout.

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

Section 6

Administration

IP Address

Port Configuration

DHCP/BOOTP Relay

User Accounts

Port Mirroring

System Log Settings

Log Settings

SNTP Settings

MAC Notification Settings

TFTP Services

Multiple Image Services

Ping Test

Safeguard Engine

SNMP Manager

PoE System

Single IP Setting

Forwarding & Filtering

SMTP Service

Device Information

This window contains the main settings for all major functions for the Switch and appears automatically when you log on. To return to the **Device Information** window, click the **DES-30xx Web Management Tool** folder. The **Device Information** window shows the Switch's **MAC Address** (assigned by the factory and unchangeable), the **Boot PROM**, **Firmware Version**, and **Hardware Version**. This information is helpful to keep track of PROM and firmware updates and to obtain the Switch's MAC address for entry into another network device's address table, if necessary. The user may also enter a **System Name**, **System Location** and **System Contact** to aid in defining the Switch, to the user's preference. In addition, this window displays the status of functions on the Switch to quickly assess their current global status. Some functions are hyper-linked to their configuration window for easy access from the **Device Information** window.

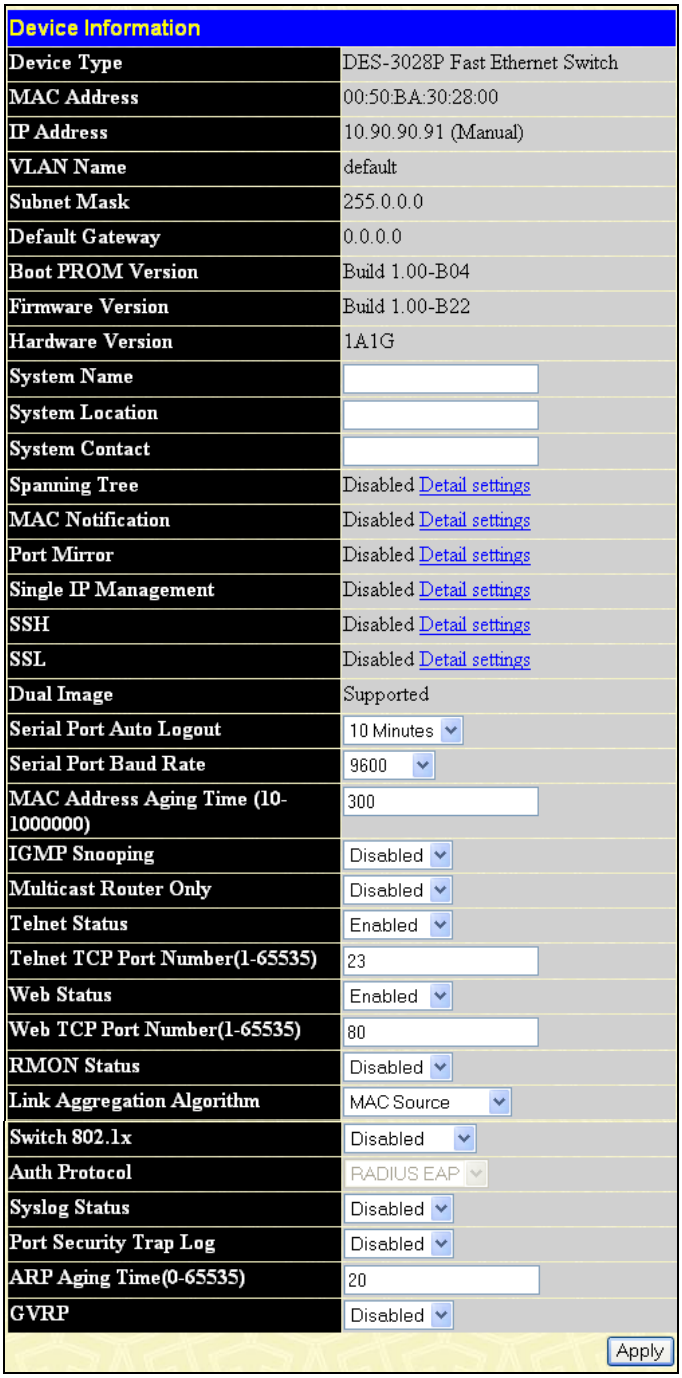


Figure 6- 1. Device Information window

The fields that can be configured are described below:

Parameter	Description
System Name	Enter a system name for the Switch, if so desired. This name will identify it in the Switch network.
System Location	Enter the location of the Switch, if so desired.
System Contact	Enter a contact name for the Switch, if so desired.
Serial Port Auto Logout Time	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*. The default setting is *10 minutes*.
Serial Port Baud	This field specifies the baud rate for the serial port on the Switch. there are four possible baud

Rate	rates to choose from, *9600*, *19200*, *38400* and *115200.* For a connection to the Switch using the CLI interface, the baud rate must be set to *9600*, which is the default setting.
MAC Address Aging Time	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). To change this, type in a different value representing the MAC address age-out time in seconds. The MAC Address Aging Time can be set to any value between *10* and *1,000,000* seconds. The default setting is *300* 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 located in the **IGMP Snooping** folder contained in the **L2 Features** folder.
Multicast Router Only	This field specifies that the Switch should only forward all multicast traffic to a multicast-enabled router, if enabled. Otherwise, the Switch will forward all multicast traffic to any IP router. The default is *Disabled*.
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 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. TCP ports are numbered between *1* and *65535*. The "well-known" TCP port for the Web is *80.*
RMON Status	Remote monitoring (RMON) of the Switch is *Enabled* or *Disabled* here.
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*, (See the Link Aggregation section of this manual).
Switch 802.1x	MAC Address may enable by port or the Switch's 802.1x function; 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 Authorization 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.
Auth Protocol	The 802.1x authentication protocol on the Switch is set to RADIUS Eap and cannot be altered.
Syslog Status	Enables or disables Syslog State; default is *Disabled*.
Port Security Trap Log	Toggle this setting to enable or disable the port security trap log feature. The default is *Disabled*.
ARP Aging Time (0-65535)	The user may globally set the maximum amount of time, in minutes, 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* to *65535* minutes with a default setting of *20* minutes.
GVRP	Use this pull-down menu to enable or disable GVRP on the Switch.

Click **Apply** to implement changes made.

IP Address

The IP address 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 *DES-3028/28P/52/52P CLI Manual* or return to Section 4 of this manual for more information. To change IP settings using the web manager you must access the **IP Address** window located in the **Administration** folder.

To configure the Switch's IP address:

Open the **Administration** folder and click the **IP Address** link. The web manager will display the Switch's current IP settings in the **IP Address** window, as seen below.

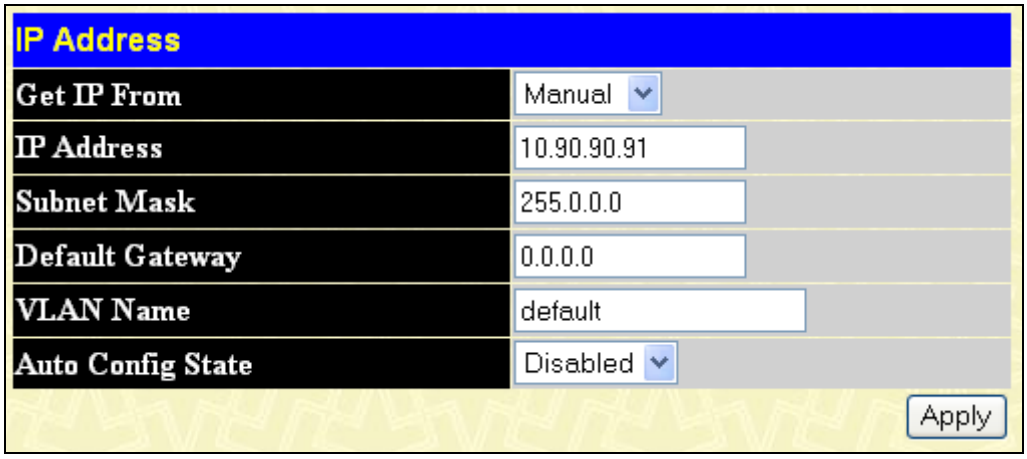


Figure 6- 2. IP Address Settings window

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

1. Select *Manual* from the Get IP From drop-down menu.
2. Enter the appropriate IP Address and Subnet Mask.
3. If you want to access the Switch from a different subnet from the one it is installed on, enter the IP address of the Default 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.
4. If no VLANs have been previously configured on the Switch, you can use the *default* VLAN Name. 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.

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 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 IP Address 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.
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.
VLAN Name	This allows the entry of a VLAN Name 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 here 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 VLAN 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 a management VLAN is specified or Management Station IP Addresses are assigned.
Auto Config State	When autoconfig is *Enabled*, the Switch is instructed to get a configuration file via TFTP, and it becomes a DHCP client automatically. The configuration file will be loaded upon booting up. In order to use Auto Config, the DHCP server must be set up to deliver the TFTP server IP address and configuration file name information in the DHCP reply packet. The TFTP server must be running and have the requested configuration file stored in its base directory when the request is received from the Switch. Consult the DHCP server and/or TFTP server software instructions for information on loading a configuration file for use by a client. If the Switch is unable to complete the autoconfiguration process the previously saved configuration file present in Switch memory will be loaded.

Click **Apply** to allow changes to take effect.

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 which 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.

Port Configuration

This section contains information for configuring various attributes and properties for individual physical ports, including port speed and flow control.

Port Settings

Click **Administration** > **Port Configuration > Port Settings** to display the following window:

To configure switch ports:

1. 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 below:

Port Configuration

From	To	State	Speed/Duplex	Flow Control	Medium Type	Apply
Port 1	Port 1	Enabled	Auto	Disabled	Copper	Apply

The Port Information Table

Port	State	Speed/Duplex	Flow Control	Connection/Duplex/FlowCtrl	Learning
1	Enabled	Auto	Disabled	LinkDown	Enabled
2	Enabled	Auto	Disabled	LinkDown	Enabled
3	Enabled	Auto	Disabled	LinkDown	Enabled
4	Enabled	Auto	Disabled	LinkDown	Enabled
5	Enabled	Auto	Disabled	LinkDown	Enabled
6	Enabled	Auto	Disabled	LinkDown	Enabled
7	Enabled	Auto	Disabled	LinkDown	Enabled
8	Enabled	Auto	Disabled	LinkDown	Enabled
9	Enabled	Auto	Disabled	LinkDown	Enabled
10	Enabled	Auto	Disabled	LinkDown	Enabled
11	Enabled	Auto	Disabled	LinkDown	Enabled
12	Enabled	Auto	Disabled	LinkDown	Enabled
13	Enabled	Auto	Disabled	LinkDown	Enabled
14	Enabled	Auto	Disabled	LinkDown	Enabled
15	Enabled	Auto	Disabled	LinkDown	Enabled
16	Enabled	Auto	Disabled	LinkDown	Enabled
17	Enabled	Auto	Disabled	LinkDown	Enabled
18	Enabled	Auto	Disabled	LinkDown	Enabled
19	Enabled	Auto	Disabled	100M/Full/None	Enabled
20	Enabled	Auto	Disabled	LinkDown	Enabled
21	Enabled	Auto	Disabled	LinkDown	Enabled
22	Enabled	Auto	Disabled	LinkDown	Enabled
23	Enabled	Auto	Disabled	LinkDown	Enabled
24	Enabled	Auto	Disabled	LinkDown	Enabled
25(C)	Enabled	Auto	Disabled	LinkDown	Enabled
25(F)	Enabled	Auto	Disabled	LinkDown	Enabled
26(C)	Enabled	Auto	Disabled	LinkDown	Enabled
26(F)	Enabled	Auto	Disabled	LinkDown	Enabled
27	Enabled	Auto	Disabled	LinkDown	Enabled
28	Enabled	Auto	Disabled	LinkDown	Enabled

Figure 6- 3. Port Configuration window

The following parameters can be configured:

Parameter	Description
From…. To	Use the pull-down menus to select the port or range of ports to be configured.
State	Toggle this field to either enable or disable a given port or group of ports.
Speed/Duplex	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 only support 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*.
Medium Type	This applies only to the Combo ports. If configuring the Combo ports this defines the type of transport medium used. SFP ports should be set at *Fiber* and the Combo 1000BASE-T ports should be set at *Copper*.
Learning	When *Enabled*, destination and source MAC addresses are automatically listed in the forwarding table. The default setting is *Enabled* and cannot be modified.

Click **Apply** to implement the new settings on the Switch.

Port Error Disabled

The following window will display the information about ports that have had their connection status disabled, for reasons such as STP loopback detection or link down status. To view this window, click **Port Configuration > Port Error Disabled**.

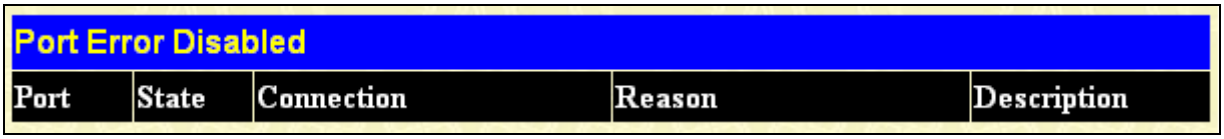


Figure 6- 4. Port Error Disabled window

The following parameters are displayed:

Parameter	Description
Port	Displays the port that has been error disabled.
State	Describes the current running state of the port, whether *Enabled* or *Disabled*.
Connection	This field will read the uplink status of the individual ports, whether enabled or Disabled.
Reason	Describes the reason why the port has been error-disabled, such as a STP loopback occurrence.
Description	This field further describes the specifics of the action.

Port Description

The Switch supports a port description feature where the user may name various ports on the Switch. To assign names to various ports, click **Administration** > **Port Configuration** > **Port Description** to view the following window:

Use the **From** and **To** pull-down menu to choose a port or range of ports to describe, and then enter a description of the port(s). Click **Apply** to set the descriptions in the **Port Description Table**.

The **Medium Type** applies only to the Combo ports. If configuring the Combo ports this defines the type of tranport medium used. SFP ports should be nominated *Fiber* and the Combo 1000BASE-T ports should be nominated *Copper*. The result will be displayed in the appropriate switch port number slot (**C** for copper ports and **F** for fiber ports).

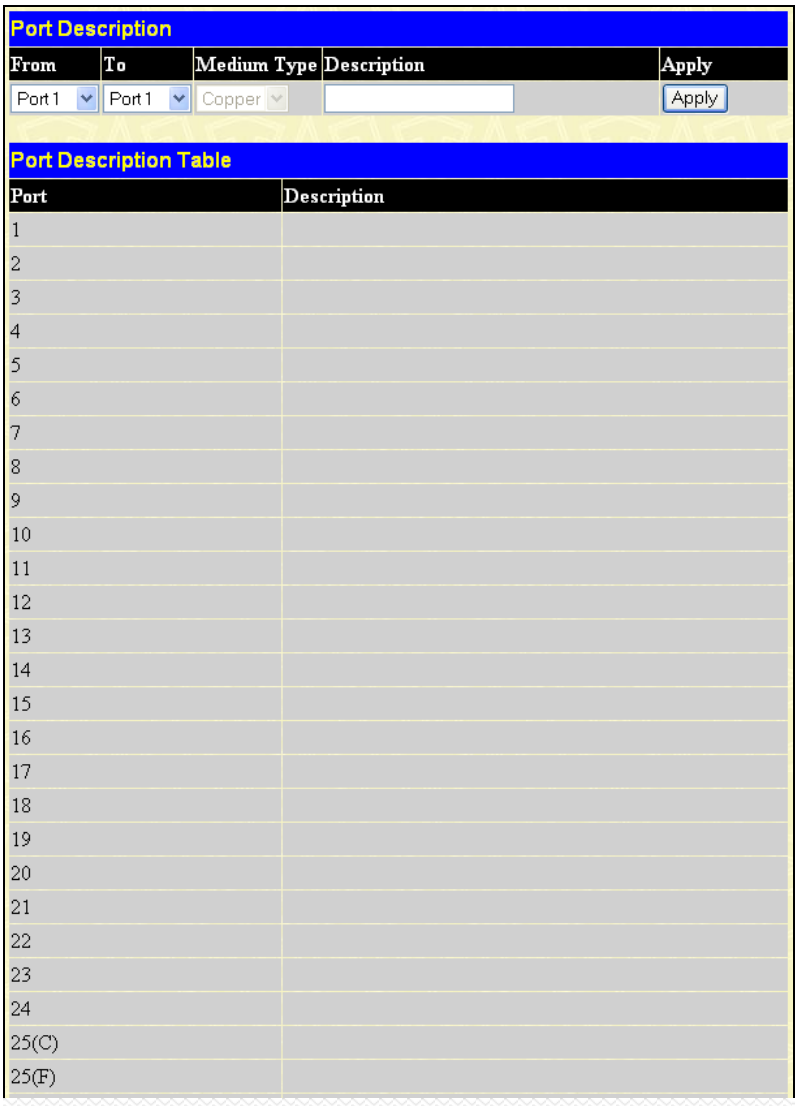


Figure 6- 5. Port Description window

DHCP/BOOTP Relay

To enable and configure **DHCP/BOOTP Relay Global Settings** on the Switch, click **Administration** > **DHCP/BOOTP Relay**>:

DHCP/BOOTP Relay Global Settings

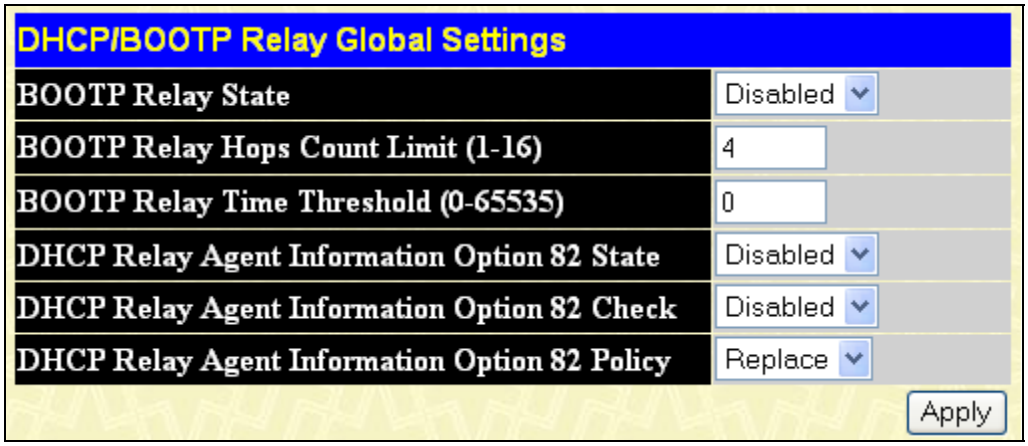


Figure 6- 6. DHCP/ BOOTP Relay Global Settings window

The following fields can be set:

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 DHCP/BOOTP 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 DHCP/BOOTP messages can be forwarded across. 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 DHCP/BOOTP 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.
DHCP Relay Agent Information Option 82 State	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the DHCP Agent Information Option 82 on the Switch. The default is *Disabled.* *Enabled* – When this field is toggled to *Enabled* the relay agent will insert and remove DHCP relay information (option 82 field) in messages between DHCP servers and clients. When the relay agent receives the DHCP request, it adds the option 82 information, and the IP address of the relay agent (if the relay agent is configured), to the packet. Once the option 82 information has been added to the packet it is sent on to the DHCP server. When the DHCP server receives the packet, if the server is capable of option 82, it can implement policies like restricting the number of IP addresses that can be assigned to a single remote ID or circuit ID. Then the DHCP server echoes the option 82 field in the DHCP reply. The DHCP server unicasts the reply to the back to the relay agent if the request was relayed to the server by the relay agent. The switch verifies that it originally inserted the option 82 data. Finally, the relay agent removes the option 82 field and forwards the packet to the switch port that connects to the DHCP client that sent the DHCP request. *Disabled* - If the field is toggled to *Disabled* the relay agent will not insert and remove DHCP relay information (option 82 field) in messages between DHCP servers and clients, and the check and policy settings will have no effect.
DHCP Relay Agent Information Option 82	This field can be toggled between *Enabled* and *Disabled* using the pull-down menu. It is used to enable or disable the Switches ability to check the validity of the packet's option 82

Check	field. *Enabled* – When the field is toggled to *Enable*, the relay agent will check the validity of the packet's option 82 field. If the switch receives a packet that contains the option-82 field from a DHCP client, the switch drops the packet because it is invalid. In packets received from DHCP servers, the relay agent will drop invalid messages. *Disabled* - When the field is toggled to *Disabled*, the relay agent will not check the validity of the packet's option 82 field.
DHCP Relay Agent Information Option 82 Policy	This field can be toggled between *Replace, Drop,* and *Keep* by using the pull-down menu. It is used to set the Switches policy for handling packets when the **DHCP Agent Information Option 82 Check** is set to *Disabled*. The default is *Replace.* *Replace* - The option 82 field will be replaced if the option 82 field already exists in the packet received from the DHCP client. *Drop* - The packet will be dropped if the option 82 field already exists in the packet received from the DHCP client. *Keep* -The option 82 field will be retained if the option 82 field already exists in the packet received from the DHCP client.

Click **Apply** to implement any changes that have been made.

NOTE: If the Switch receives a packet that contains the option-82 field from a DHCP client and the information-checking feature is enabled, the switch drops the packet because it is invalid. However, in some instances, you might configure a client with the option-82 field. In this situation, you should disable the information-check feature so that the switch does not remove the option-82 field from the packet. You can configure the action that the switch takes when it receives a packet with existing option-82 information by configuring the **DHCP Agent Information Option 82 Policy.**

The Implementation of DHCP Information Option 82 in the DES-3028/28P/52/52P switches

The **config dhcp_relay option_82** command configures the DHCP relay agent information option 82 setting of the switch. The formats for the circuit ID sub-option and the remote ID sub-option are as follows:

NOTE: For the circuit ID sub-option of a standalone switch, the module field is always zero.

Circuit ID sub-option format:

1.	2.	3.	4.	5.	6.	7.
1	6	0	4	VLAN	Module	Port
1 byte	1 byte	1 byte	1 byte	2 bytes	1 byte	1 byte

a. Sub-option type
b. Length
c. Circuit ID type
d. Length
e. VLAN : the incoming VLAN ID of DHCP client packet.
f. Module : For a standalone switch, the Module is always 0; For a stackable switch, the Module is the Unit ID.
g. Port : The incoming port number of DHCP client packet, port number starts from 1.

Remote ID sub-option format:

1.	2.	3.	4.	5.
2	8	0	6	MAC address
1 byte	1 byte	1 byte	1 byte	6 bytes

1. Sub-option type
2. Length
3. Remote ID type
4. Length
5. MAC address: The Switch's system MAC address.

Figure 6- 7. Circuit ID and Remote ID Sub-option Format

DHCP/BOOTP Relay Interface Settings

This window allows 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 ✕. To enable and configure **DHCP/BOOTP Relay Global Settings** on the Switch, click **Configuration** > **Layer 3 Networking > DHCP/BOOTP Relay** > **DHCP/BOOTP Relay Interface Settings**:

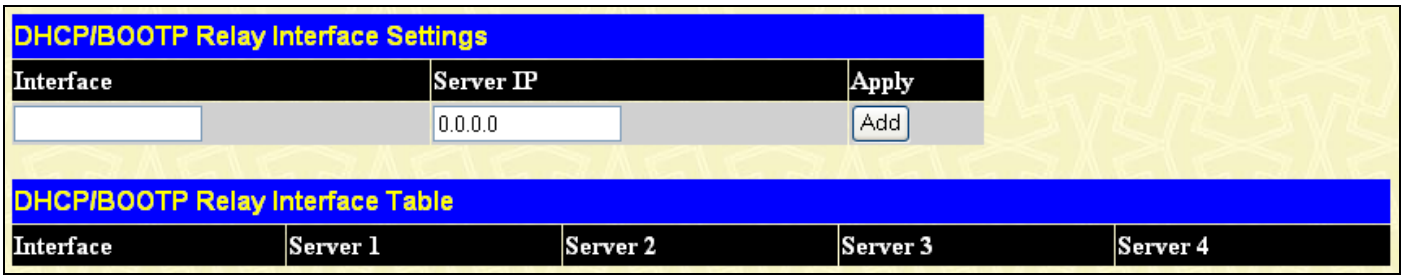


Figure 6- 8. DHCP/BOOTP Relay Interface Settings and DHCP/BOOTP Relay Interface Table window

The following parameters may be configured or viewed.

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

User Accounts

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

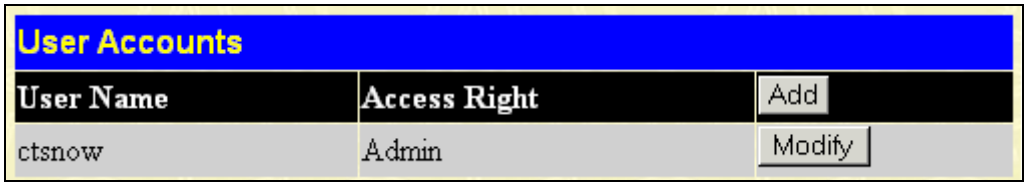


Figure 6- 9. User Accounts window

To add a new user, click on the **Add** button.

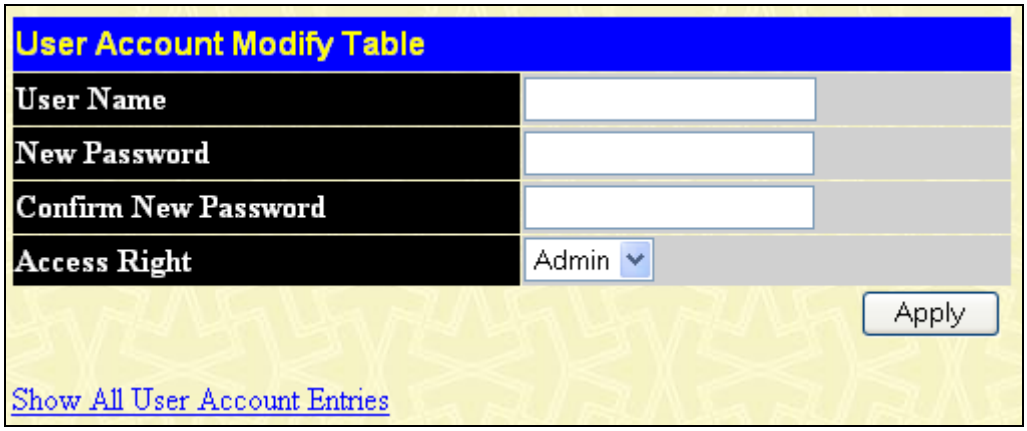


Figure 6- 10. User Account Modify Table window

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.

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

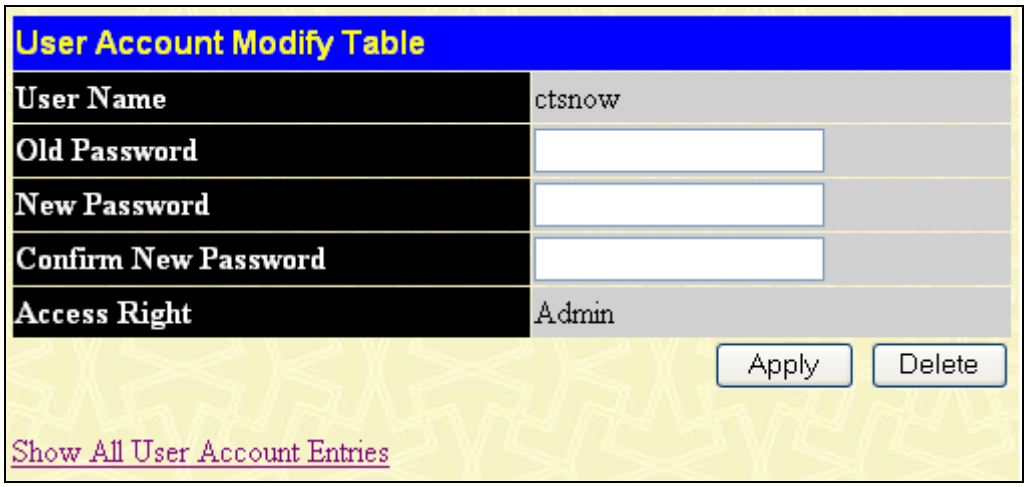


Figure 6- 11. User Account Modify Table window

Modify or delete an existing user account in the **User Account Modify Table**. 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. The level of privilege (*Admin* or *User*) can be viewed in the **Access Right** field.

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. This is useful for network monitoring and troubleshooting purposes. To view the **Port Mirroring** window, click **Port Mirroring** in the **Administration** folder.

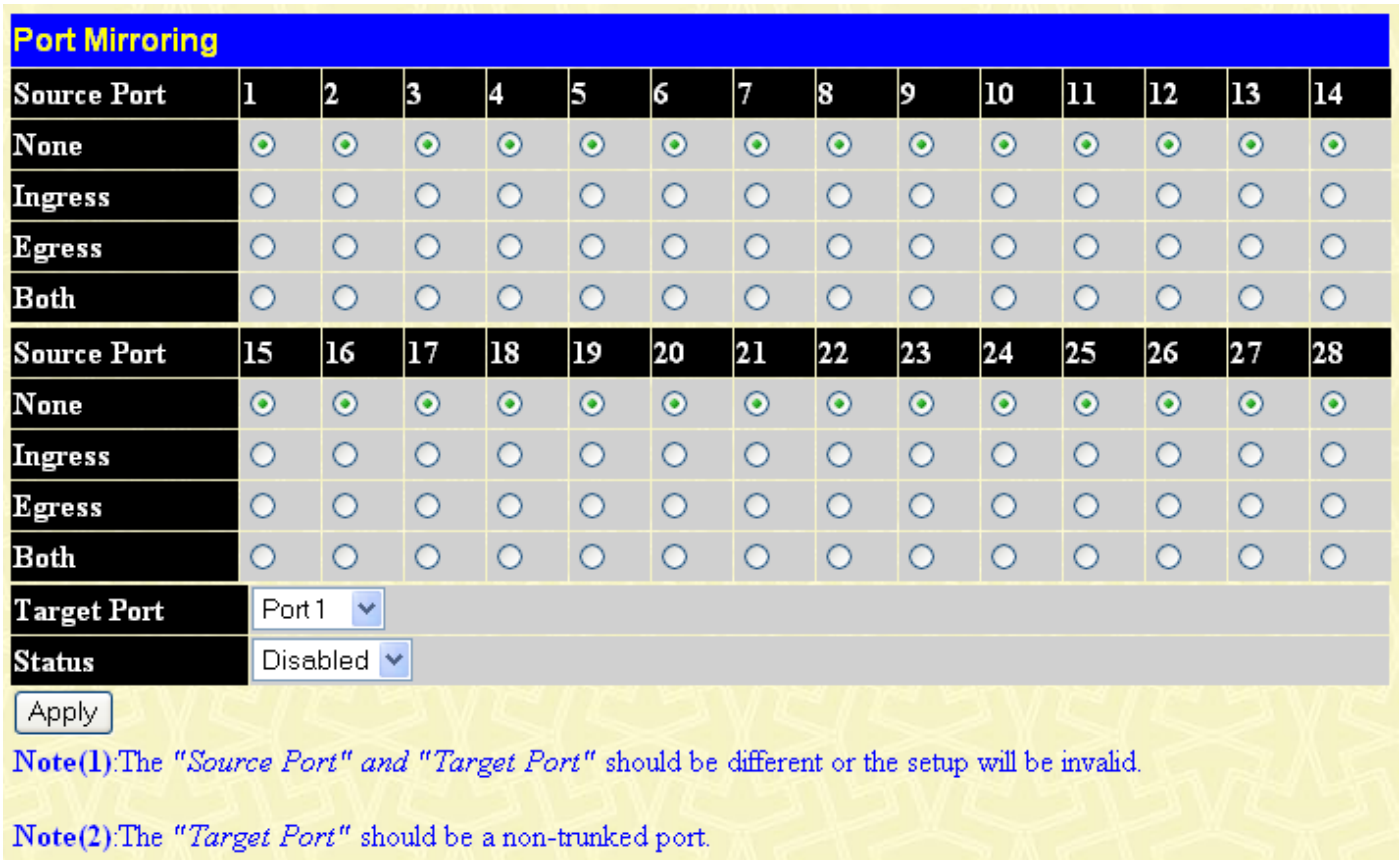


Figure 6- 12. Port Mirroring window

To configure a mirror port:

1. Select the Source Port from where you want to copy frames and the Target Port, which receives the copies from the source port.
2. Select the Source Direction, Ingress, Egress, or Both and change the Status drop-down menu to *Enabled*.
3. 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. Also, 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.

System Log Settings

The Switch can send Syslog messages to up to four designated servers using the **System Log Server**. In the **Administration** folder, click **System Log Settings**, to view the window shown below.

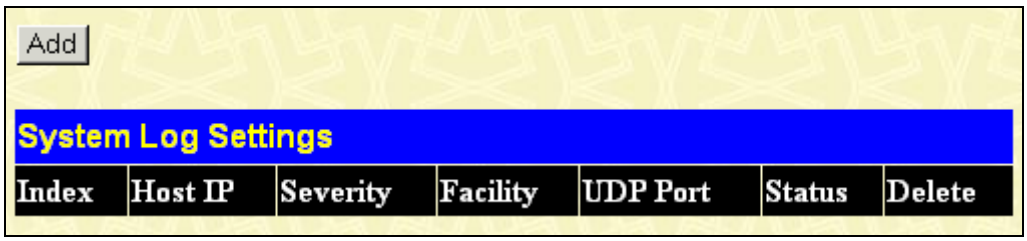


Figure 6- 13. System Log Host window

The parameters configured for adding and editing **System Log Server** settings are the same. See the table below for a description.

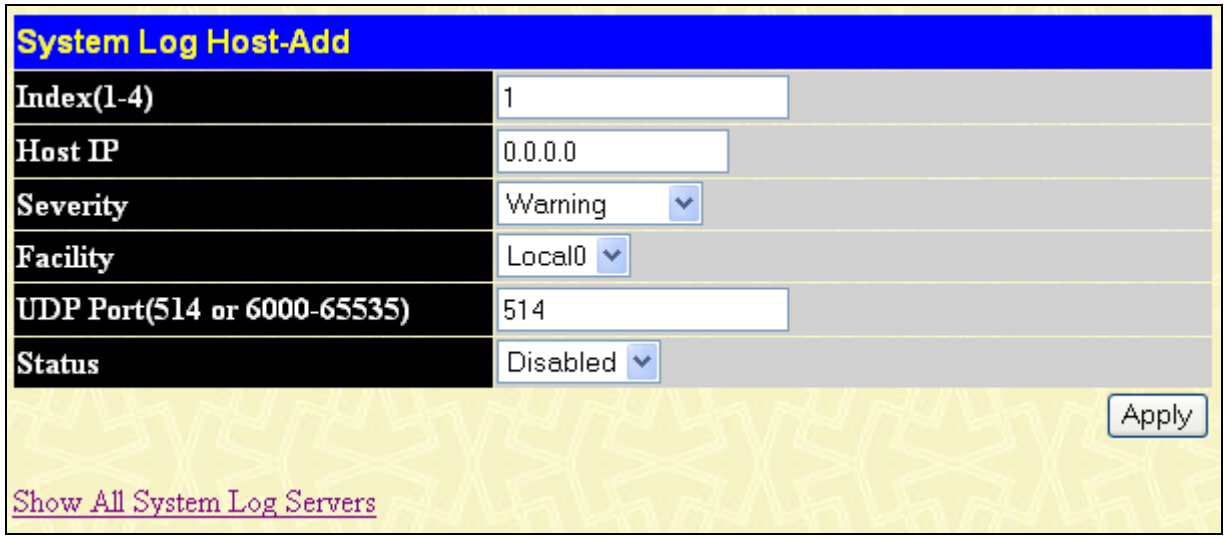


Figure 6- 14. System Log Host – Add window

The following parameters can be set:

Parameter	Description
Index	Syslog server settings index (1-4).
Host 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 indicates the facility values that the Switch is currently employing. **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 (514 or 6000-65535)	Type the UDP port number used for sending Syslog messages. The default is *514*.	
Status	Choose *Enabled* or *Disabled* to activate or deactivate.	

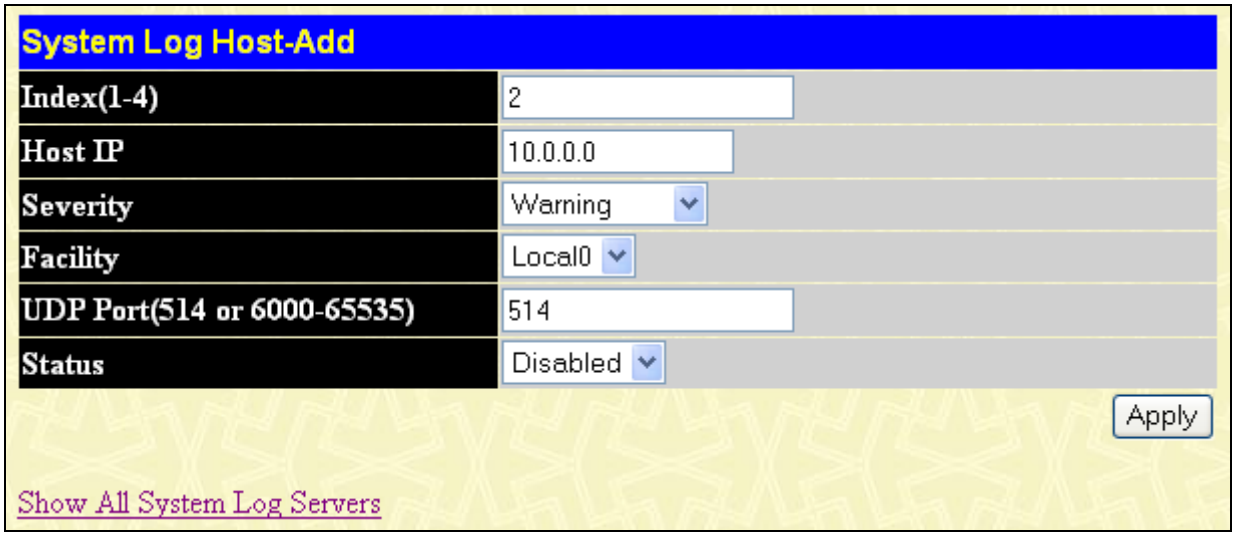


Figure 6- 15. System Log Host – Add window

To set the System Log Server configuration, click **Apply**. To delete an entry from the **System Log Host** window, click the corresponding ✕ under the Delete heading of the entry to delete. To return to the **System Log Host** window, click the Show All System Log Servers link.

Log Settings

The Log settings can be changed by clicking the **System Log Settings** link to open the following window:

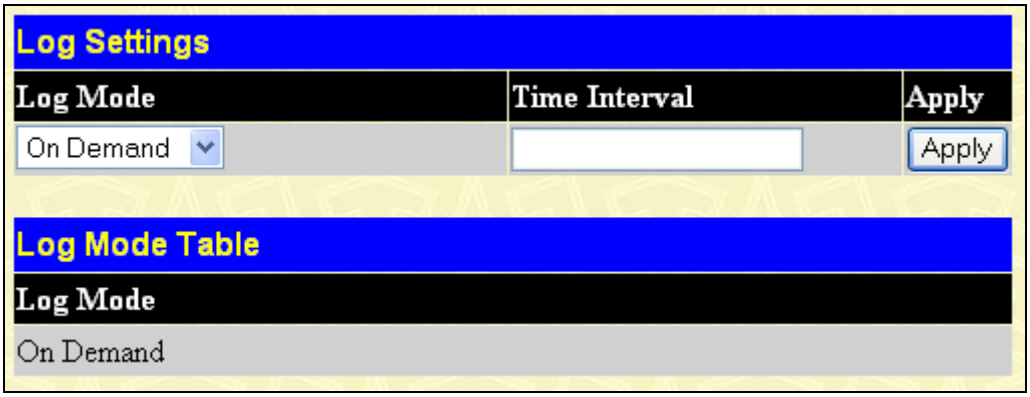


Figure 6- 16. Log Settings window

The following parameters can be set:

Parameter	Description
Log Mode	Use this drop-down menu to choose the method that will trigger a log entry. You can choose between *On Demand*, *Log Trigger*, and *Time Interval*.
Time Interval	Enter a time interval, in seconds, for which you would like a log entry to be made.

SNTP Settings

Time Settings

To configure the time settings for the Switch, open the **Administration** folder. Then the **SNTP Settings** folder and click on the **Time Settings** link, revealing the following window for the user to configure.

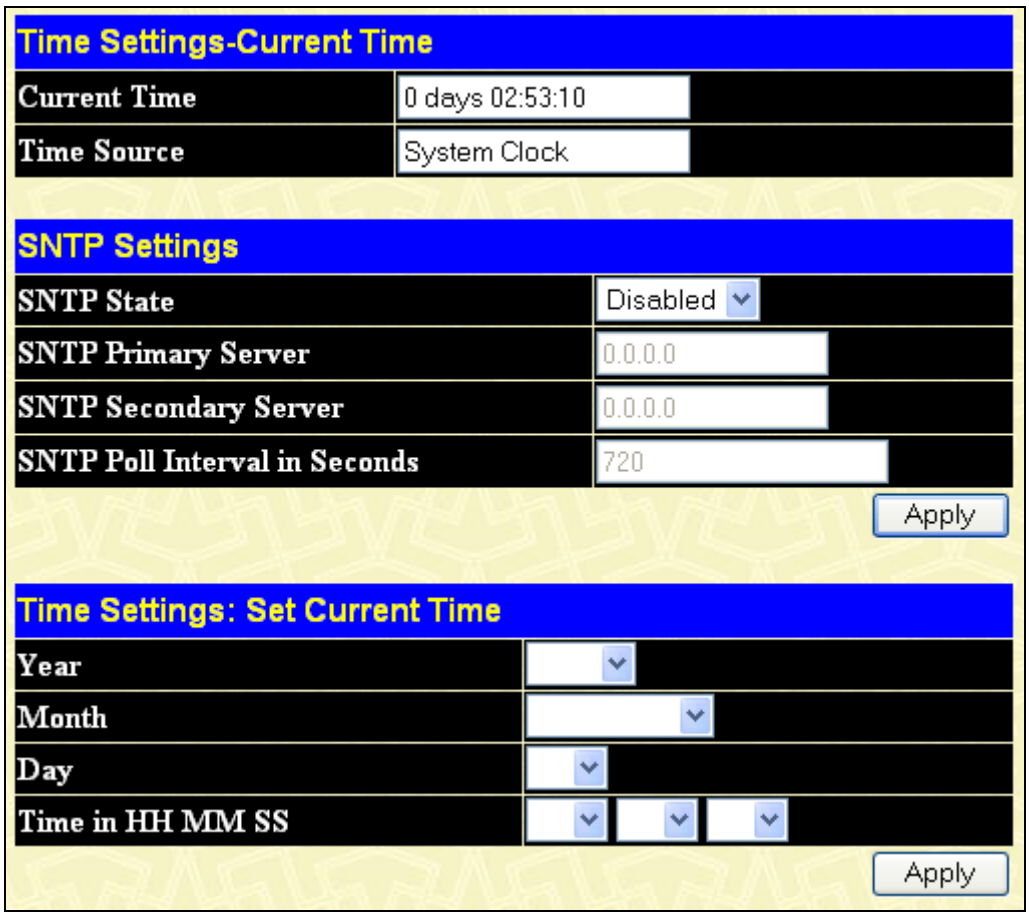


Figure 6- 17. Time Settings window

The following parameters can be set or are displayed:

Parameter	Description
Current Time	
Current Time	Displays the Current Time set on the Switch.
Time Source	Displays the time source for the system.
SNTP Settings	
SNTP State	Use this pull-down menu to *Enabled* or *Disabled* SNTP.
SNTP Primary Server	This is the IP address of the primary server the SNTP information will be taken from.
SNTP Secondary Server	This is the IP address of the secondary server the SNTP information will be taken from.
SNTP Poll Interval in Seconds	This is the interval, in seconds, between requests for updated SNTP information.
Set Current Time	
Year	Enter the current year, if you want to update the system clock.
Month	Enter the current month, if you would like to update the system clock.
Day	Enter the current day, if you would like to update the system clock.
Time in HH MM SS	Enter the current time in hours, minutes, and seconds.

Click **Apply** to implement changes made.

Time Zone and DST

The following are windows used to configure time zones and Daylight Savings time settings for SNTP. Open the **Administration** folder, then the **SNTP Settings** folder and click on the **Time Zone and DST** link, revealing the following window.

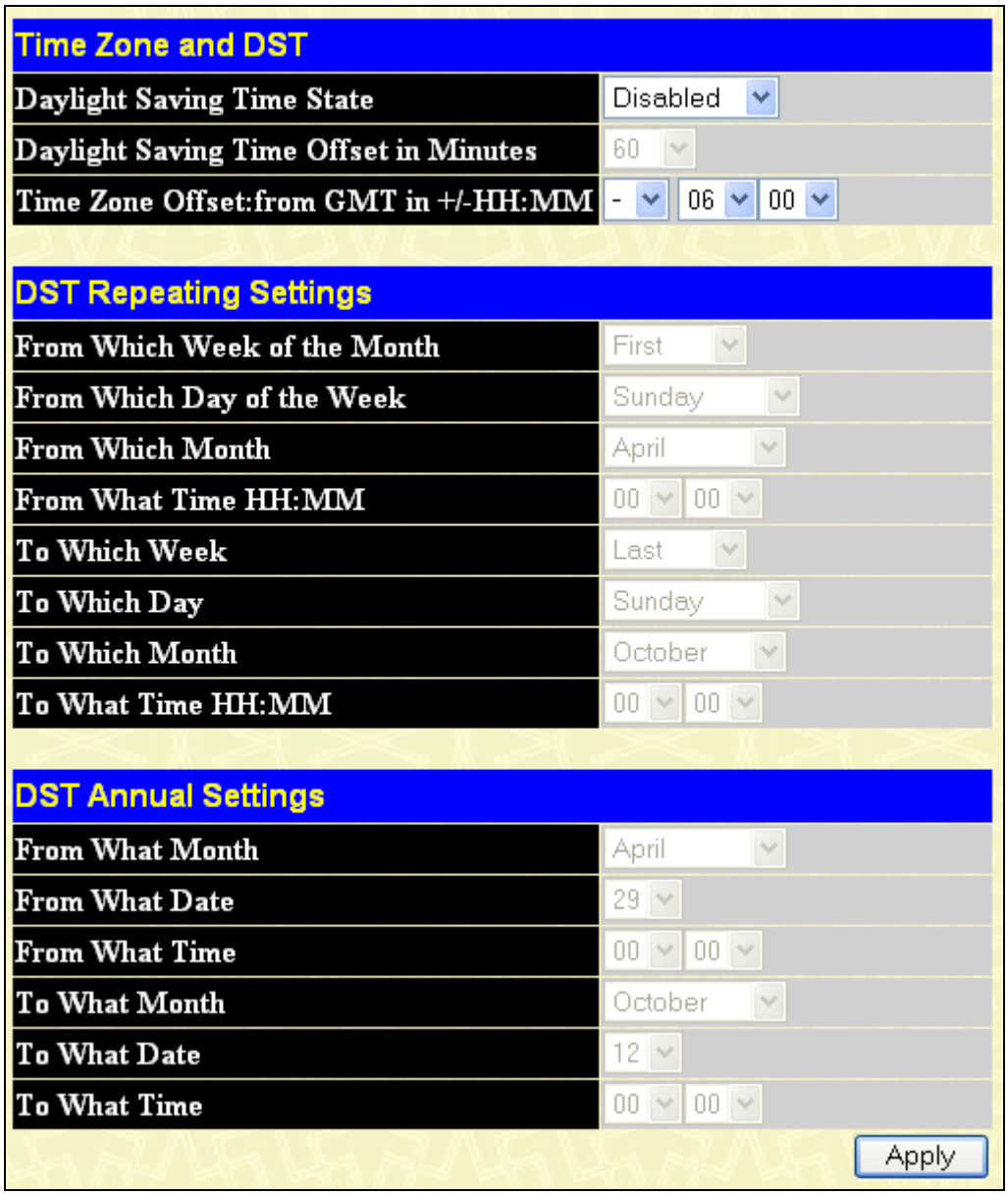


Figure 6- 18. Time Zone and DST Settings window

The following parameters can be set:

Parameter	Description
Time Zone and DST	
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	Use these pull-down menus to specify your local time zone's offset from Greenwich Mean

from GMT in +/- HH:MM	Time (GMT.)
DST Repeating Settings 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 the 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 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 date 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 to the **Time Zone and DST** window.

MAC Notification Settings

MAC Notification is used to monitor MAC addresses learned and entered into the forwarding database. To globally set MAC notification on the Switch, open the following window by opening the **MAC Notification Settings** in the Administration folder.

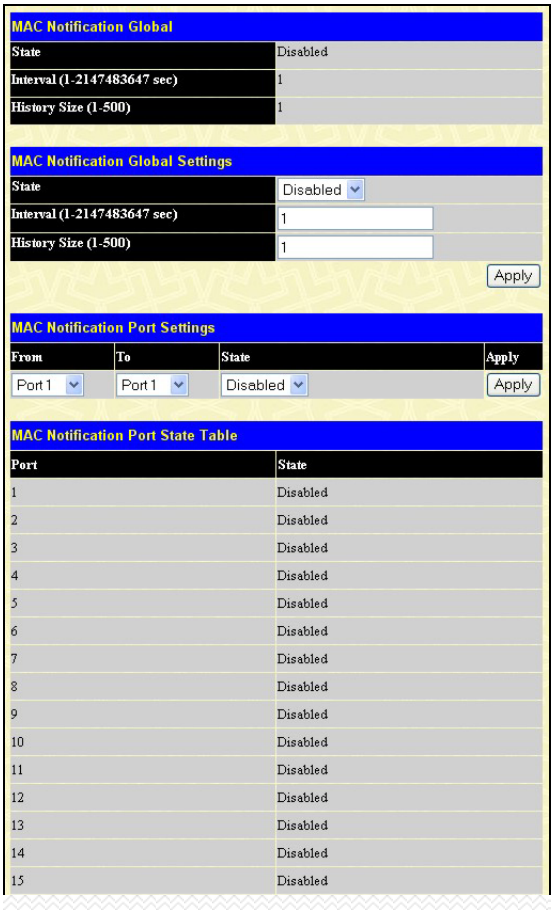


Figure 6- 19. MAC Notification Settings window

Global Settings

The following parameters may be viewed and modified:

Parameter	Description
State	Enable or disable MAC notification globally on the Switch
Interval (sec)	The time in seconds between notifications.
History Size	The maximum number of entries listed in the history log used for notification. Up to 500 entries can be specified.

Port Settings

To change MAC notification settings for a port or group of ports on the Switch, configure the following parameters.

Parameter	Description
From…To	Select a port or group of ports to enable for MAC notification using the pull-down menus.
State	Enable MAC Notification for the ports selected using the pull-down menu.

Click **Apply** to implement changes made.

TFTP Services

Trivial File Transfer Protocol (TFTP) services allow the Switch's 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. The TFTP server must be running TFTP server software to perform the file transfer.

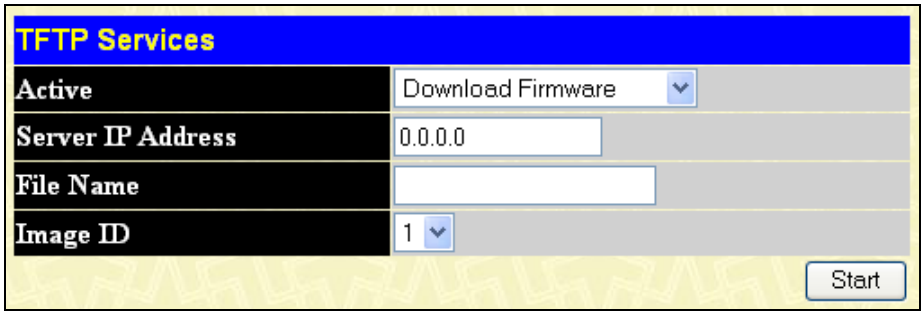


Figure 6- 20. TFTP Services window

The user also has the option of transferring firmware and configuration files to and from the internal Flash drive, located on the Switch. Using this window, the user can add a configuration or firmware file from a TFTP server to the flash memory, or transfer that firmware or configuration file to a TFTP server. More about configuring the internal Flash drive can be found in the next section entitled **Flash File Services**.

TFTP server software is a part of many network management software packages – such as NetSight, or can be obtained as a separate program. To update the Switch's firmware or configuration file, open the **TFTP Services** hyperlink, located in the **Administration** folder.

The following parameters can be configured:

Parameter	Description
Active	Select a service for the TFTP server to perform from the drop down window: • *Download Firmware* - Enter the IP address of the TFTP server and specify the location of the new firmware on the TFTP server. Click **Start** to record the IP address of the TFTP server and to initiate the file transfer. • *Download Configuration* - Enter the IP address of the TFTP server, and the path and filename for the Configuration file on the TFTP server. Click **Start** to record the IP address of the TFTP server and to initiate the file transfer. • *Upload Configuration* - Enter the IP address of the TFTP server and the path and filename for the switch settings on the TFTP server. Click **Start** to record the IP address of the TFTP server and to initiate the file transfer. • *Upload Log* - Enter the IP address of the TFTP server and the path and filename for the history log on the TFTP server. Click **Start** to record the IP address of the TFTP server and to initiate the file transfer.
Server IP Address	Enter the IP address of the server from which to download firmware or configuration files.
File Name	Enter the path and filename of the firmware or configuration file to upload or download, located on the TFTP server.
Image ID	To select a firmware file from the internal Flash drive to which the firmware file will be transferred.

Click **Start** to initiate the file transfer.

Multiple Image Services

To configure the files located on the Flash memory, use the following windows to guide you.

Firmware Information

This window is used to view boot up firmware images.

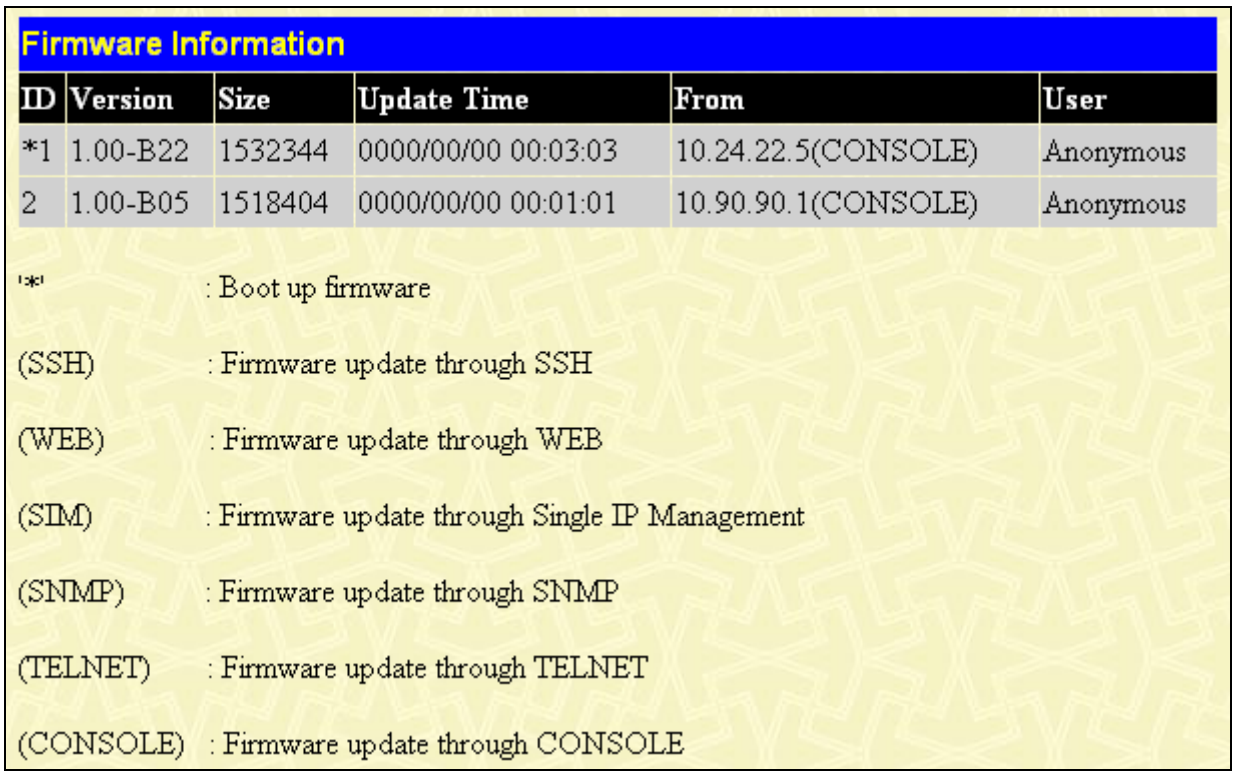


Figure 6- 21. Firmware Information window

Config Firmware Image

The following window is used to determine which of the two firmware images will be used as the default boot file. You can also delete either of the two images.

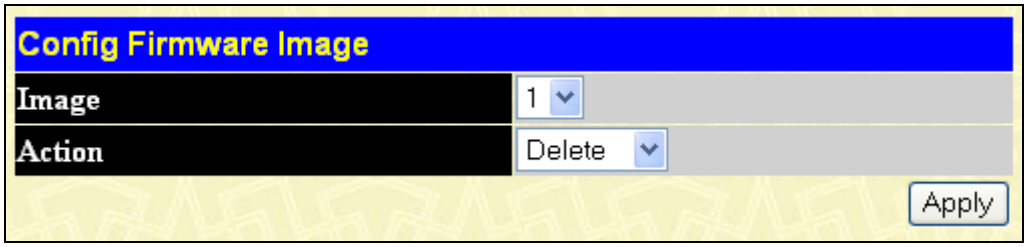


Figure 6- 22. Config Firmware Image window

Ping Test

Ping is a small program that sends ICMP Echo packets to the IP address you specify. The destination node then responds to or "echoes" the packets sent from the Switch. This is very useful to verify connectivity between the Switch and other nodes on the network.

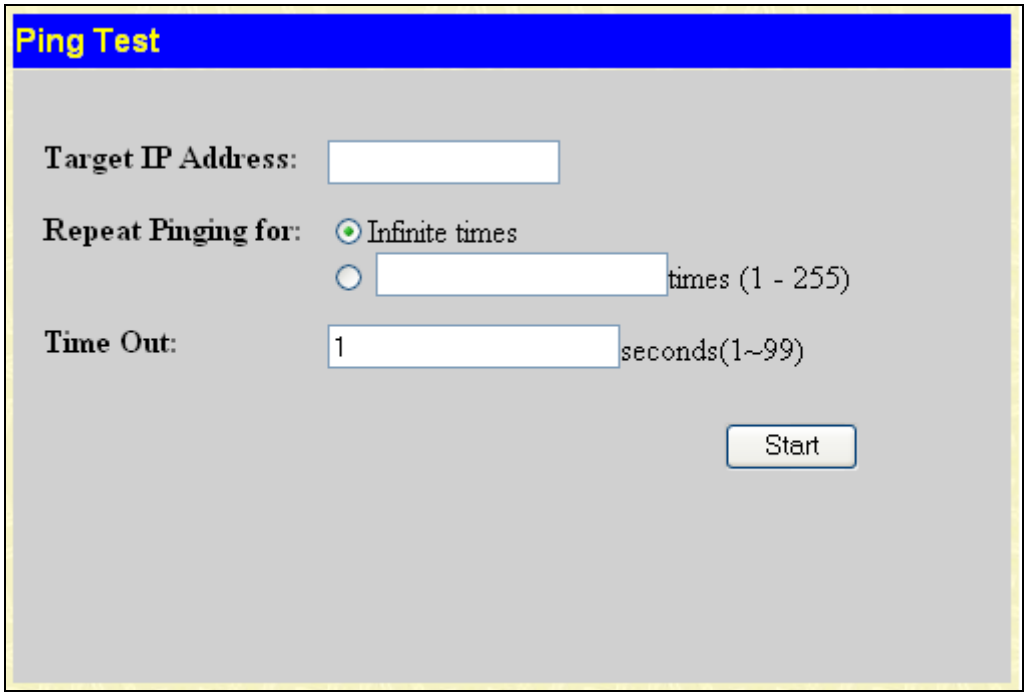


Figure 6- 23. Ping Test window

The user may use Infinite times radio button, in the **Repeat Pinging for** field, which will tell the ping program to keep sending ICMP Echo packets to the specified IP address until the program is stopped. The user may opt to choose a specific number of times to ping the **Target IP Address** by clicking its radio button and entering a number between *1* and *255*. Click **Start** to initiate the Ping program.

Safeguard Engine

Periodically, malicious hosts on the network will attack the Switch by utilizing packet flooding (ARP Storm) or other methods. These attacks may increase the Safeguard Engine beyond its capability. To alleviate this problem, the Safeguard Engine function was added to the Switch's software.

The Safeguard Engine can help the overall operability of the Switch by minimizing the workload of the Switch while the attack is ongoing, thus making it capable to forward essential packets over its network in a limited bandwidth. When the Switch either (a) receives too many packets to process or (b) exerts too much memory, it will enter an **Exhausted** mode. When in this mode, the Switch will drop all ARP and IP broadcast packets for a calculated time interval. Every five seconds, the Switch will check to see if there are too many packets flooding the Switch. If the threshold has been crossed, the Switch will initially stop all ingress ARP and IP broadcast packets for five seconds. After another five-second checking interval arrives, the Switch will again check the ingress flow of packets. If the flooding has stopped, the Switch will again begin accepting all packets. Yet, if the checking shows that there continues to be too many packets flooding the Switch, it will stop accepting all ARP and IP broadcast packets for double the time of the previous stop period. This doubling of time for stopping ingress ARP and IP broadcast packets will continue until the maximum time has been reached, which is 320 seconds and every stop from this point until a return to normal ingress flow would be 320 seconds. For a better understanding, examine the following example of the Safeguard Engine.

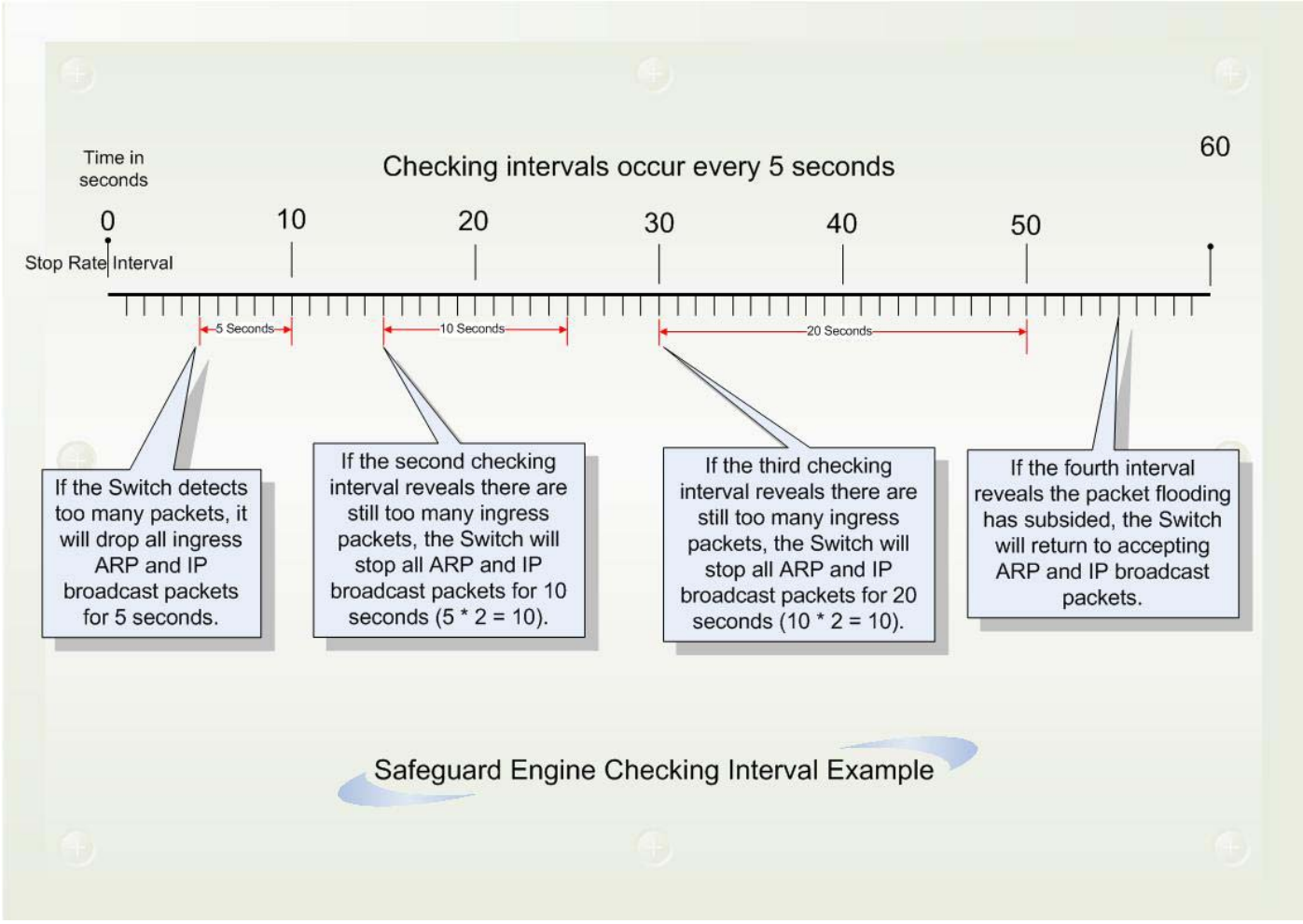


Figure 6- 24. Safeguard Engine example

For every consecutive checking interval that reveals a packet flooding issue, the Switch will double the time it will discard ingress ARP and IP broadcast packets. In the example above, the Switch doubled the time for dropping ARP and IP broadcast packets when consecutive flooding issues were detected at 5 second intervals. (First stop = 5 seconds, second stop = 10 seconds, third stop = 20 seconds) Once the flooding is no longer detected, the wait period for dropping ARP and IP broadcast packets will return to 5 seconds and the process will resume.

Once in Exhausted mode, the packet flow will decrease by half of the level that caused the Switch to enter Exhausted mode. After the packet flow has stabilized, the rate will initially increase by 25% and then return to a normal packet flow.

NOTE: While in Exhausted mode, only trusted IP addresses are accepted to connect to the Switch.

To configure the Safeguard Engine for the Switch, click **Security > Safeguard Engine** which will open the following window.

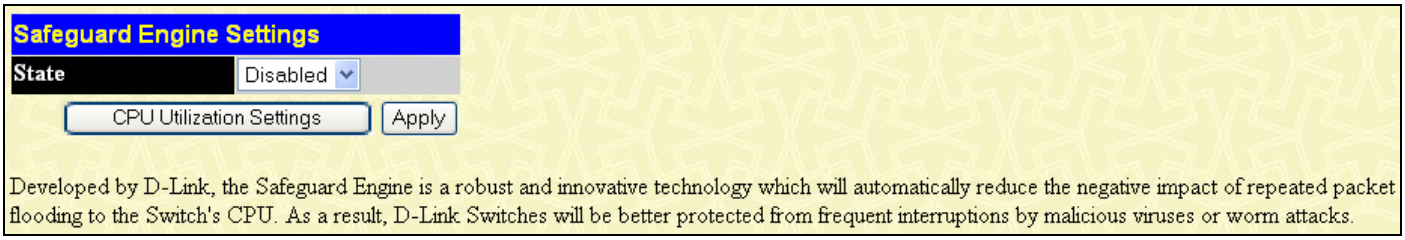


Figure 6- 25. Safeguard Engine Settings window

To configure the Switch's Safeguard Engine, change the **State** to *Enabled*. To configure the parameters for the Safeguard Engine, click the **CPU Utilization Settings** button, which will alter the previous window to look like this:

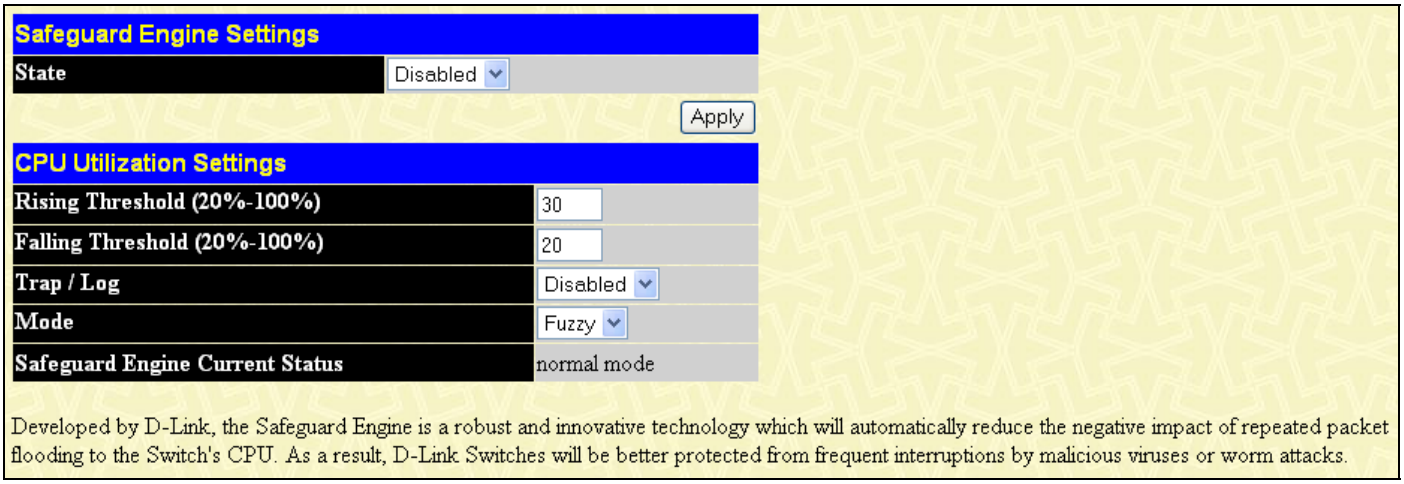


Figure 6- 26. Safeguard Engine Settings window – CPU Utilization Settings

To set the Safeguard Engine for the Switch, complete the following fields:

Parameter	Description
State	Toggle this field to either *Enabled* or *Disabled* for the Safeguard Engine of the Switch.
Rising Threshold	Used to configure the acceptable level of CPU utilization before the Safeguard Engine mechanism is enabled. Once the CPU utilization reaches this percentage level, the Switch will move into the **Exhausted** state.
Falling Threshold	Used to configure the acceptable level of CPU utilization as a percentage, where the Switch leaves the **Exhausted** state and returns to normal mode.
Trap/Log	Use the pull-down menu to enable or disable the sending of messages to the device's SNMP agent and switch log once the Safeguard Engine has been activated by a high CPU utilization rate.
Mode	You can choose between *Fuzzy* and *Strict*.

SNMP Manager

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 DES-3028/28P/52/52P supports the SNMP versions 1, 2c, and 3. The default SNMP setting is disabled. You must enable SNMP. Once SNMP is enabled you can choose which version 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

The Switch in the Management Information Base (MIB) stores management and counter information. 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. Specifying the MIB Object Identifier may also retrieve the proprietary MIB. MIB values can be either read-only or read-write.

The DES-3028/28P/52/52P 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 DES-3028/28P/52/52P 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** window.

SNMP Traps Settings

The following window is used to enable and disable trap settings for the SNMP function on the Switch. To view this window for configuration, click **Administration > SNMP Manager > SNMP Trap Settings**:

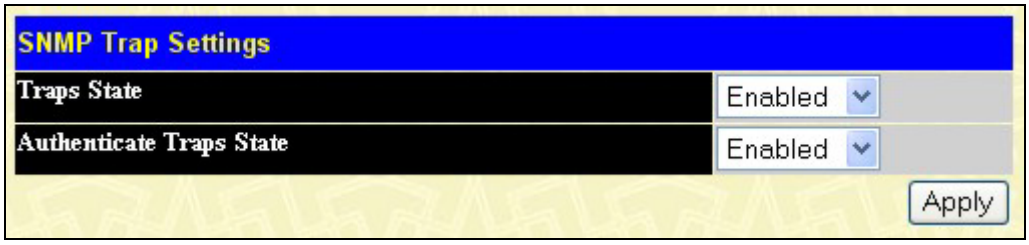


Figure 6- 27. SNMP Trap Settings window

To enable or disable the Traps State and/or the Authenticate Traps State, use the corresponding pull-down menu to change and click **Apply**.

SNMP User Table

This window displays all of the SNMP User's currently configured on the Switch.

In the **SNMP Manager** folder, located in the **Administration** folder, click on the **SNMP User Table** link. This will open the **SNMP User Table** window, as shown below.

Figure 6- 28. SNMP User Table window

To delete an existing **SNMP User Table** entry, click the ✕ below the Delete heading corresponding to the entry you wish to delete.

To display the detailed entry for a given user, click on the View button under the Display heading. This will open the **SNMP User Table Display** window, as shown below.

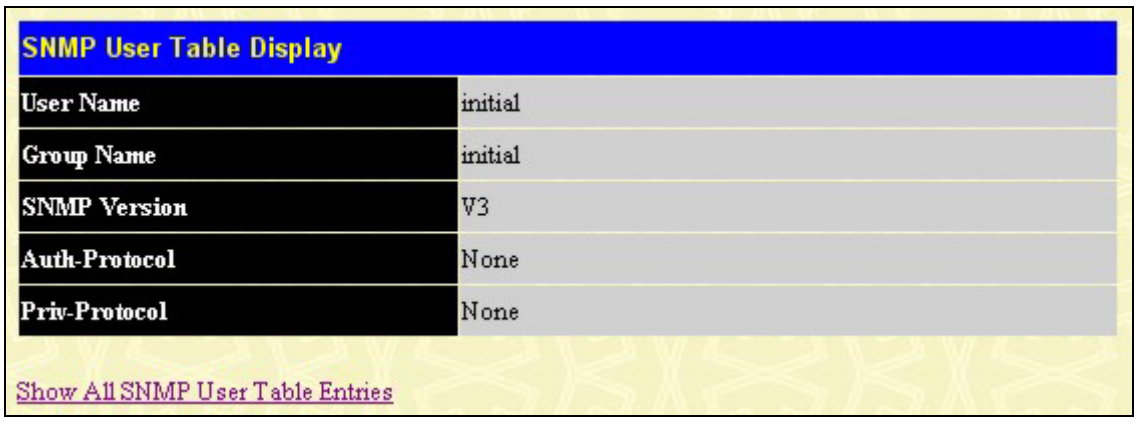


Figure 6- 29. SNMP User Table Display window

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 return to the SNMP User Table, click the Show All SNMP User Table Entries link. To add a new entry to the **SNMP User Table Configuration** window, click on the **Add** button on the **SNMP User Table** window. This will open the **SNMP User Table Configuration** window, as shown below.

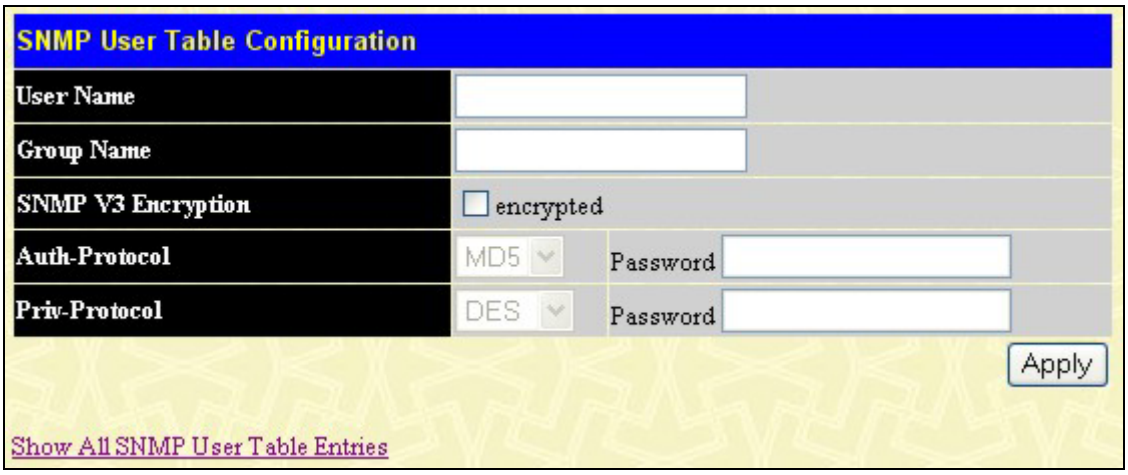


Figure 6- 30. SNMP User Table Configuration window

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.
Encrypted	Checking the corresponding box will enable encryption for SNMP V3 and is only operable in SNMP V3 mode.

To implement changes made, click **Apply**. To return to the SNMP User Table, click the Show All SNMP User Table Entries link.

SNMP View Table

This window 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** window, open the **SNMP Manager** folder under **Administration** and click the **SNMP View Table** entry. The following window should appear:

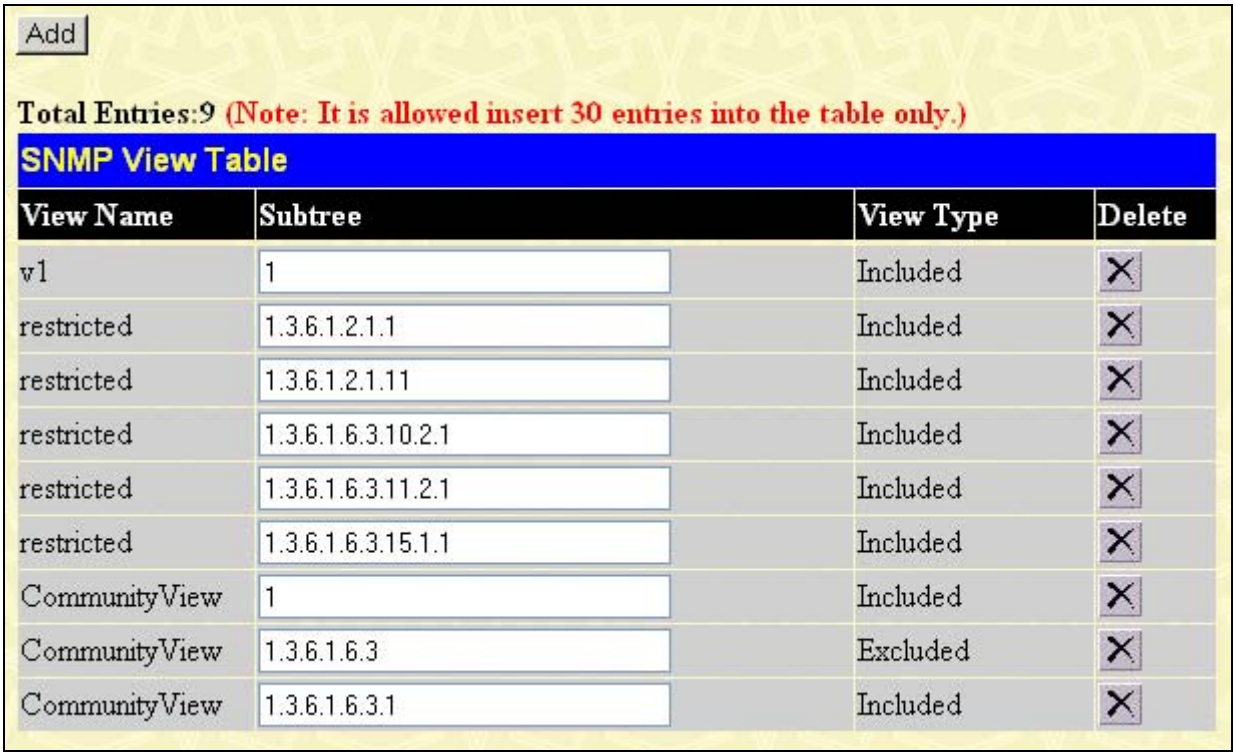


Figure 6- 31. SNMP View Table window

To delete an existing SNMP View Table entry, click the in the Delete column corresponding to the entry to delete. To create a new entry, click the **Add** button and a separate window will appear.

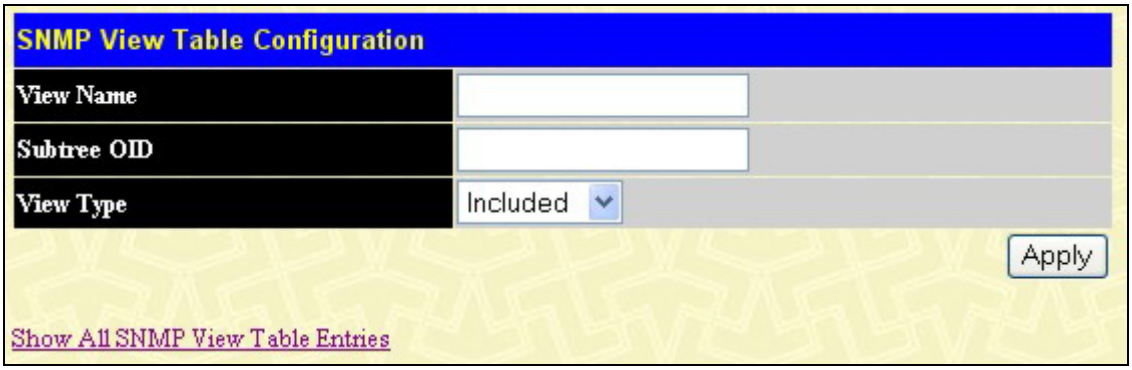


Figure 6- 32. SNMP View Table Configuration window

The SNMP Group created with this table maps SNMP users (identified in the SNMP User Table) 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.

To implement your new settings, click **Apply**. To return to the **SNMP View Table**, click the Show All SNMP View Table Entries link.

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** window, open the **SNMP Manager** folder in the **Administration** folder and click the **SNMP Group Table** entry. The following window should appear:

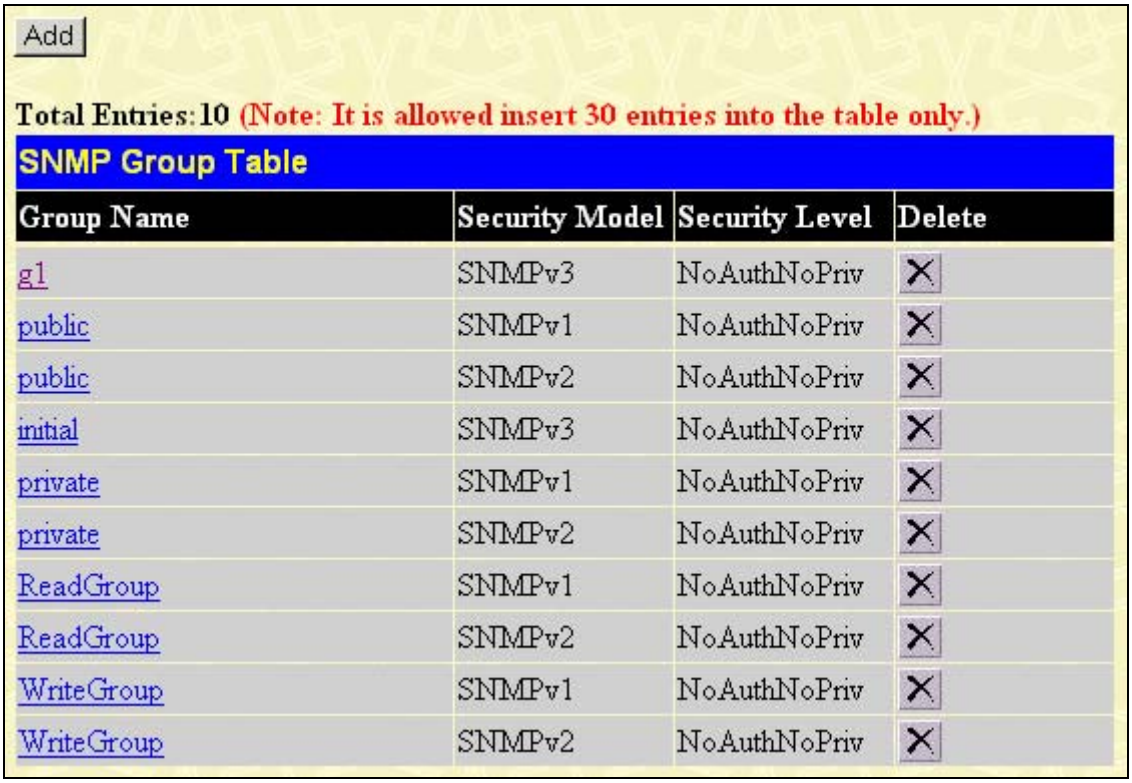


Figure 6- 33. SNMP Group Table window

To delete an existing SNMP Group Table entry, click the corresponding ✕ under the Delete heading.

To display the current settings for an existing **SNMP Group Table** entry, click the View button located under the Display heading, which will show the following window.

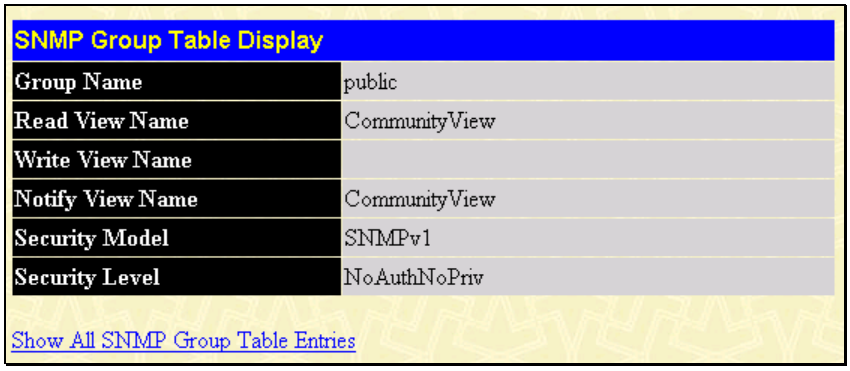


Figure 6- 34. SNMP Group Table Display window

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.

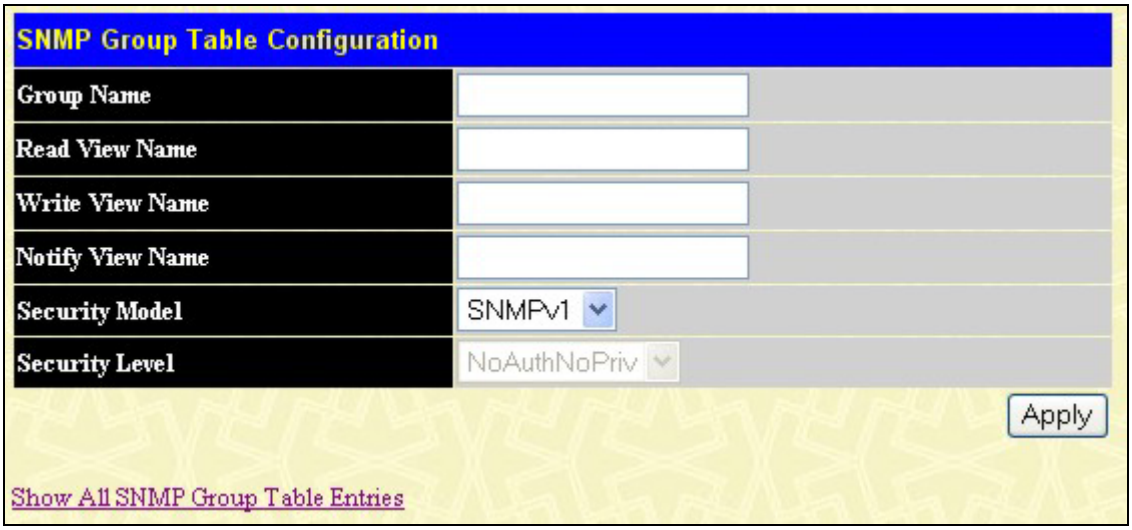


Figure 6- 35. SNMP Group Table Configuration window

The following parameters can 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.

To implement your new settings, click **Apply**. To return to the SNMP Group Table, click the Show All SNMP Group Table Entries link.

SNMP Community Table Configuration

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 **Administration** folder) and click the **SNMP Community Table** link, which will open the following window:

Figure 6- 36. 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.

To implement the new settings, click **Apply**. To delete an entry from the **SNMP Community Table**, click the ✕ under the Delete heading, corresponding to the entry to delete.

SNMP Host Table

Use the **SNMP Host Table** window to set up SNMP trap recipients. Open the **SNMP Manager** folder, (located in the **Administration** folder) and click on the **SNMP Host Table Configuration** link. This will open the **SNMP Host Table** window, as shown to the right. To delete an existing SNMP Host Table entry, click the corresponding ✕ under the Delete heading. To display the current settings for an existing **SNMP Host Table** entry, click the blue link for the entry under the Host IP Address heading.

To add a new entry to the Switch's SNMP Host Table, click the **Add** button in the upper left-hand corner of the window. This will open the **SNMP Host Table Configuration** window, as shown to the right.

Figure 6- 37. SNMP Host Table window

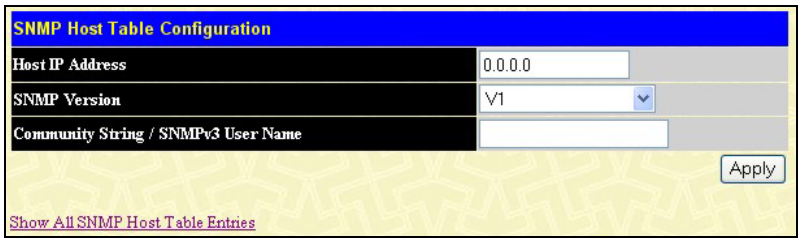


Figure 6- 38. SNMP Host Table Configuration window

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/ SNMP V3 User Name	Type in the community string or SNMP V3 user name as appropriate.

To implement your new settings, click **Apply.** To return to the **SNMP Host Table**, click the Show All SNMP Host Table Entries link.

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 **Administration**) folder and click on the **SNMP Engine ID** link. This will open the **SNMP Engine ID** window, as shown below.

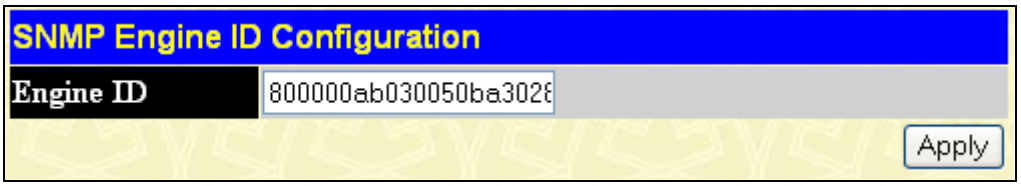


Figure 6- 39. SNMP Engine ID Configuration window

To change the Engine ID, type the new Engine ID in the space provided and click the **Apply** button.

PoE System

The DES-3028P and DES-3052P support Power over Ethernet (PoE) as defined by the IEEE 802.3af specification. Ports 1-24/1-48 can supply 48 VDC power to Power Devices (PDs) over Category 5 or Category 3 UTP Ethernet cables. Both the DES-3028P and DES-3052P follow the standard PSE (Power Source over Ethernet) pinout *Alternative A*, whereby power is sent out over pins 1, 2, 3 and 6. Both the DES-3028P and DES-3052P work with all D-Link 802.3af capable devices.

The DES-3028P and DES-3052P include the following PoE features:

- Auto-discovery recognizes the connection of a PD (Power Device) and automatically sends power to it.
- The Auto-disable feature will occur under two conditions: first, if the total power consumption exceeds the system power limit; and second, if the per port power consumption exceeds the per port power limit.
- Active circuit protection automatically disables the port if there is a short. Other ports will remain active.

PDs receive power according to the following classification:

Class	Max power used by PD
0	0.44 to 12.95W
1	0.44 to 3.84W
2	3.84 to 6.49W
3	6.49 to 12.95W

PSE provides power according to the following classification:

Class	Max power used by PSE
0	15.4W
1	4.0W
2	7.0W
3	15.4W

To configure the PoE features on the DES-3028P and DES-3052P, click **Administration** > **PoE Configuration**. The **PoE System** window is used to assign a power limit and power disconnect method for the whole PoE system. To configure the **Power Limit** for the PoE system, enter a value between 37W and 185W (for the DES-3028P) and between 37W and 370W (for the DES-3052P) in the Power Limit field. The default setting is 185W (DES-3028P) and 370W (DES-3052P). When the total consumed power exceeds the power limit, the PoE controller (located in the PSE) disconnects the power to prevent overloading the power supply.

To configure PoE for the Switch, click **Administration > PoE Configuration**, which will reveal the following window for the user to configure:

PoE System Configuration

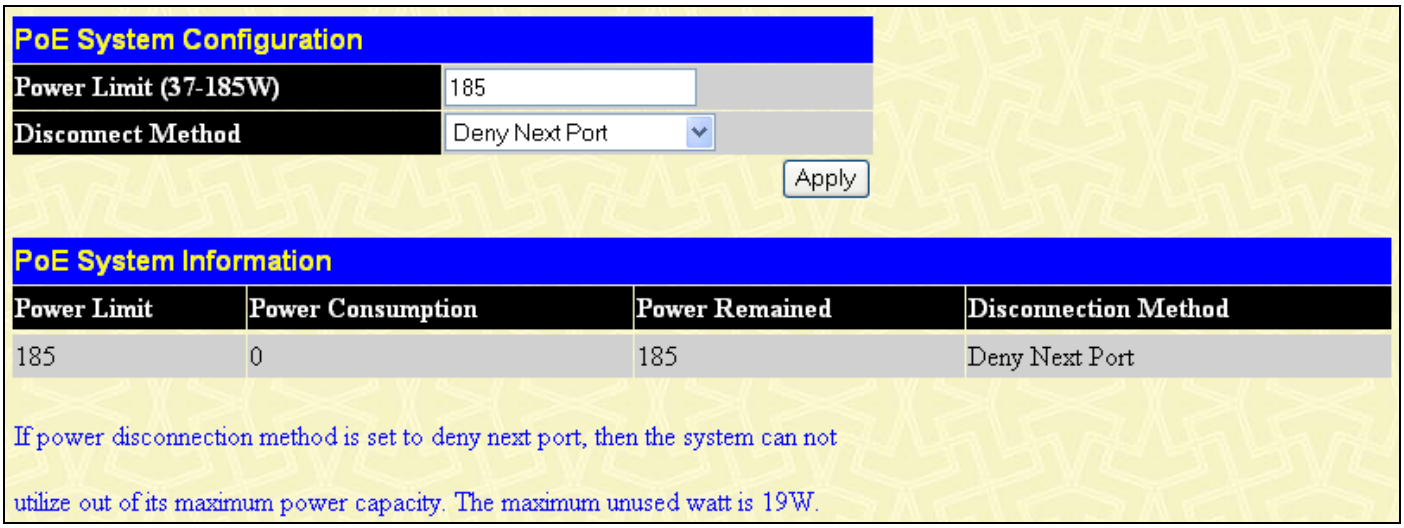
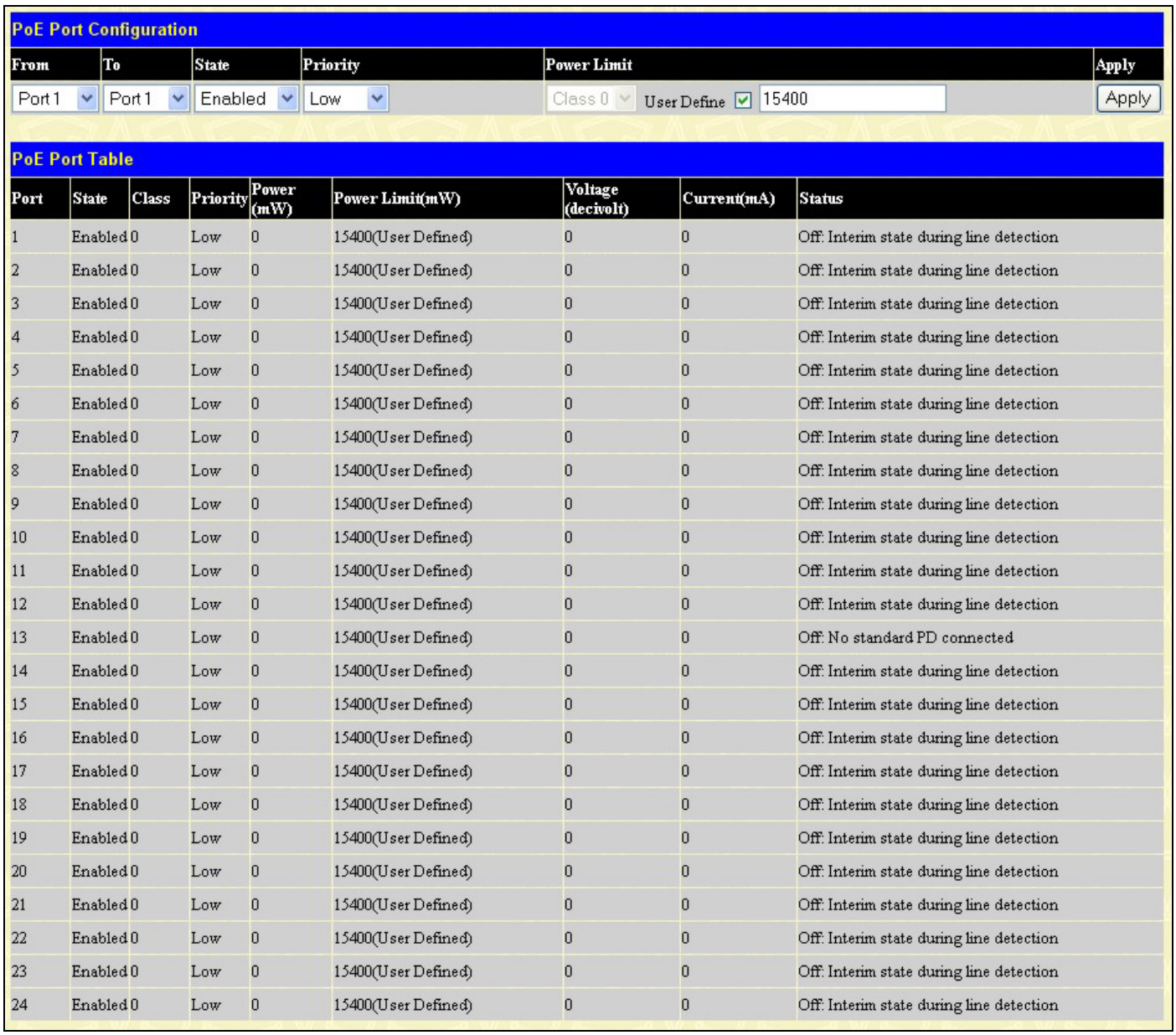


Figure 6- 40. PoE System Configuration window

PoE Port Configuration



PoE Port Configuration

From	To	State	Priority	Power Limit			Apply
Port 1	Port 1	Enabled	Low	Class 0	User Define	15400	Apply

PoE Port Table

Port	State	Class	Priority	Power (mW)	Power Limit(mW)	Voltage (decivolt)	Current(mA)	Status
1	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
2	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
3	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
4	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
5	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
6	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
7	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
8	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
9	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
10	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
11	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
12	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
13	Enabled	0	Low	0	15400(User Defined)	0	0	Off: No standard PD connected
14	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
15	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
16	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
17	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
18	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
19	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
20	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
21	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
22	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
23	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection
24	Enabled	0	Low	0	15400(User Defined)	0	0	Off: Interim state during line detection

Figure 6- 41. PoE Port Configuration window

The previous window contains the following fields to configure for PoE:

Parameter	Description
PoE System	
Power Limit	Sets the limit of power to be used from the Switch's power source to PoE ports. The user may configure a Power Limit between 37 and 185W (for the DES-3028P) and 37 and 370W (for the DES-3052P). The default setting is 185W (DES-3028P) and 370W (DES-3052P).
Power Disconnect Method	The PoE controller uses either **Deny next port** or **Deny low priority port** to offset the power limit being exceeded and keep the Switch's power at a usable level. Use the drop down menu to select a **Power Disconnect Method**. The default for the Power Disconnect Method is **Deny next port**. Both Power Disconnection Methods are described below: **Deny next port** - After the power limit has been exceeded, the next port attempting to power up is denied, regardless of its priority. **Deny low priority port -** After the power limit has been exceeded, the next port attempting to power up causes the port with the lowest priority to shut down to allow the high-priority and

	critical priority ports to power up.
PoE Configuration	
From… To…	Select a range of ports from the pull-down menus to be enabled or disabled for PoE.
State	Use the pull-down menu to enable or disable ports for PoE.
Priority	Use the pull-down menu to select the priority of the PoE ports.
Power Limit	Sets the power limit per PoE port. Once this threshold has been reached on the port, the PoE will go into the Power Disconnect Method, as described above. The user may set a limit between 1000 and 15400mW

Click **Apply** to implement changes made to the PoE settings. The port status of all PoE configured ports is displayed in the table in the bottom half of the screen shown above.

Single IP Settings

Simply put, D-Link Single IP Management is a concept that will stack switches together over Ethernet instead of using stacking ports or modules. There are some advantages in implementing the "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 D-Link 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 or Web Interface. SIM grouping has no effect on the normal operation of the Switch in the user's network.
- There are three classifications for 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 33 switches (numbered 0-32), 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 system VLAN on any switch.

SIM allows intermediate devices that do not support SIM. This enables the user to manage switches that are more than one hop away from the CS.

The SIM group is a group of switches that are managed as a single entity. SIM switches may take on three different roles:

1. **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 commander switch or member switch of another Single IP group.
    - It is connected to the member switches through its management VLAN.
2. **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 Single IP group.
    - It is connected to the CS through the CS management VLAN.
3. **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 of a switch 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

After configuring one switch to operate as the CS of a SIM group, additional switches may join the group through a direct connection to the Commander switch. Only the Commander switch will allow entry to the candidate switch enabled for SIM. 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, 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 CS 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.

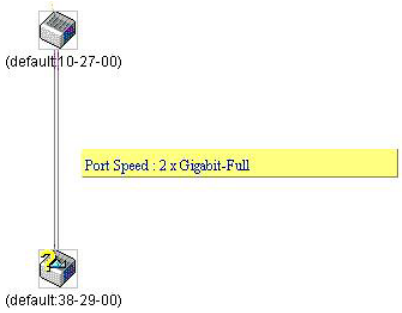
The Upgrade to v1.6

To better improve SIM management, the DES-3028/28P/52/52P Switches have been upgraded to version 1.6 in this release. Many improvements have been made, including:

1. The Commander Switch (CS) now has the capability to automatically rediscover member switches that have left the SIM group, either through a reboot or web malfunction. This feature is accomplished through the use of Discover packets and Maintain packets that previously set SIM members will emit after a reboot. Once a MS has had its MAC address and password saved to the CS's database, if a reboot occurs in the MS, the CS will keep this MS information in its database and when a MS has been rediscovered, it will add the MS back into the SIM tree automatically. No configuration will be necessary to rediscover these switches.

There are some instances where pre-saved MS switches cannot be rediscovered. For example, if the Switch is still powered down, if it has become the member of another group, or if it has been configured to be a Commander Switch, the rediscovery process cannot occur.

2. The topology map now includes new features for connections that are a member of a port trunking group. It will display the speed and number of Ethernet connections creating this port trunk group, as shown in the adjacent picture.



3. This version will support multiple switch upload and downloads for firmware, configuration files and log files, as follows:

- **Firmware** – The switch now supports multiple MS firmware downloads from a TFTP server.
- **Configuration Files** – This switch now supports multiple downloading and uploading of configuration files both to (for configuration restoration) and from (for configuration backup) MS's, using a TFTP server..
- **Log** – The switch now supports uploading multiple MS log files to a TFTP server.

4. The user may zoom in and zoom out when utilizing the topology window to get a better, more defined view of the configurations.

SIM Settings

All switches are set as Candidate (CaS) switches as their 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 Settings** folder, located in the **Administration** folder, and click the **SIM Settings** link, revealing the following window.

Figure 6- 42. SIM Settings window (disabled)

Change the **SIM State** to *Enabled* using the pull-down menu and click **Apply**. The window will then refresh to look like this:

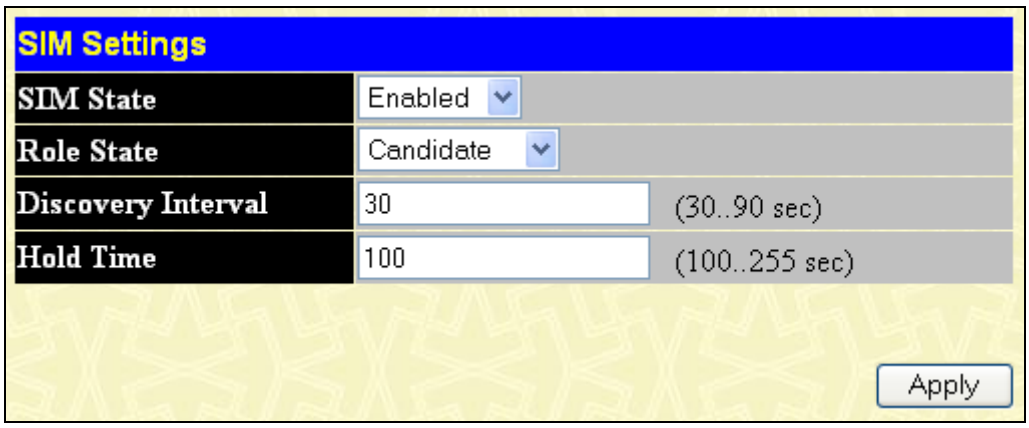


Figure 6- 43. SIM Settings window (enabled)

If the Switch Administrator wishes to configure the Switch as a Commander Switch (CS), select *Commander* from the **Role State** field and click **Apply**. The window will change once again to look like this:

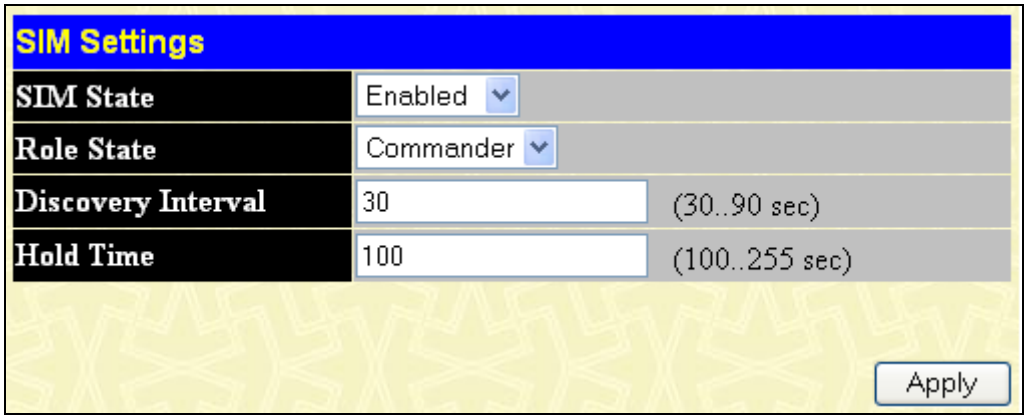


Figure 6- 44. SIM Settings window (Commander enabled)

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. • *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.
Hold Time	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 four added links to aid the user in configuring SIM through the web, including **Topology**, **Firmware Upgrade** and **Configuration Backup/Restore** and **Upload Log File**.

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 Java Runtime Environment on your server should initiate and lead you to the topology window, as seen below.

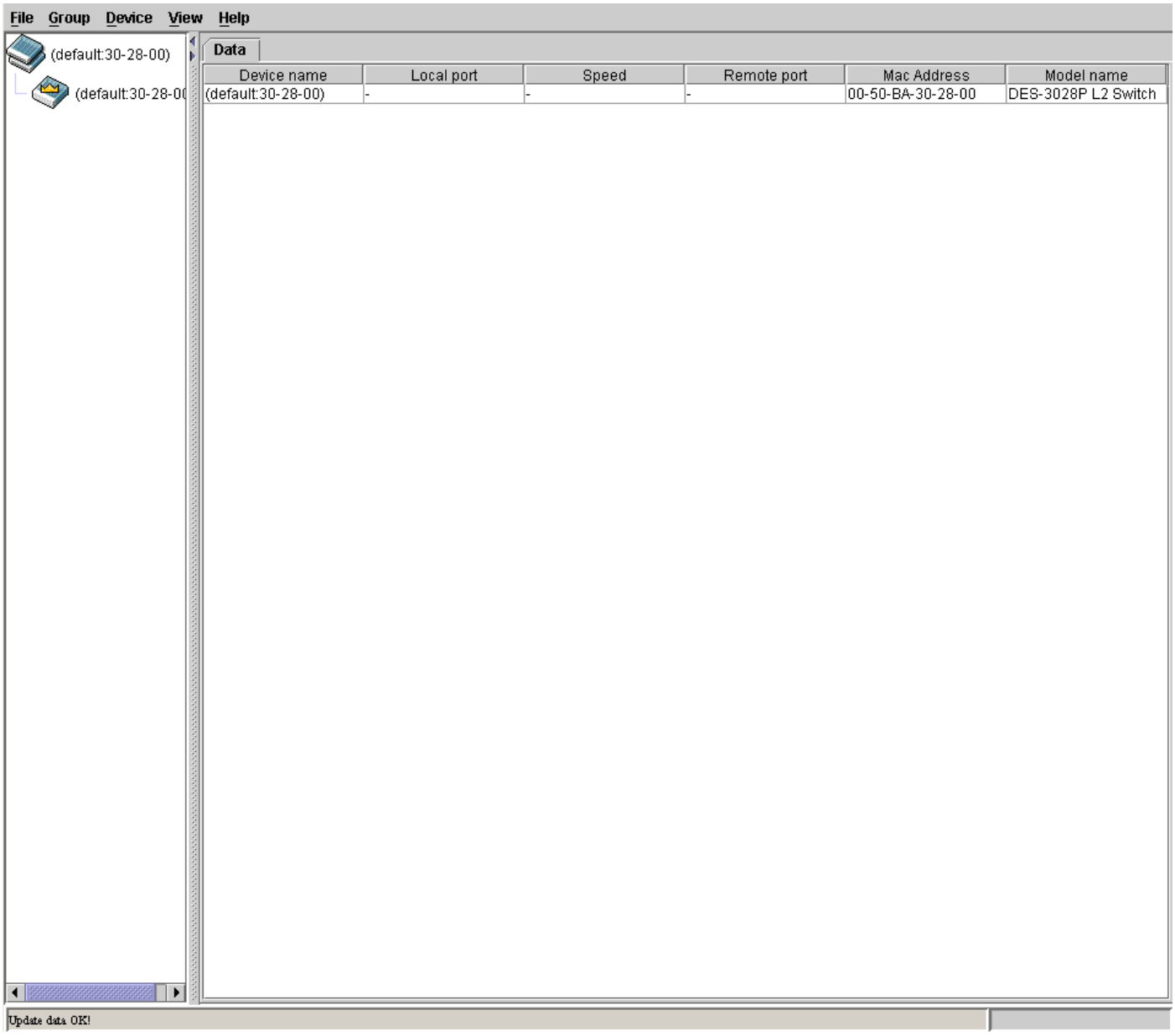


Figure 6- 45. Single IP Management window - Tree View

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.

	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 window. The **Topology View** will refresh itself periodically (20 seconds by default).

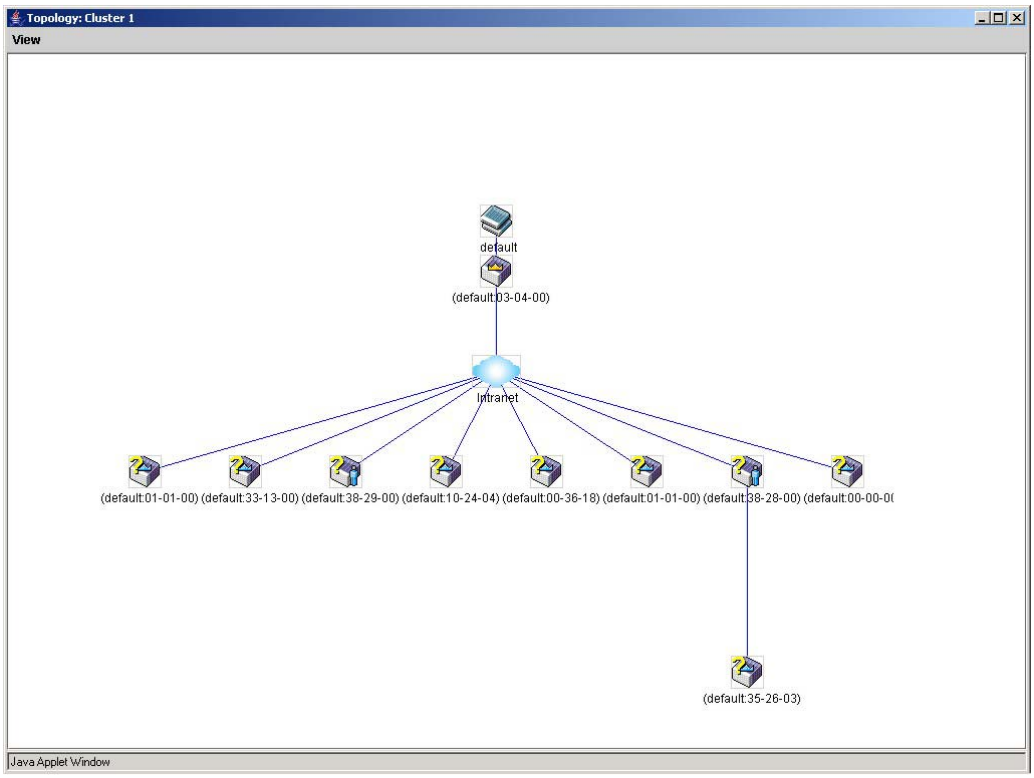


Figure 6- 46. Topology view

This window 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.

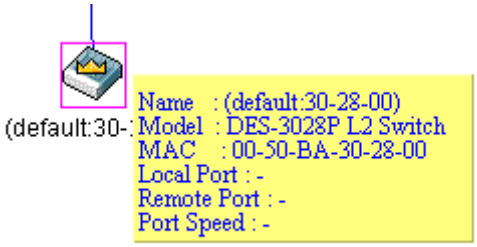


Figure 6- 47. Device Information Utilizing the Tool Tip

Setting the mouse cursor over a line between two devices will display the connection speed between the two devices, as shown below.

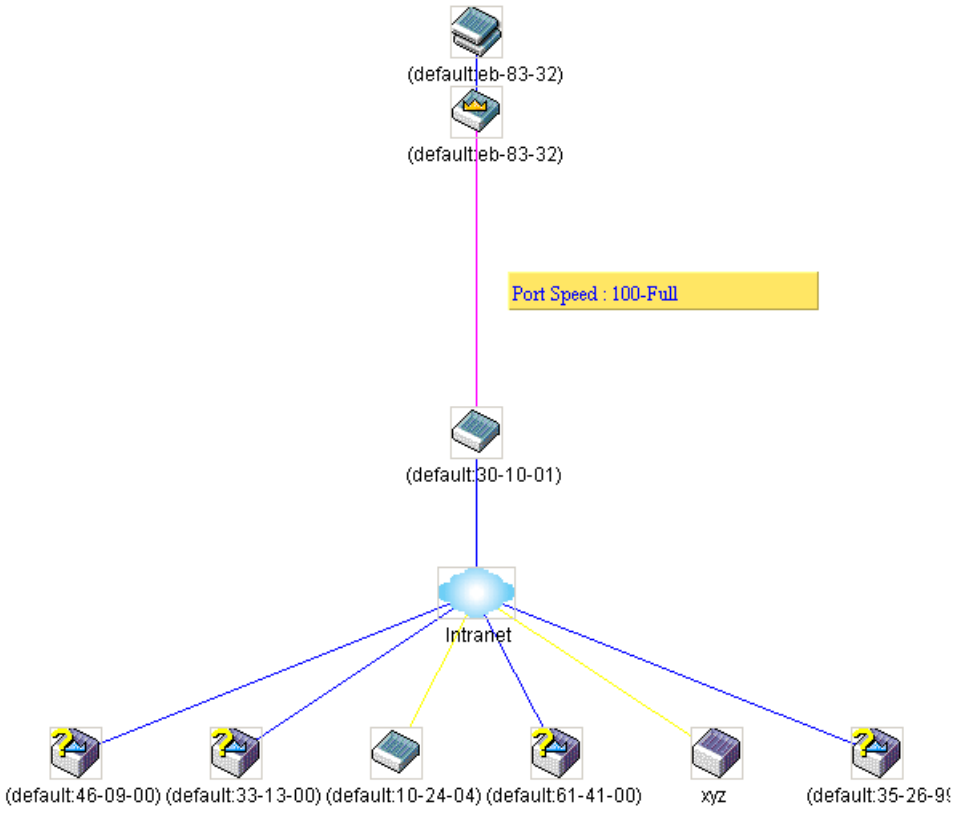


Figure 6- 48. Port Speed Utilizing the Tool Tip

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

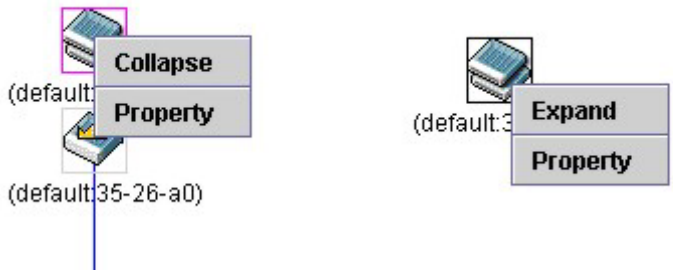


Figure 6- 49. Right-Clicking a Group Icon

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.

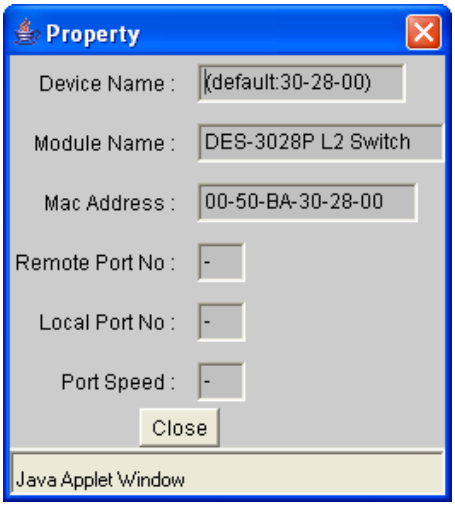


Figure 6- 50. Property window

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

Click **Close** to close the **Property** window.

Commander Switch Icon

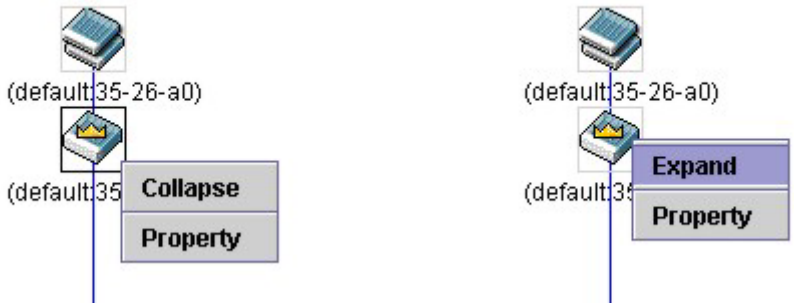


Figure 6- 51. Right-Clicking a Commander Icon

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.

Member Switch Icon

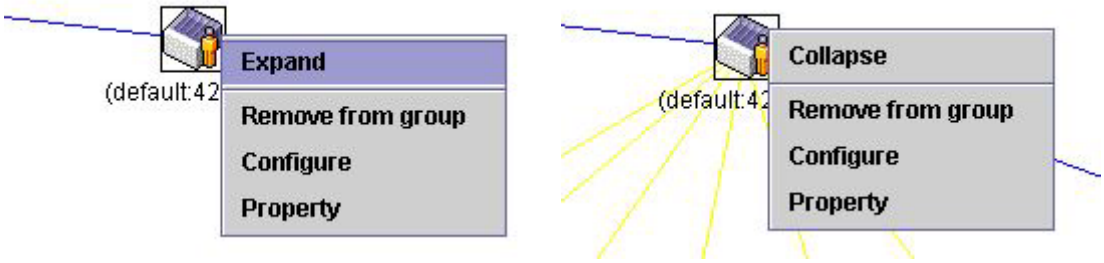


Figure 6- 52. Right-Clicking a Member icon

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.

Candidate Switch Icon

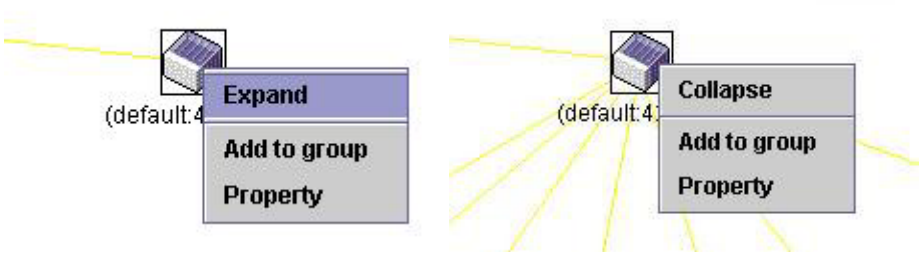


Figure 6- 53. Right-Clicking a Candidate icon

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 dialog 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 6- 54. Input password window

- **Property** - To pop up a window to display the device information, as shown below.

Menu Bar

The **Single IP Management** window contains a menu bar for device configurations, as seen below.

Figure 6- 55. 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 dialog 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 6- 56. 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.

Figure 6- 57. About window

Firmware Upgrade

This screen is used to upgrade firmware from the Commander Switch to the Member Switch. To access the following window, click **Administration > Single IP Management Settings > Firmware Upgrade**. 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.

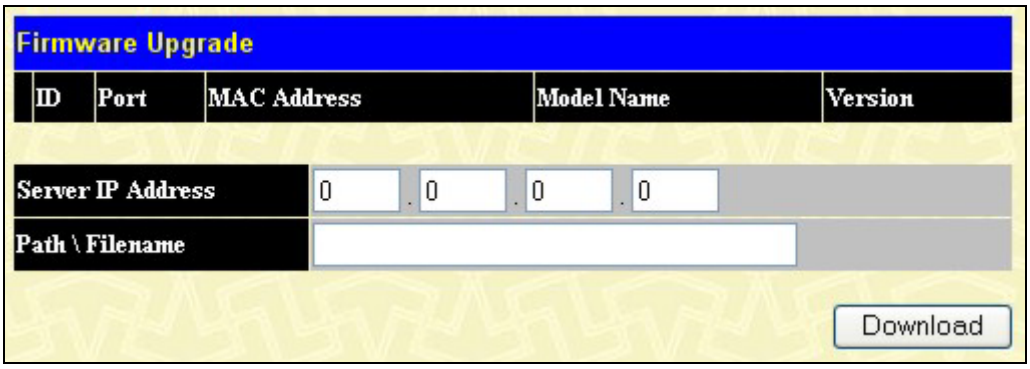


Figure 6- 58. Firmware Upgrade window

Configuration Backup/Restore

This screen is used to upgrade configuration files from the Commander Switch to the Member Switch using a TFTP server. 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 file resides and enter the **Path/Filename** of the configuration file. Click **Download** to initiate the file transfer from a TFTP server to the Switch. Click **Upload** to backup the configuration file to a TFTP server. To access the following window, click **Administration > Single IP Management Settings > Configuration Backup/Restore**.

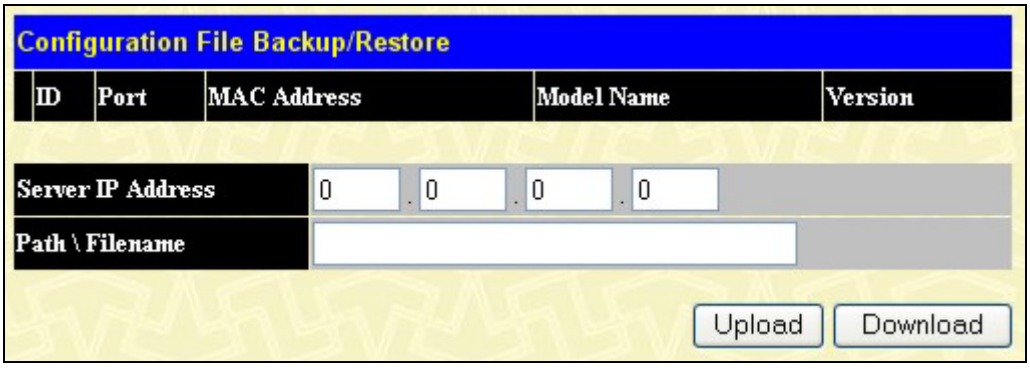


Figure 6- 59. Configuration File Backup/Restore window

Upload Log

The following window is used to upload log files from SIM member switches to a specified PC. To view this window click **Administration > Single IP Management > Upload Log File.** To upload a log file, enter the IP address of the SIM member switch and then enter a path on your PC where you wish to save this file. Click **Upload** to initiate the file transfer.

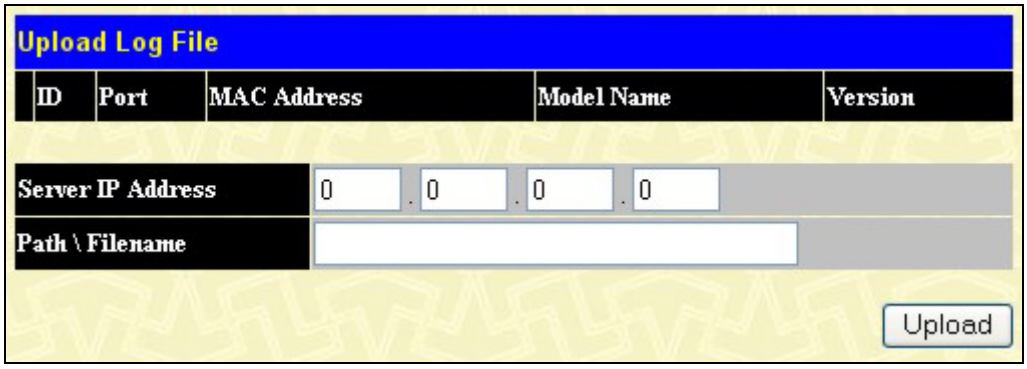


Figure 6- 60. Upload Log File window

Forwarding & Filtering

Unicast Forwarding

Open the **Forwarding Filtering** folder in the **Configuration** menu and click on the **Unicast Forwarding** link. This will open the following window:

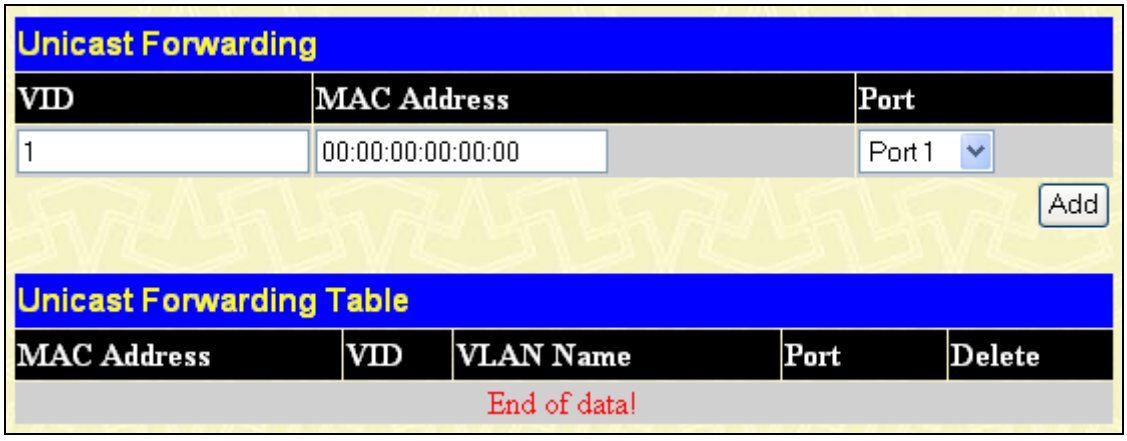


Figure 6- 61. Unicast Forwarding window

To add or edit an entry, define the following parameters and then click **Add/Modify**:

Parameter	Description
VID	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.
Port	Allows the selection of the port number on which the MAC address entered above resides.

Click **Apply** to implement the changes made. To delete an entry in the Static Unicast Forwarding Table, click the corresponding ***X*** under the Delete heading.

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:

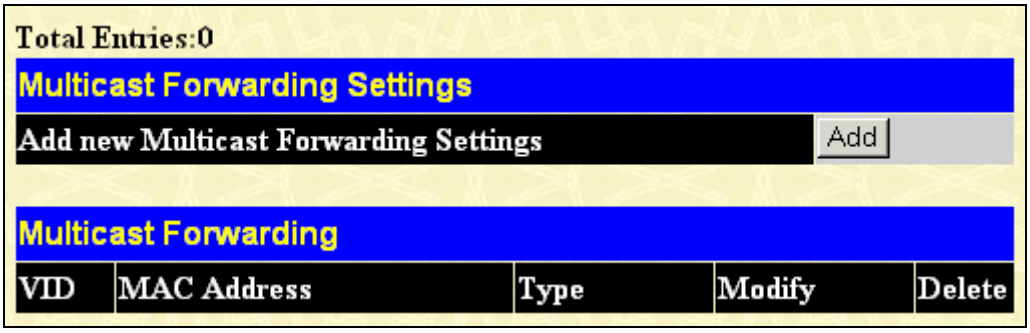


Figure 6- 62. Multicast Forwarding Settings window

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:

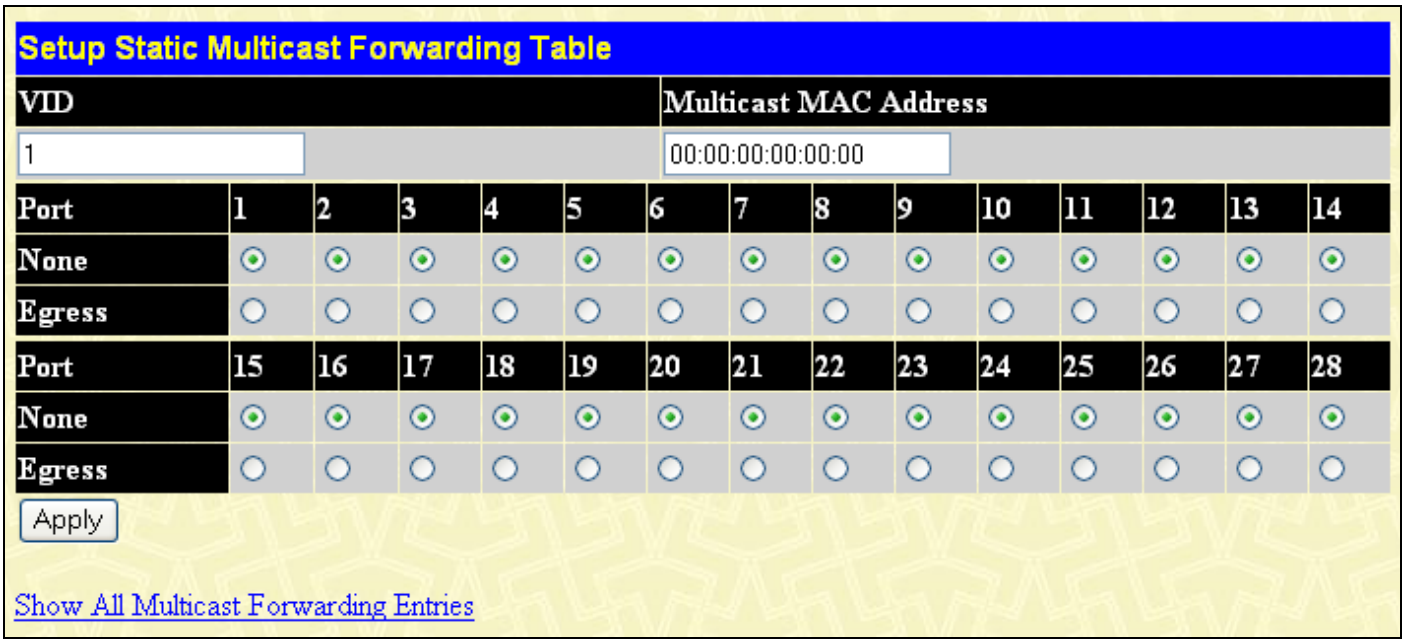


Figure 6- 63. Setup Static Multicast Forwarding Table window

The following parameters can be set:

Parameter	Description
VID	The VLAN ID of the VLAN to which the corresponding MAC address 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 either that are forbidden from joining dynamically, or that can join the multicast group dynamically, using GMRP. The options are: *None* - No restrictions on the port dynamically joining the multicast group. When None is chosen, the port will not be a member of the Static Multicast Group. *Egress* - The port is a static member of the multicast group.

Click **Apply** to implement the changes made. To delete an entry in the Static Multicast Forwarding Table, click the corresponding ***X*** under the Delete heading. Click the **Show All Multicast Forwarding Entries** link to return to the **Static Multicast Forwarding Settings** window.

Multicast Filtering Mode

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 Filtering Mode Setup** link to see the entry window below:

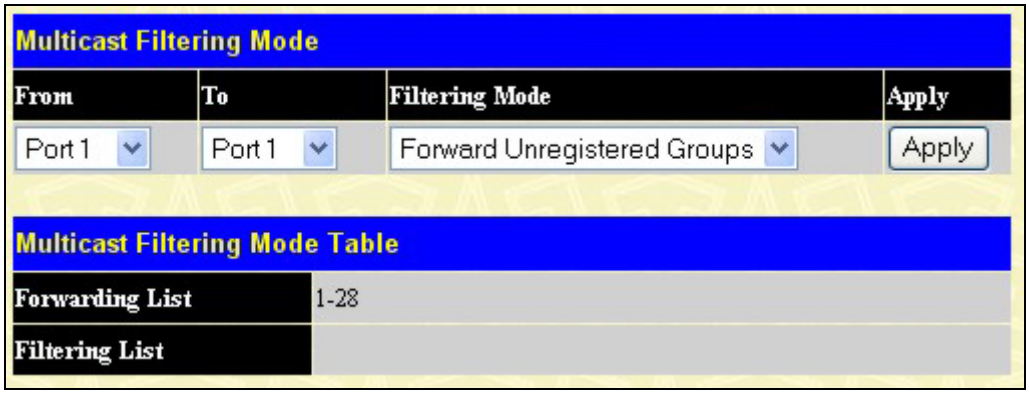


Figure 6- 64. Multicast Filtering Mode window

The following parameters can be set:

Parameter	Description
From/To	These two drop-down menus allow you to select a range of ports to which the filter settings will be applied.
Mode	This drop-down menu allows you to select the action the Switch will take when it receives a multicast packet that is to be forwarded to one of the ports in the range specified above. • *Forward Unregistered Groups* - This will instruct the Switch to forward a multicast packet whose destination is an unregistered multicast group residing within the range of ports specified above. • *Filter Unregistered Groups* - This will instruct the Switch to filter any multicast packets whose destination is an unregistered multicast group residing within the range of ports specified above.

Click **Apply** to implement changes made.

SMTP Service

SMTP or Simple Mail Transfer Protocol is a function of the Switch that will send switch events to mail recipients based on e-mail addresses entered using the commands below. The Switch is to be configured as a client of SMTP while the server is a remote device that will receive messages from the Switch, place the appropriate information into an e-mail and deliver it to recipients configured on the Switch. This can benefit the Switch administrator by simplifying the management of small workgroups or wiring closets, increasing the speed of handling emergency Switch events and enhancing security by recording questionable events occurring on the Switch.

The Switch plays four important roles as a client in the functioning of SMTP:

- The server and server virtual port must be correctly configured for this function to work properly. This is accomplished in the **SMTP Service Settings** window by properly configuring the *SMTP Server Address* and *SMTP Server Port* fields.
- Mail recipients must be configured on the Switch. This information is sent to the server which then processes the information and then e-mails Switch information to these recipients. Up to 8 e-mail recipients can be configured on the Switch using the **SMTP Service Settings** window by configuring the *Mail Receiver Address* field.
- The administrator can configure the source mail address from which messages are delivered to configured recipients. This can offer more information to the administrator about Switch functions and problems. The personal e-mail can be configured using the **SMTP Service Settings** window and setting the *Self Mail Address* field.
- The Switch can be configured to send out test mail to first ensure that the recipient will receive e-mails from the SMTP server regarding the Switch. To configure this test mail, the SMTP function must first be enabled by configuring the SMTP State in the **SMTP Service Settings** window and then by sending an email using the **SMTP Service** window. All recipients configured for SMTP will receive a sample test message from the SMTP server, ensuring the reliability of this function.

The Switch will send out e-mail to recipients when one or more of the following events occur:

- When a cold start occurs on the Switch.
- When a port enters a link down status.
- When a port enters a link up status.
- When SNMP authentication has been denied by the Switch.
- When a switch configuration entry has been saved to the NVRAM by the Switch.
- When an abnormality occurs on TFTP during a firmware download event. This includes *in-process*, *invalid-file*, *violation*, *file-not-found*, *complete* and *time-out* messages from the TFTP server.
- When a system reset occurs on the Switch.

Information within the e-mail from the SMTP server regarding switch events includes:

- The source device name and IP address.
- A timestamp denoting the identity of the SMTP server and the client that sent the message, as well as the time and date of the message received from the Switch. Messages that have been relayed will have timestamps for each relay.
- The event that occurred on the Switch, prompting the e-mail message to be sent.
- When an event is processed by a user, such as save or firmware upgrade, the IP address, MAC address and User Name of the user completing the task will be sent along with the system message of the event occurred.
- When the same event occurs more than once, the second mail message and every repeating mail message following will have the system's error message placed in the subject line of the mail message.

The following details events occurring during the Delivery Process.

- Urgent mail will have high priority and be immediately dispatched to recipients while normal mail will be placed in a queue for future transmission.
- The maximum number of untransmitted mail messages placed in the queue cannot exceed 30 messages. Any new messages will be discarded if the queue is full.
- If the initial message sent to a mail recipient is not delivered, it will be placed in the waiting queue until its place in the queue has been reached, and then another attempt to transmit the message is made.
- The maximum attempts for delivering mail to recipients is three. Mail message delivery attempts will be tried every five minutes until the maximum number of attempts is reached. Once reached and the message has not been successfully delivered, the message will be dropped and not received by the mail recipient.

If the Switch shuts down or reboots, mail messages in the waiting queue will be lost.

SMTP Server Settings

The following window is used to configure the fields to set up the SMTP server for the switch, along with setting e-mail addresses to which switch log files can be sent when a problem arises on the Switch. To open the following window, open the **Administration** folder, then the **SMTP Service** folder and then click the **SMTP Server Settings** link.

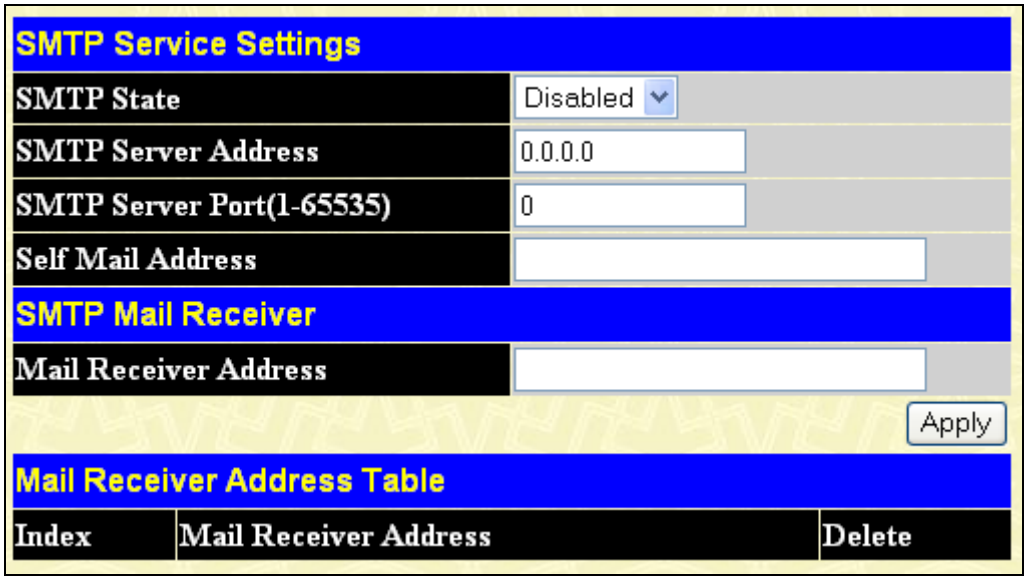


Figure 6- 65. SMTP Service Settings and Mail Receiver Address Table window

The following parameters can be set:

Parameter	Description
SMTP State	Use the pull-down menu to enable or disable the SMTP service on this device.
SMTP Server Address	Enter the IP address of the SMTP server on a remote device. This will be the device that sends out the mail for you.
SMTP Server Port	Enter the virtual port number that the Switch will connect with on the SMTP server. The common port number for SMTP is *25*, yet a value between *1* and *65535* can be chosen.
Self Mail Address	Enter the e-mail address from which mail messages will be sent. This address will be the "from" address on the e-mail message sent to a recipient. Only one self mail address can be configured for this Switch. This string can be no more that 64 alphanumeric characters.
Mail Receiver Address	Enter a list of e-mail addresses so recipients can receive e-mail messages regarding Switch functions. Up to 8 e-mail addresses can be added per Switch. Do delete these addresses from the Switch, click it's corresponding ✕ under the Delete heading in the Mail Receiver Address Table.

Click **Apply** to implement changes made.

SMTP Service

The following window is used to send test messages to all mail recipients configured on the Switch, thus testing the configurations set and the reliability of the SMTP server. To access the following window, open the **Administration** folder, then the **SMTP Service** folder and click the **SMTP Service** link.

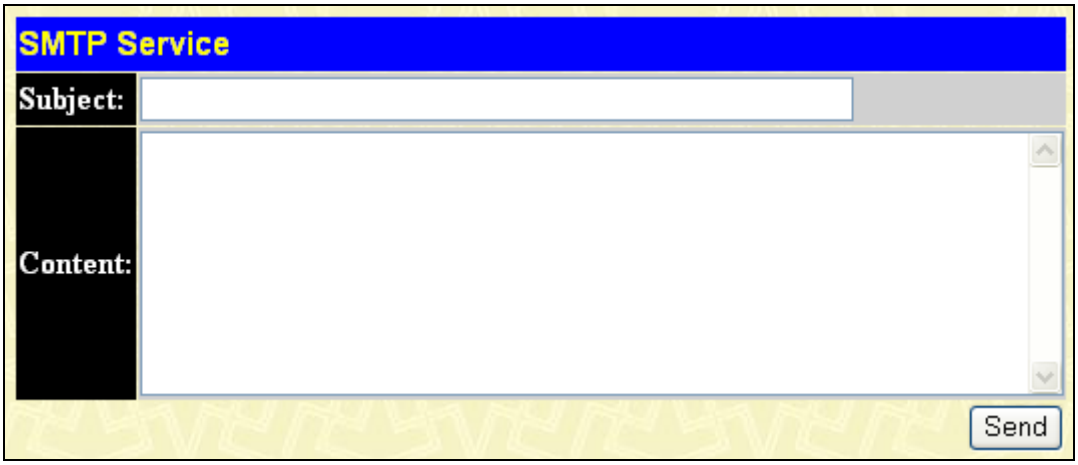


Figure 6- 66. SMTP Service window

The following parameters can be set:

Parameter	Description
Subject	Enter the subject of the test e-mail.
Content	Enter the content of the test e-mail.

Once your message is ready, click **Send** to send this mail to all recipients configured on the Switch for SMTP.

Section 7

L2 Features

VLAN

Trunking

IGMP Snooping

Spanning Tree

VLANs

A Virtual Local Area Network (VLAN) is a network topology configured according to a logical scheme rather than the physical layout. VLANs can be used to combine any collection of LAN segments into an autonomous user group that appears as a single LAN. VLANs also logically segment the network into different broadcast domains so that packets are forwarded only between ports within the VLAN. Typically, a VLAN corresponds to a particular subnet, although not necessarily.

VLANs can enhance performance by conserving bandwidth, and improve security by limiting traffic to specific domains.

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

Notes about VLANs on the Switch

No matter what basis is used to uniquely identify end nodes and assign these nodes VLAN membership, packets cannot cross VLANs without a network device performing a routing function between the VLANs.

The Switch supports IEEE 802.1Q VLANs. The port untagging function can be used to remove the 802.1Q tag from packet headers to maintain compatibility with devices that are tag-unaware.

The Switch's default is to assign all ports to a single 802.1Q VLAN named "default."

The "default" VLAN has a VID = 1.

The member ports of Port-based VLANs may overlap, if desired.

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 Switch. 802.1Q VLANs require tagging, which enables them to span the entire network (assuming all switches on the network are IEEE 802.1Q-compliant).

VLANs allow a network to be segmented in order to reduce the size of broadcast domains. All packets entering a VLAN will only be forwarded to the stations (over IEEE 802.1Q enabled switches) that are members of that VLAN, and this includes broadcast, multicast and unicast packets from unknown sources.

VLANs can also provide a level of security to your network. IEEE 802.1Q VLANs will only deliver packets between stations that are members of the VLAN.

Any port can be configured as either tagging or untagging. The untagging feature of IEEE 802.1Q VLANs allows 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-compliant switches through a single physical connection and allows Spanning Tree to be enabled on all ports and work normally.

The IEEE 802.1Q standard restricts the forwarding of untagged packets to the VLAN of which the receiving port is a member.

The main characteristics of IEEE 802.1Q are as follows:

- Assigns packets to VLANs by filtering.
- Assumes the presence of a single global spanning tree.
- Uses an explicit tagging scheme with one-level tagging.
- 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 whether to filter or forward the packet.
- Egress rules - determines if the packet must be sent tagged or untagged.

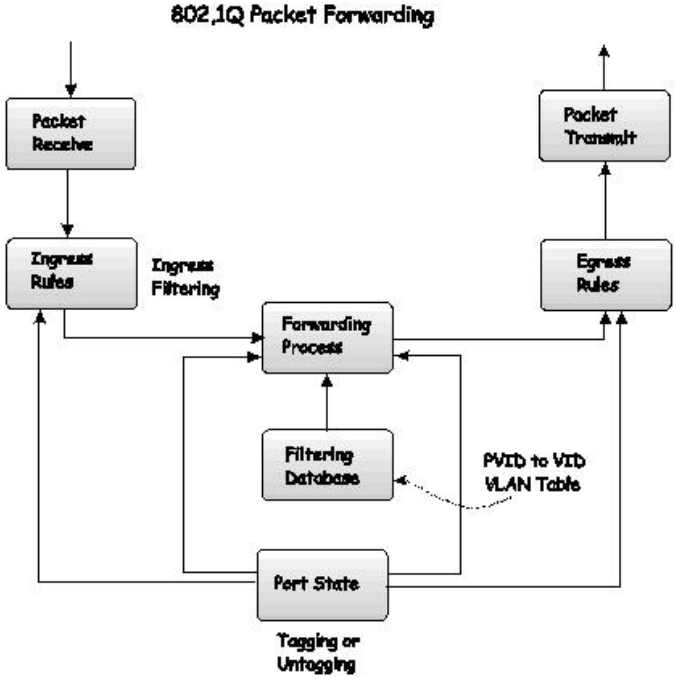


Figure 7- 1. IEEE 802.1Q Packet Forwarding

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 3 bits of user priority, 1 bit of Canonical Format Identifier (CFI - used for encapsulating Token Ring packets so they can be carried across Ethernet backbones), and 12 bits of VLAN ID (VID). The 3 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 12 bits long, 4094 unique VLANs can be identified.

The tag is inserted into the packet header making the entire packet longer by 4 octets. All of the information originally contained in the packet is retained.

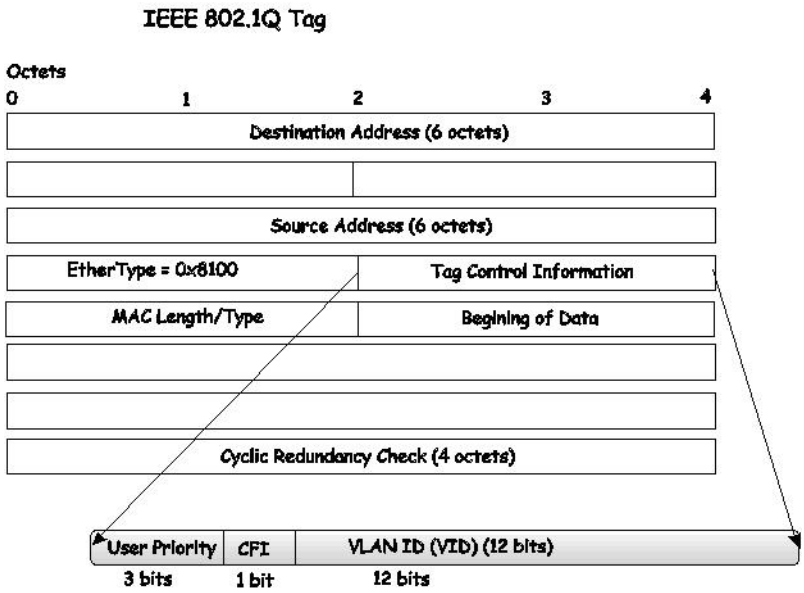


Figure 7- 2. IEEE 802.1Q Tag

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.

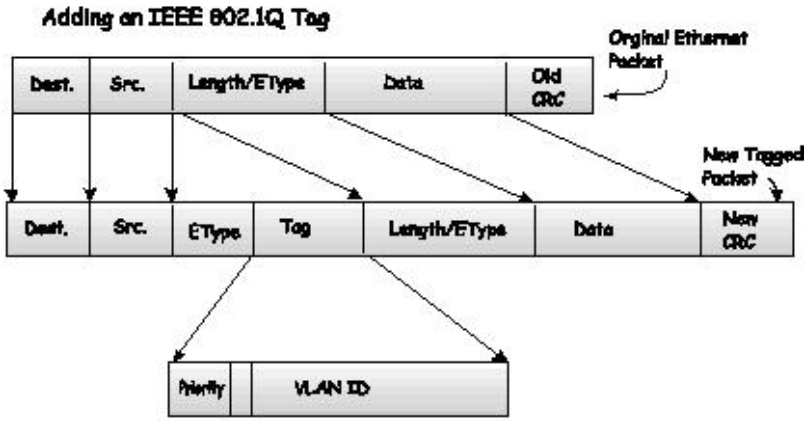


Figure 7- 3. Adding an IEEE 802.1Q Tag

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.

Default VLANs

The Switch initially configures one VLAN, VID = 1, called "default." The factory default setting assigns all ports on the Switch to the "default." As new VLANs are configured in Port-based mode, their respective member ports are removed from the "default."

Packets cannot cross VLANs. If a member of one VLAN wants to connect to another VLAN, the link must be through an external router.

NOTE: If no VLANs are configured on the Switch, then all packets will be forwarded to any destination port. Packets with unknown source addresses will be flooded to all ports. Broadcast and multicast packets will also be flooded to all ports.

An example is presented below:

VLAN Name	VID	Switch Ports
System (default)	1	5, 6, 7, 8, 21, 22, 23, 24
Engineering	2	9, 10, 11, 12
Marketing	3	13, 14, 15, 16
Finance	4	17, 18, 19, 20
Sales	5	1, 2, 3, 4

Table 7- 1. VLAN Example - Assigned Ports

VLAN Segmentation

Take for example a packet that is transmitted by a machine on Port 1 that is a member of VLAN 2. If the destination lies on another port (found through a normal forwarding table lookup), the Switch then looks to see if the other port (Port 10) is a member of VLAN 2 (and can therefore receive VLAN 2 packets). If Port 10 is not a member of VLAN 2, then the packet will be dropped by the Switch and will not reach its destination. If Port 10 is a member of VLAN 2, the packet will go through. This selective forwarding feature based on VLAN criteria is how VLANs segment networks. The key point being that Port 1 will only transmit on VLAN 2.

Network resources such as printers and servers however, can be shared across VLANs. This is achieved by setting up overlapping VLANs. That is ports can belong to more than one VLAN group. For example, setting VLAN 1 members to ports 1, 2, 3, and 4 and VLAN 2 members to ports 1, 5, 6, and 7. Port 1 belongs to two VLAN groups. Ports 8, 9, and 10 are not configured to any VLAN group. This means ports 8, 9, and 10 are in the same VLAN group.

VLAN and Trunk Groups

The members of a trunk group have the same VLAN setting. Any VLAN setting on the members of a trunk group will apply to the other member ports.

Static VLAN Entry

In the **L2 Features** folder, open the **VLAN** folder and click the **Static VLAN Entry** link to open the following window:

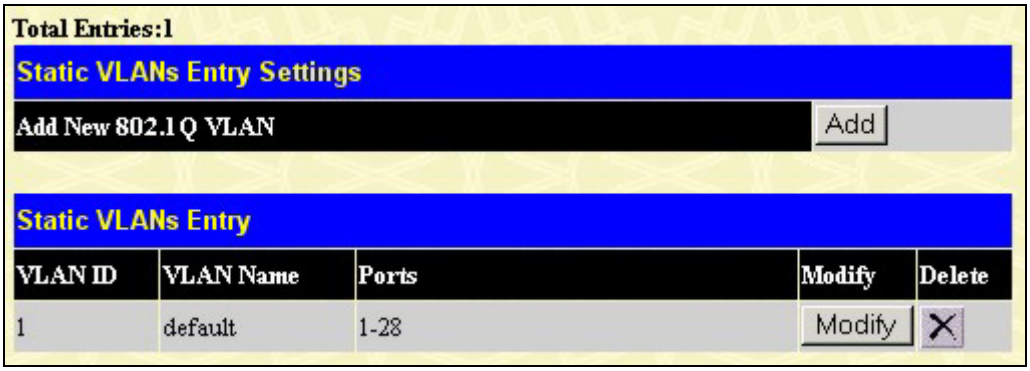


Figure 7- 4. Static VLANs Entry Settings window

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

To create a new 802.1Q VLAN, click the **Add** button in the **802.1Q Static VLANs** window. A new window will appear, as shown below, 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.

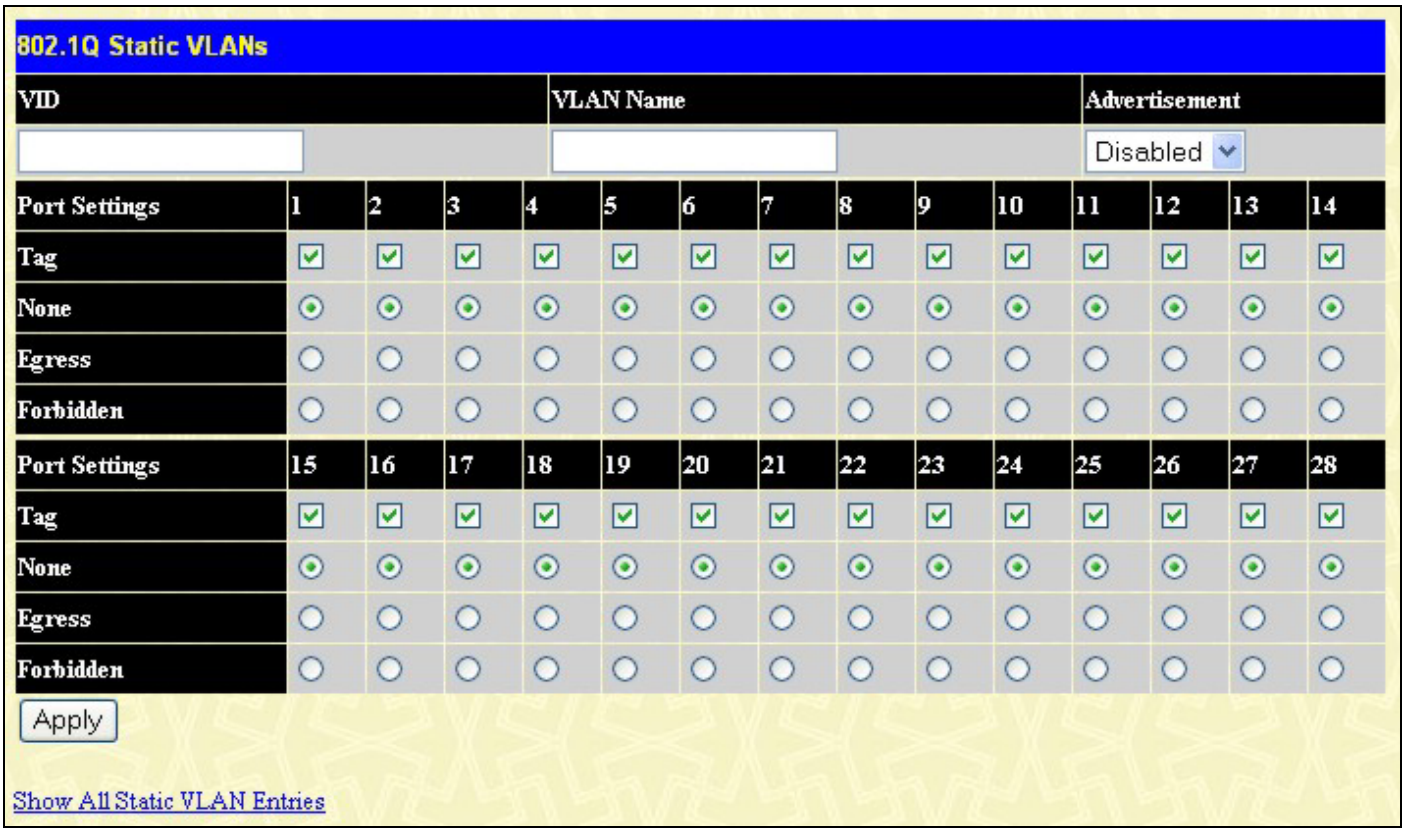


Figure 7- 5. 802.1Q Static VLANs window - Add

To return to the **Current 802.1Q Static VLANs Entries** window, click the Show All Static VLAN Entries link. To change an existing 802.1Q VLAN entry, click the **Modify** button of the corresponding entry you wish to modify. A new window will appear 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.

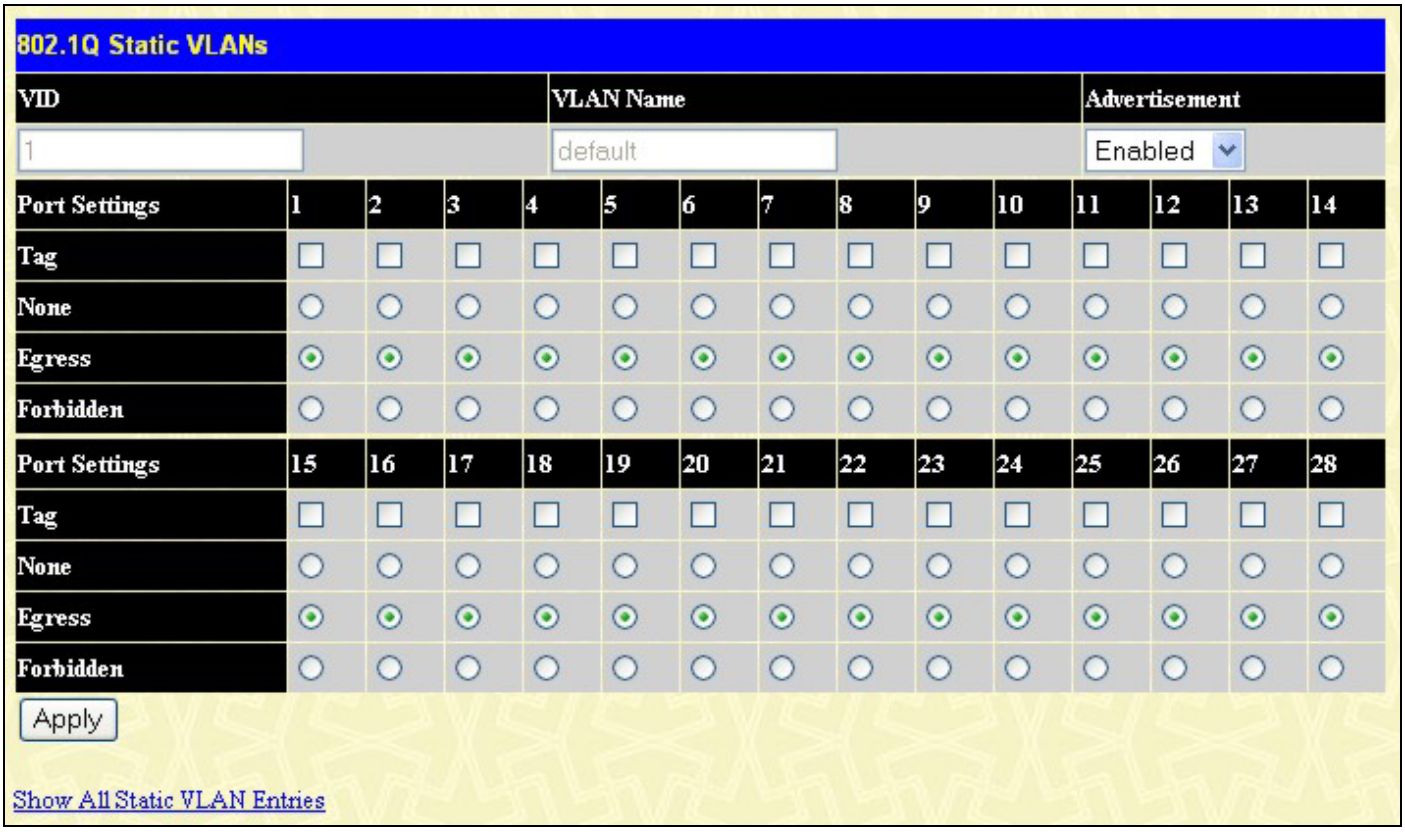


Figure 7- 6. 802.1Q Static VLANs window - Modify

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

Parameter	Description
VID	Allows the entry of a VLAN ID in the Add dialog box, or displays the VLAN ID of an existing VLAN in the Modify dialog box. VLANs can be identified by either the VID or the VLAN name.
VLAN Name	Allows the entry of a name for the new VLAN in the Add dialog box, or for editing the VLAN name in the Modify dialog box.
Port Settings	Allows an individual port to be specified as member of a VLAN.
Tag	Specifies the port as either 802.1Q tagging or 802.1Q untagged. Checking the box will designate the port as Tagged.
None	Allows an individual port to be specified as a non-VLAN member.
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.

Click **Apply** to implement changes made. Click the Show All Static VLAN Entries link to return to the **802.1Q Static VLANs** window.

GVRP Settings

In the **L2 Features** folder, open the **VLAN** folder and click **GVRP Settings**. The **GVRP Settings** window, shown left, allows you to determine whether the Switch will share its VLAN configuration information with other GARP VLAN Registration Protocol (GVRP) enabled switches. In addition, Ingress Checking can be used to limit traffic by filtering incoming packets whose PVID does not match the PVID of the port. Results can be seen in the table under the configuration settings, as seen below.

The following fields can be set:

Parameter	Description
From/To	These two fields allow you to specify the range of ports that will be included in the Port-based VLAN that you are creating using the **802.1Q Port Settings** window.
GVRP	The Group VLAN Registration Protocol (GVRP) enables the port to dynamically become a member of a VLAN. GVRP is *Disabled* by default.
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.
PVID	The read-only field in the 802.1Q Port Table shows the current PVID assignment for each port, which may be manually assigned to a VLAN when created in the 802.1Q Port Settings table. The Switch's default is to assign all ports to the default VLAN with a VID of 1. The PVID is used by the port to tag outgoing, untagged packets, and to make filtering decisions about incoming packets. If the port is specified to accept only tagged frames - as tagging, and an untagged packet is forwarded to the port for transmission, the port will add an 802.1Q tag using the PVID to write the VID in the tag. When the packet arrives at its destination, the receiving device will use the PVID to make VLAN forwarding decisions. If the port receives a packet, and Ingress filtering is enabled, the port will compare the VID of the incoming packet to its PVID. If the two are unequal, the port will drop the packet. If the two are equal, the port will receive the packet.
Acceptable Frame Type	This field denotes the type of frame that will be accepted by the port. The user may choose between *Tagged Only*, which means only VLAN tagged frames will be accepted, and *Admit_All*, which mean both tagged and untagged frames will be accepted. *Admit_All* is enabled by default.

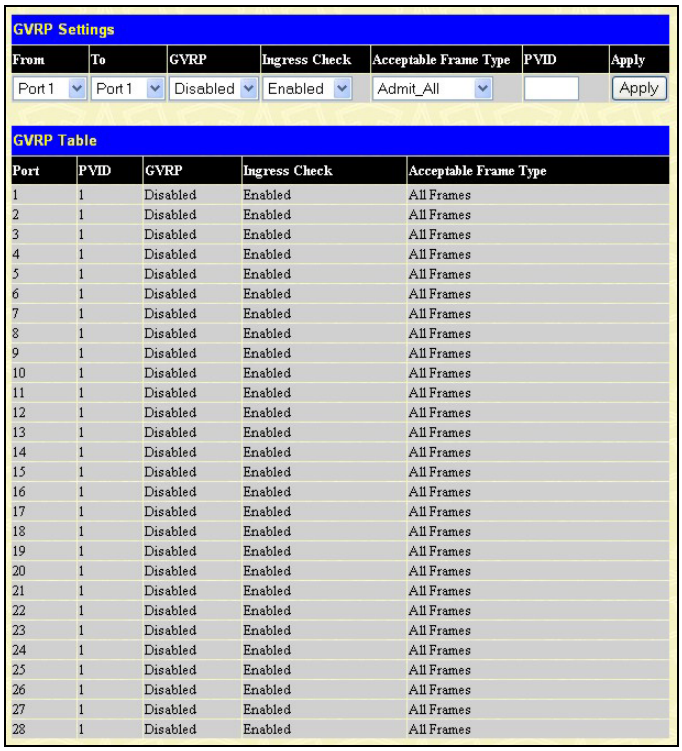


Figure 7- 7. GVRP Settings window

Click **Apply** to implement changes made.

Trunking

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

The Switch supports up to six port trunk groups with 2 to 8 ports in each group. A potential bit rate of 800 Mbps can be achieved.

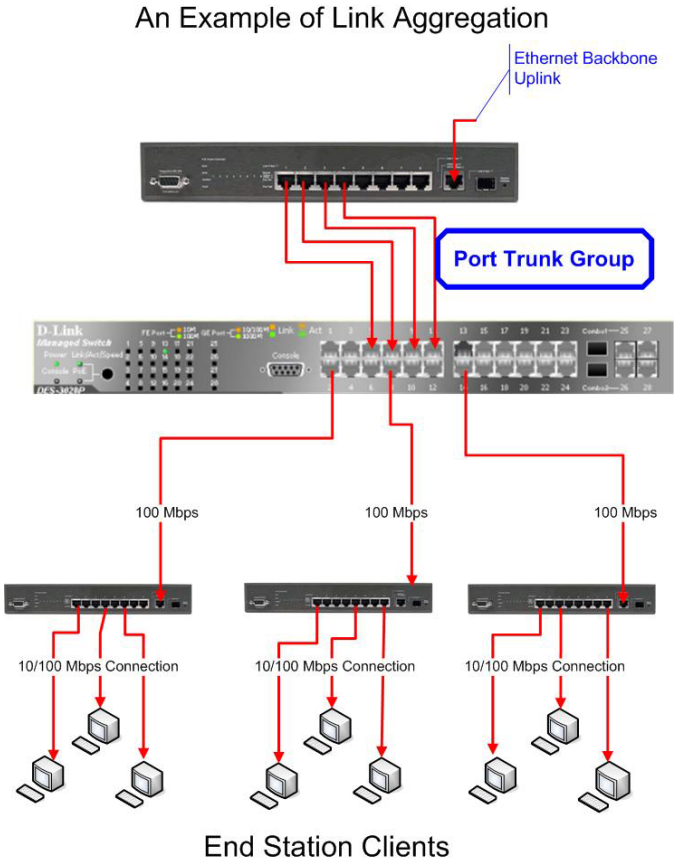


Figure 7- 8. Example of Port Trunk Group

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.

Link Aggregation

To configure port trunking, click **L2 Features > Trunking > Link Aggregation** to bring up the following window:

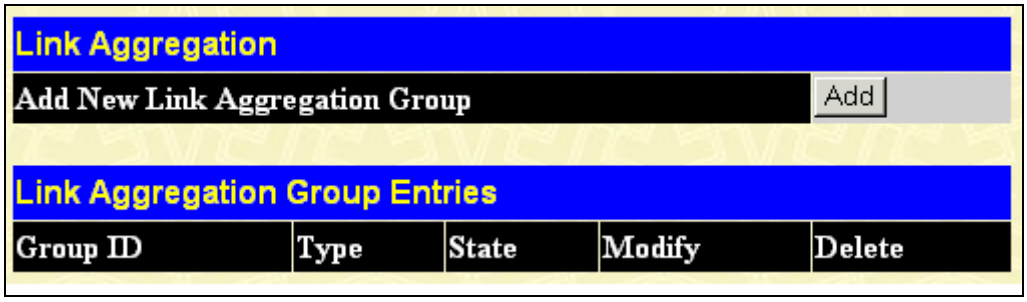


Figure 7- 9. Link Aggregation window

To configure port trunk groups, click the **Add** button to add a new trunk group and use the **Port Trunking Configuration** menu (see example below) to set up trunk groups. To modify a port trunk group, click the hyperlinked group number corresponding to the entry you wish to alter. To delete a port trunk group, click the corresponding  under the **Delete** heading in the **Link Aggregation Group Entries** table (at the bottom of the **Link Aggregation** window).

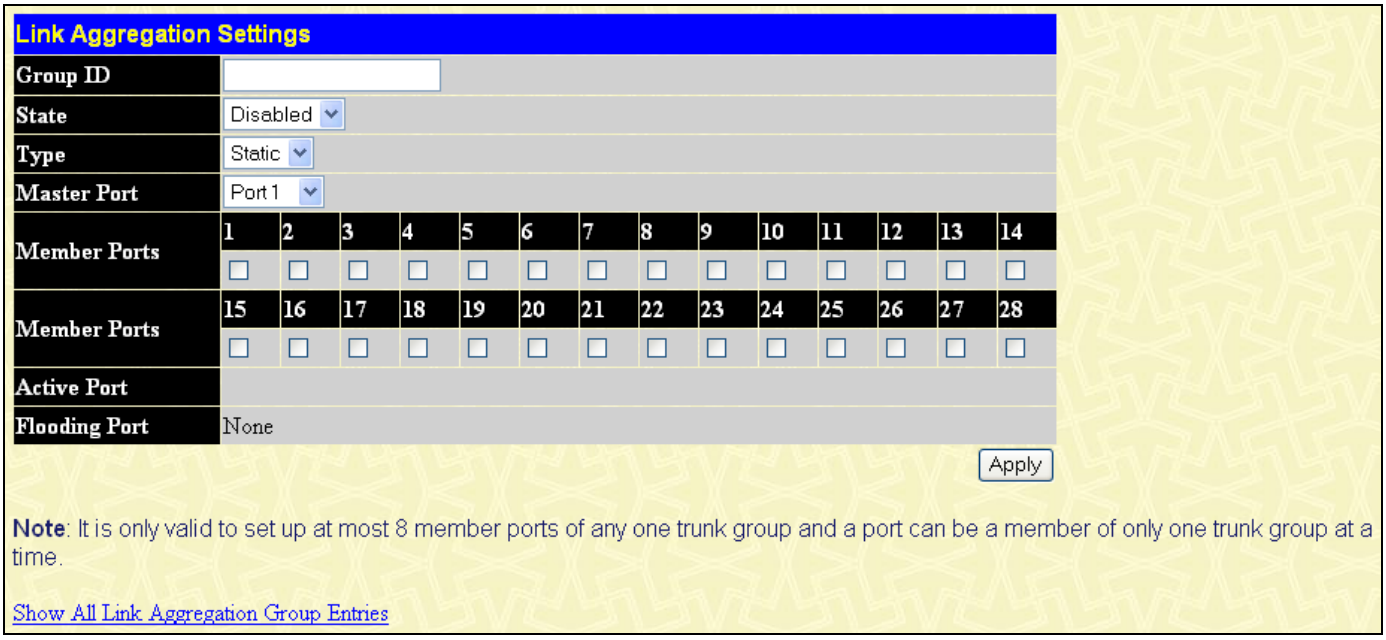


Figure 7- 10. Link Aggregation Settings window – Add

LACP Port Settings

To configure Link Aggregation Control Protocol port trunking, click **L2 Features > Trunking > LACP Port Settings** to bring up the **Port Link Aggregation Group** table:

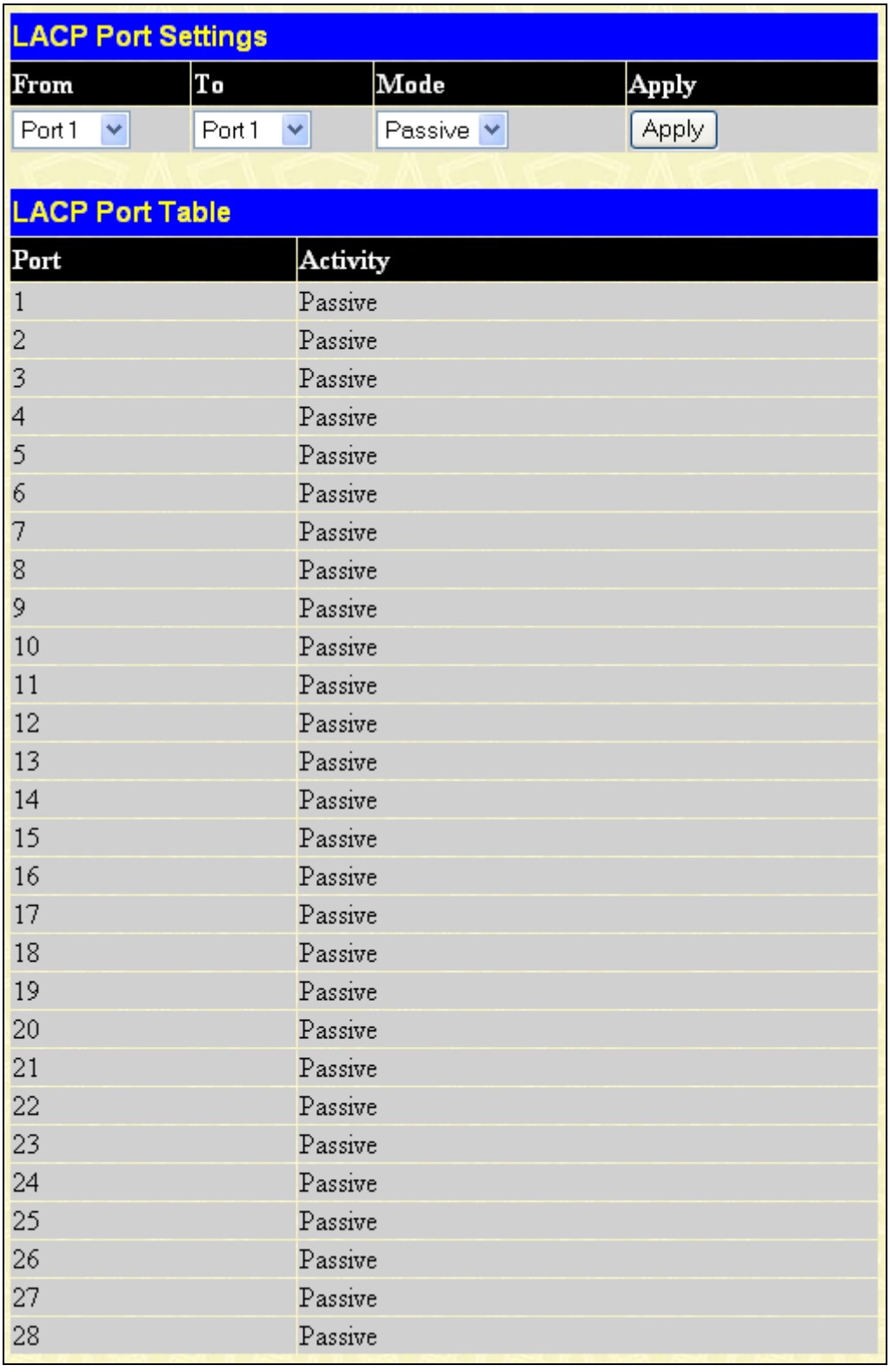


Figure 7- 11. LACP Port Settings window

To configure LACP port trunk settings, select a port range using the **From** and **To** drop-down menus, select either *Passive* or *Active* **Mode**, and then click **Apply** to let your changes take effect.

IGMP Snooping

Internet Group Management Protocol (IGMP) snooping allows the Switch to recognize IGMP queries and reports sent between network stations or devices and an IGMP host. When enabled for IGMP snooping, the Switch can open or close a port to a specific device based on IGMP messages passing through the Switch.

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** link in the **L2 Features** folder. 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. Use the **IGMP Snooping** window to view IGMP Snooping status. To modify settings, click the **Modify** button for the VLAN Name entry you want to change.

Use the **IGMP Snooping** window to view IGMP Snooping settings. To modify the settings, click the **Modify** button of the VLAN ID to change.

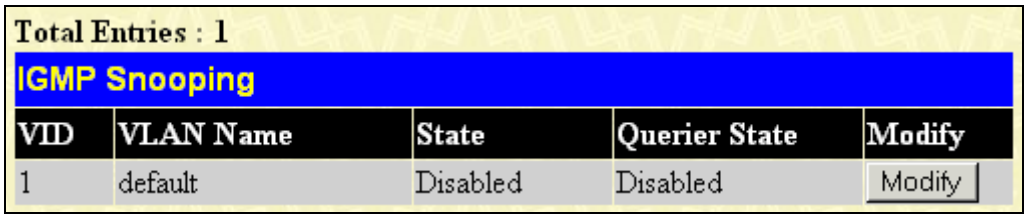


Figure 7- 12. IGMP Snooping window

Clicking the **Modify** button will open the **IGMP Snooping Settings** menu, shown below:

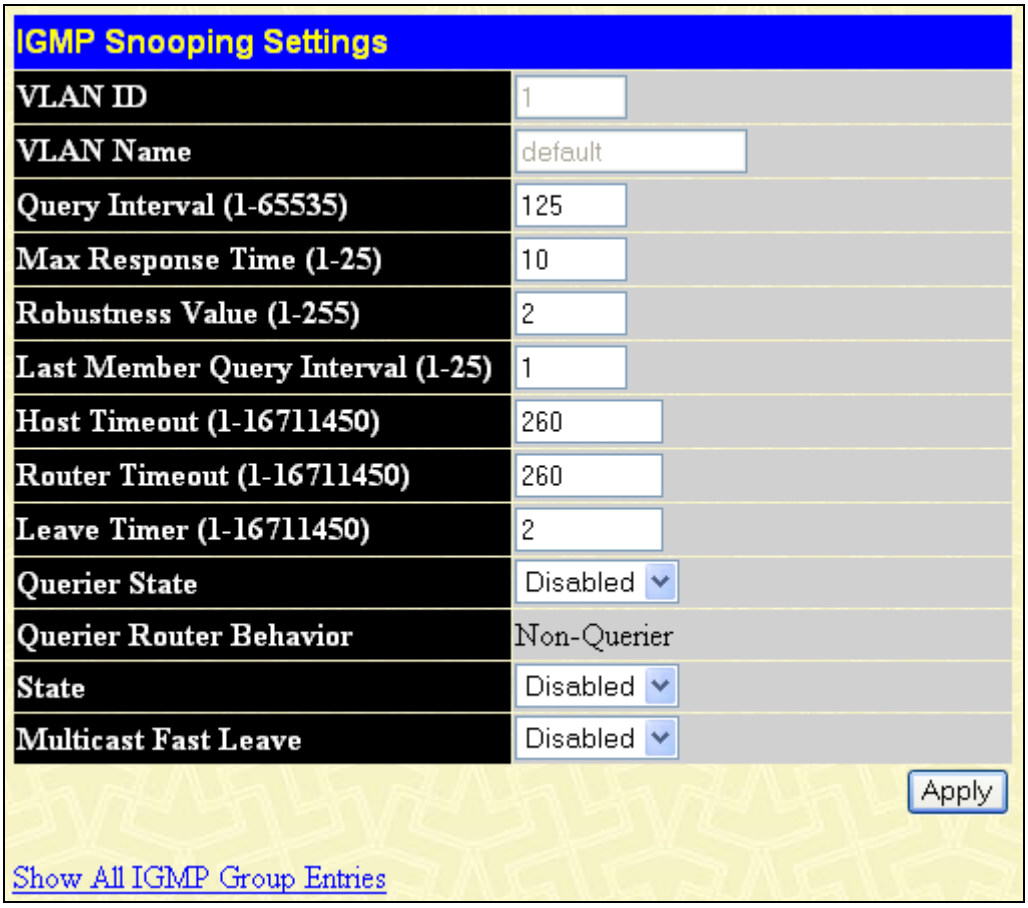


Figure 7- 13. IGMP Snooping Settings window

The following parameters may be viewed or modified:

Parameter	Description
VLAN ID	This is the VLAN ID that, along with the VLAN Name, identifies the VLAN for which to modify the IGMP Snooping Settings.

VLAN Name	This is the VLAN Name that, along with the VLAN ID, identifies the VLAN for which to modify the IGMP Snooping Settings.
Query Interval	This field is used to set the time (in seconds) between transmitting IGMP queries. Entries between *1* and *65535* seconds are allowed. Default = *125*.
Max Response Time	This determines the maximum amount of time in seconds allowed before sending an IGMP response report. This field allows an entry between *1* and *25* (seconds). Default = *10*.
Robustness Value	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 *1* to *255*. Default = *2*.
Last Member Query Interval	This field specifies the maximum amount of time between group-specific query messages, including those sent in response to leave group messages. Default = *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. Default = *260*.
Router Timeout	This is the maximum amount of time in seconds a route is kept in the forwarding table without receiving a membership report. Default = *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 or *Disabled* to disable. The default 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 field is *Disabled* by default.
Multicast Fast Leave	This parameter allows the user to enable the *Fast Leave* function. *Enabled*, this function will allow members of a multicast group to leave the group immediately (without the implementation of the Last Member Query Timer) when an IGMP Leave Report Packet is received by the Switch. The default is *Disabled*.

Click **Apply** to implement the new settings. Click the Show All IGMP Snooping Entries link to return to the **Current IGMP Snooping Group Entrie**s window.

NOTE: The Fast Leave function is intended for IGMPv2 users wishing to leave a multicast group and is best implemented on VLANs that have only one host connected to each port. When one host of a group of hosts uses the Fast Leave function, it may cause the inadvertent fast leave of other hosts of the group.

Static Router Ports Settings

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 a 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 or PIM-DM multicast packets are detected flowing into a port.

Open the **IGMP Snooping** folder and the click on the **Static Router Ports Settings** link to open the **Static Router Port Settings** window, as shown below.

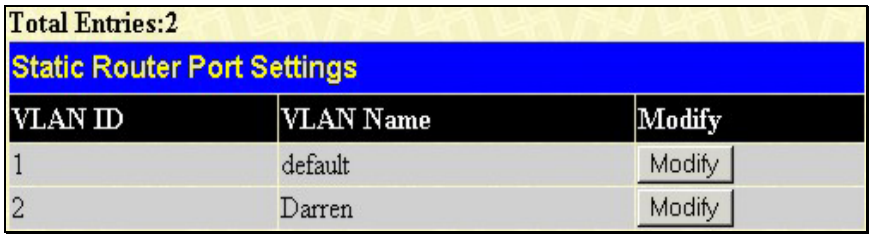


Figure 7- 14. Static Router Ports Settings window

The **Static Router Ports Settings** page (shown above) 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 following window:

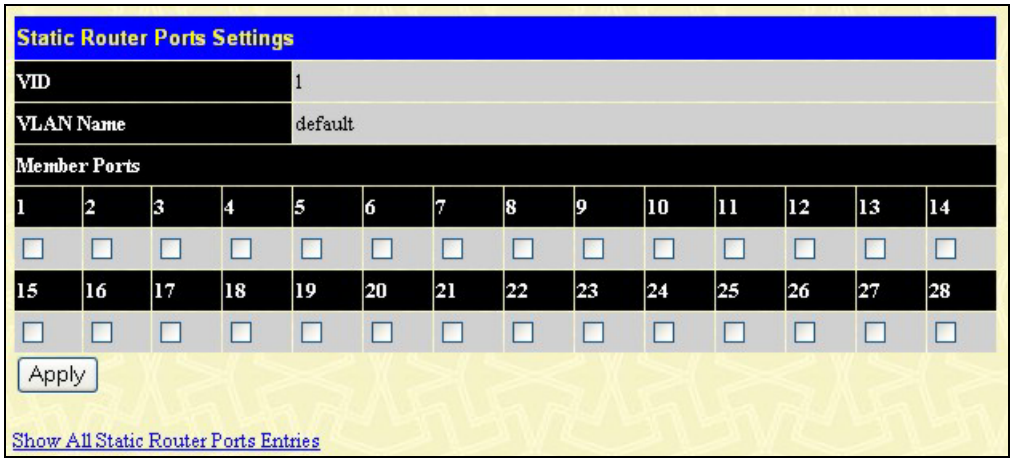


Figure 7- 15. Static Router Ports Settings - Edit window

The following parameters can be set:

Parameter	Description
VID (VLAN ID)	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.
Member Ports	These are the ports on the Switch that will have a multicast router attached to them.

Click **Apply** to implement the new settings, Click the Show All Static Router Port Entries link to return to the **Current Static Router Port Entries** window.

Spanning Tree

This Switch supports three versions of the Spanning Tree Protocol; 802.1d STP, 802.1w Rapid STP and MSTP. 802.1d STP will be familiar to most networking professionals. However, since 802.1w RSTP 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 and 802.1w RSTP.

802.1w Rapid Spanning Tree

The Switch implements two versions of the Spanning Tree Protocol, 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. RSTP combines 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 port state discarding, there is no functional difference, the port is not active in the network topology. Table 6-2 below compares how the two 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 drawback of 802.1d is this absence of immediate feedback from adjacent bridges.

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

Table 7- 2. 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, all ports operating in full-duplex mode are considered to be P2P ports, unless manually overridden through configuration.

802.1d and 802.1w Compatibility

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 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.

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 LoopBack Prevention

When connected to other switches, STP is an important configuration in consistency for delivering packets to ports and can greatly improve the throughput of your switch. Yet, even this function can malfunction with the emergence of STP BPDU packets that occasionally loopback to the Switch, such as BPDU packets looped back from an unmanaged switch connected to the DES-3028P. To maintain the consistency of the throughput, the DES-3028P now implements the STP LoopBack prevention function.

When the STP LoopBack Detection function is enabled, the Switch will be protected against a loop occurring between switches. Once a BPDU packet returns to the Switch, this function will detect that there is an anomaly occurring and will place the receiving port in an error-disabled state. Consequentially, a message will be placed in the Switch's Syslog and will be defined there as "BPDU Loop Back on Port #".

Setting the LoopBack Timer

The LoopBack timer plays a key role in the next step the switch will take to resolve this problem. Choosing a non-zero value on the timer will enable the Auto-Recovery Mechanism. When the timer expires, the Switch will again look for its returning BPDU packet on the same port. If no returning packet is received, the Switch will recover the port as a Designated Port in the Discarding State. If another returning BPDU packet is received, the port will remain in a blocked state, the timer will reset to the specified value, restart, and the process will begin again.

For those who choose not to employ this function, the LoopBack Recovery time must be set to zero. In this case, when a BPDU packet is returned to the Switch, the port will be placed in a blocking state and a message will be sent to the Syslog of the switch. To recover the port, the administrator must disable the state of the problematic port and enable it again. This is the only method available to recover the port when the LoopBack Recover Time is set to 0.

Regulations and Restrictions for the LoopBack Detection Function

- All versions of STP (STP and RSTP) can enable this feature.
- May be configured globally (STP Global Bridge Settings).
- Neighbor switches of the Switch must have the capability to forward BPDU packets. Switches the fail to meet this requirement will disable this function for the port in question on the Switch.
- The default setting for this function is disabled.
- The default setting for the LoopBack timer is 60 seconds.
- This setting will only be operational if the interface is STP-enabled.

The LoopBack Detection feature can only prevent BPDU loops on designated ports. It can detect a loop condition occurring on the user's side connected to the edge port, but it cannot detect the LoopBack condition on the elected root port of STP on another switch

STP Bridge Global Settings

To open the following window, open **Spanning Tree** in the **L2 features** folder and click the **STP Bridge Global Settings** link.

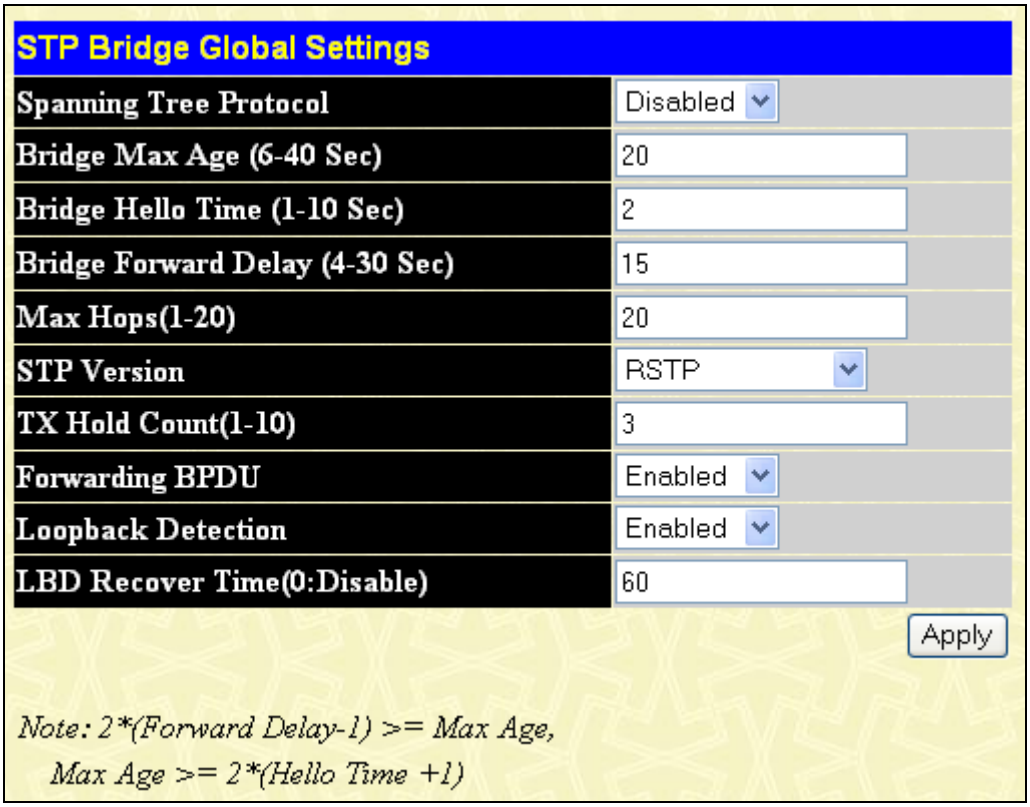


Figure 7- 16. STP Bridge Global Settings window

The following parameters can be set:

Parameter	Description
Spanning Tree Protocol	Use the pull-down menu to enable or disable STP globally on the Switch. The default is *Disabled*.
Bridge 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*.
Bridge 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.
Bridge 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 BPDU 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*.

STP Version	Use the pull-down menu to choose the desired version of STP to be implemented on the Switch. There are two choices: *STPCompatability* - 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
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.
Loopback Detection	This feature is used to temporarily block STP on the Switch when a BPDU packet has been looped back to the switch. When the Switch detects its own BPDU packet coming back, it signifies a loop on the network. STP will automatically be blocked and an alert will be sent to the administrator. The LBD STP port will restart (change to discarding state) when the Loopback Detection Recover Time times out. The user may enable or disable this function using the pull-down menu.
LBD Recover Time (0:Disable)	This field will set the time the STP port will wait before recovering the STP state set. 0 will denote that the LBD will never time out or restart until the administrator personally changes it. The user may also set a time between *60* and *1000000* seconds. The default is *60* seconds.

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)

STP Port Settings

STP can be set up on a port per port basis. To view the following window click **L2 Features > Spanning Tree > STP Port Settings**:

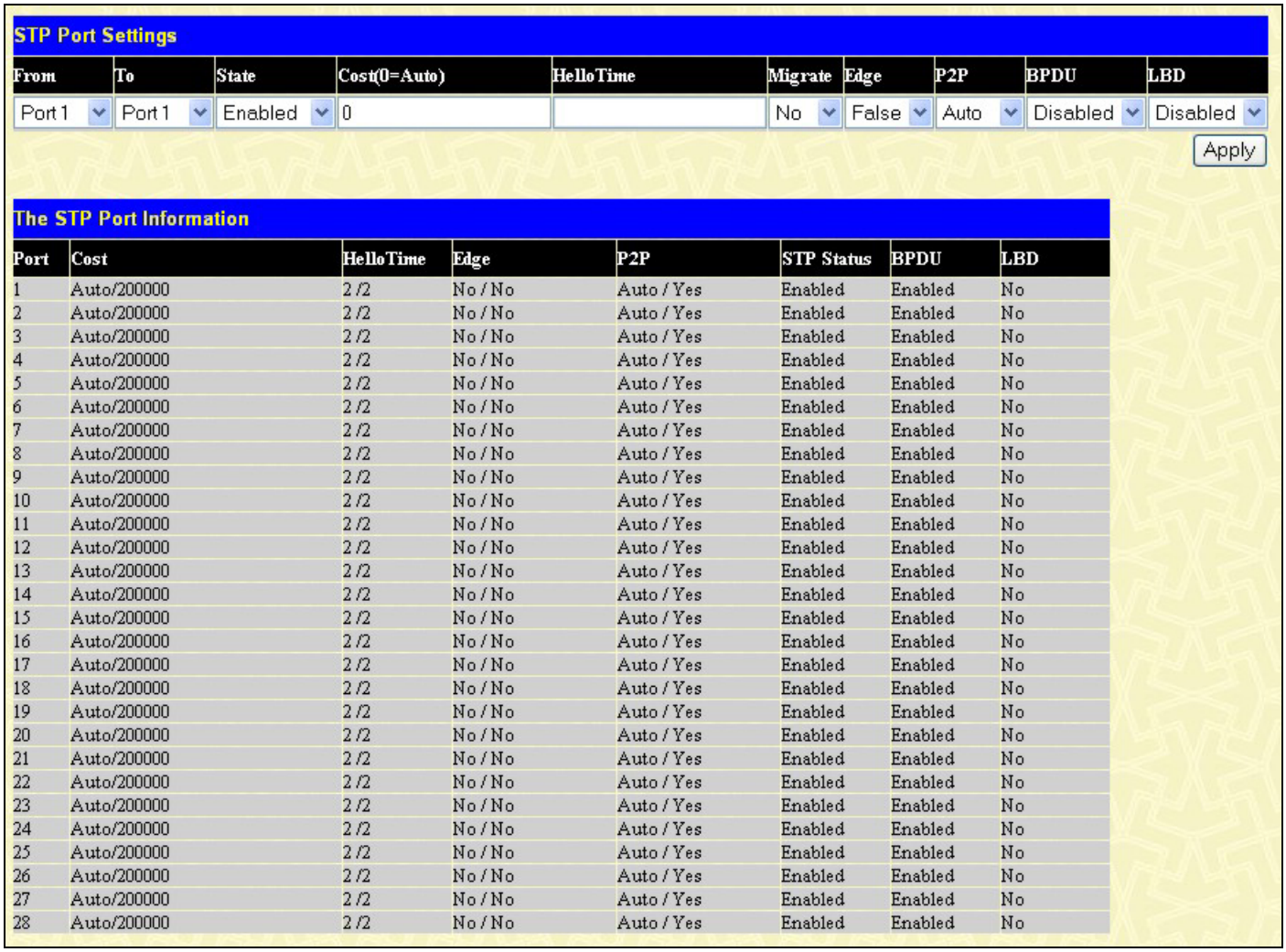


Figure 7- 17. STP Port Settings window

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
From/To	A consecutive group of ports may be configured starting with the selected port.
State	Toggle from *Disabled* to *Enabled* to implement BPDU packet forwarding.
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 1-2000000* - Define a value between *1* and *2000000* to determine the external cost. The lower the number, the greater the probability the port will be chosen to forward packets.
Hello Time	This 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.
Migrate	Setting this parameter as *Yes* will set the ports to send out BPDU 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. Migration should be set as yes on ports connected to network stations or segments that are capable of being upgraded to 802.1w RSTP 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*.
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*.
LBD	Use the pull-down menu to enable or disable the loop-back detection function on the Switch for the ports configured above. For more information on this function, see the **STP LoopBack Prevention** section.

Click **Apply** to implement changes made.

MST Configuration Identification

The following windows in the **MST Configuration Identification** section 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 **L2 Features > Spanning Tree > MST Configuration Identification:**

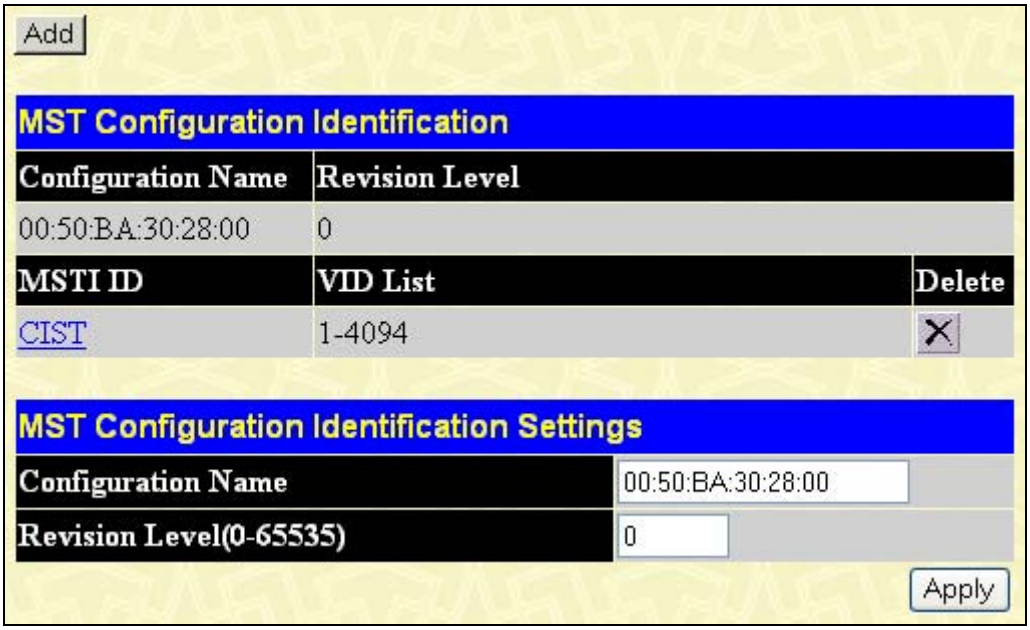


Figure 7- 18. MST Configuration Identification window

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. This field can be set in the **STP Bridge Global Settings** window.
Revision Level	This value, along with the Configuration Name will identify the MSTP region configured on the Switch. The user may choose a value between *0* and *65535* with a default setting of *0*.
MSTI ID	This field shows the MSTI IDs 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.

Clicking the **Add** button will reveal the following window to configure:

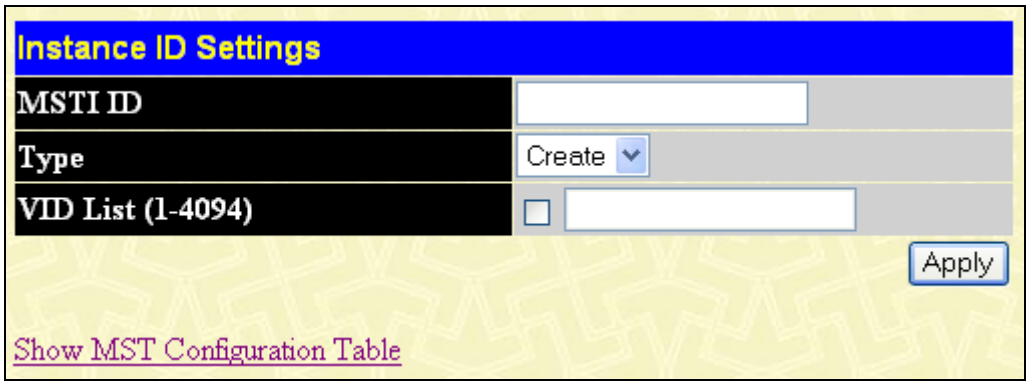


Figure 7- 19. Instance ID Settings window – Add

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

Parameter	Description
MSTI ID	Enter a number between *1* and *4 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 name in the **MST Configuration Identification** window, which will reveal the following window to configure:

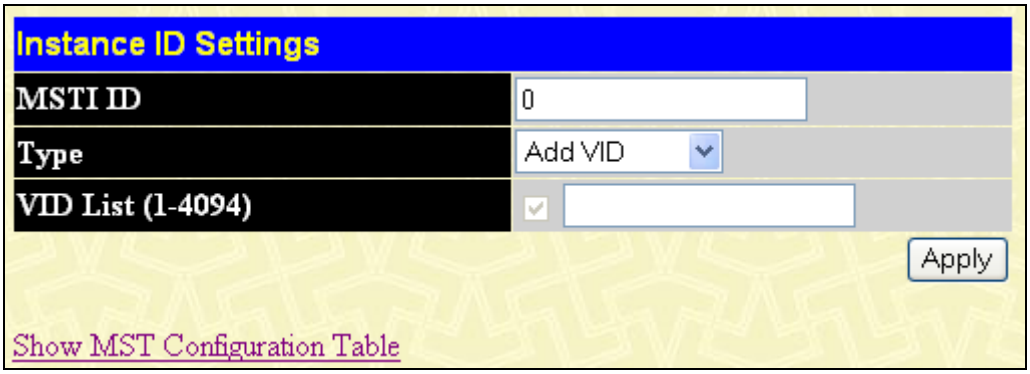


Figure 7- 20. Instance ID Settings window - CIST modify

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*. This field is inoperable when configuring the CIST.

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 window for configuration.

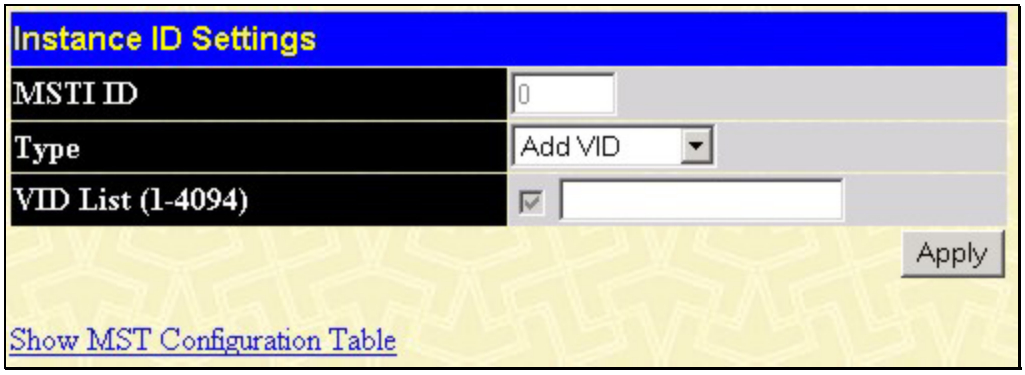


Figure 7- 21. Instance ID Settings window – modify

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 four choices. • *Add* - Select this parameter to add VIDs to the MSTI ID, in conjunction with the VID List parameter. • Remove - 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.

STP Instance Settings

The following window displays MSTIs currently set on the Switch. To view the following table, click **L2 Features > Spanning Tree > STP Instance Settings**:

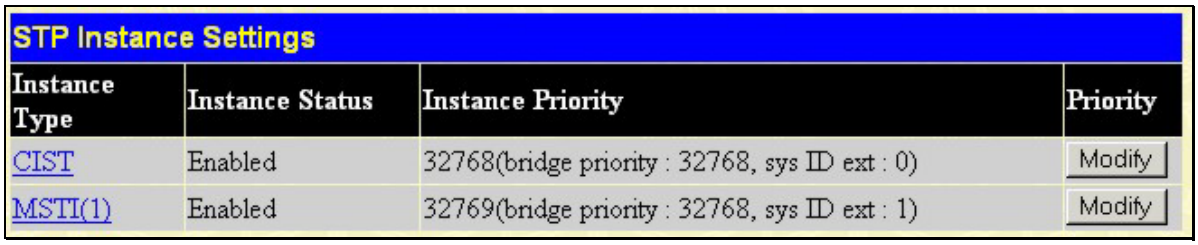


Figure 7- 22. STP Instance Settings window

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 ID. The lowest priority will be the root bridge.

Click **Apply** to implement changes made.

Click the **Modify** button to change the priority of the MSTI. This will open the **Instance ID Settings** window to configure.

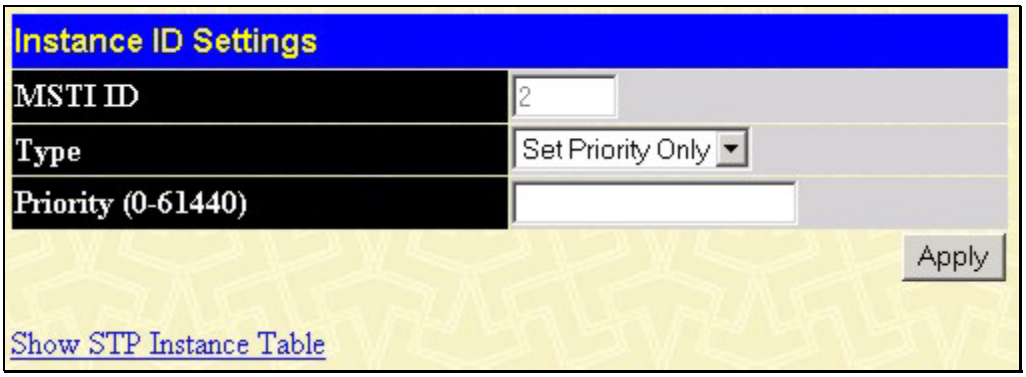


Figure 7- 23. Instance ID Settings - modify priority window

The following parameters can be viewed or set:

Parameter	Description
MSTI ID	Displays the MSTI ID of the instance being modified. An entry of 0 in this field denotes the CIST (default MSTI)

	CIST (default MSTI).
Type	The Type field in this window will be permanently set to *Set Priority Only*.
Priority (0-61440)	Enter the new priority in the Priority field. The user may set a priority value between 0-61440.

Click **Apply** to implement the new priority setting.

MSTP Port Information

This window displays the current MSTP Port Information 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 MAC address 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 **L2 Features > Spanning Tree > MSTP Port Information**:

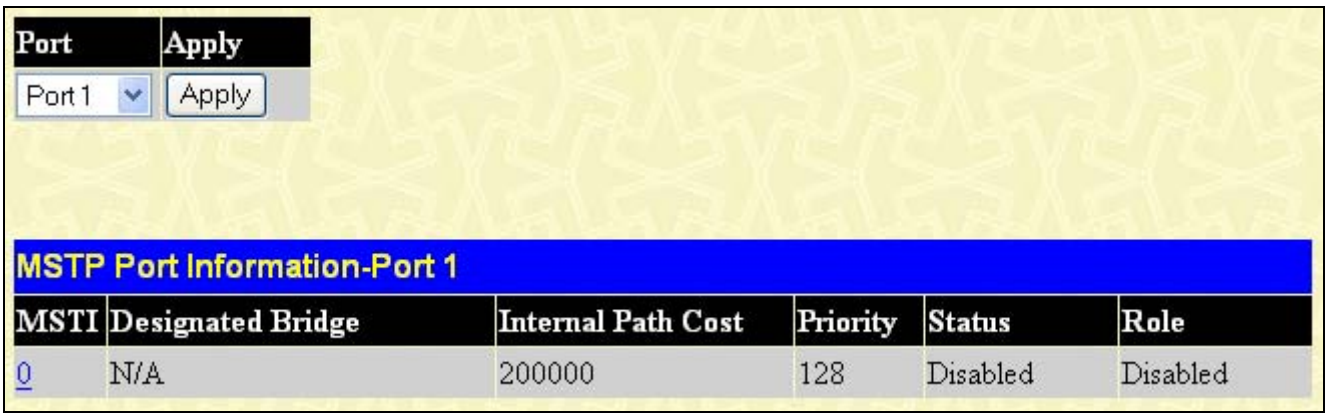


Figure 7- 24. MSTP Port Information window

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

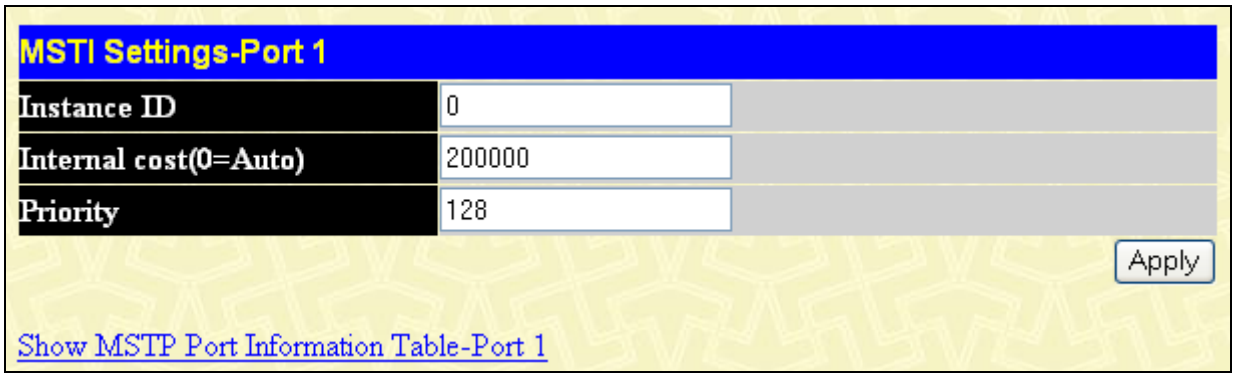


Figure 7- 25. MSTI Settings window

The following parameters can be viewed or set:

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 (0=Auto)	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* to *2000000* 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.

Click **Apply** to implement changes made.

Section 8

CoS

The Switch supports 802.1p priority queuing Quality of Service. The following section discusses the implementation of CoS (Quality of Service) and benefits of using 802.1p priority queuing.

Understanding IEEE 802.1p Priority

Priority tagging is a function defined by the IEEE 802.1p standard designed to provide a means of managing traffic on a network where many different types of data may be transmitted simultaneously. It is intended to alleviate problems associated with the delivery of time critical data over congested networks. The quality of applications that are dependent on such time critical data, such as video conferencing, can be severely and adversely affected by even very small delays in transmission.

Network devices that are in compliance with the IEEE 802.1p standard have the ability to recognize the priority level of data packets. These devices can also assign a priority label or tag to packets. Compliant devices can also strip priority tags from packets. This priority tag determines the packet's degree of expeditiousness and determines the queue to which it will be assigned.

Priority tags are given values from 0 to 7 with 0 being assigned to the lowest priority data and 7 assigned to the highest. The highest priority tag 7 is generally only used for data associated with video or audio applications, which are sensitive to even slight delays, or for data from specified end users whose data transmissions warrant special consideration.

The Switch allows you to further tailor how priority tagged data packets are handled on your network. Using queues to manage priority tagged data allows you to specify its relative priority to suit the needs of your network. There may be circumstances where it would be advantageous to group two or more differently tagged packets into the same queue. Generally, however, it is recommended that the highest priority queue, Queue 3, be reserved for data packets with a priority value of 7. Packets that have not been given any priority value are placed in Queue 0 and thus given the lowest priority for delivery.

A weighted round robin system is employed on the Switch to determine the rate at which the queues are emptied of packets. The ratio used for clearing the queues is 4:1. This means that the highest priority queue, Queue 3, will clear 4 packets for every 1 packet cleared from Queue 0.

Remember, the priority queue settings on the Switch are for all ports, and all devices connected to the Switch will be affected. This priority queuing system will be especially beneficial if your network employs switches with the capability of assigning priority tags.

Advantages of CoS

CoS 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 Switch implements basic 802.1P priority queuing.

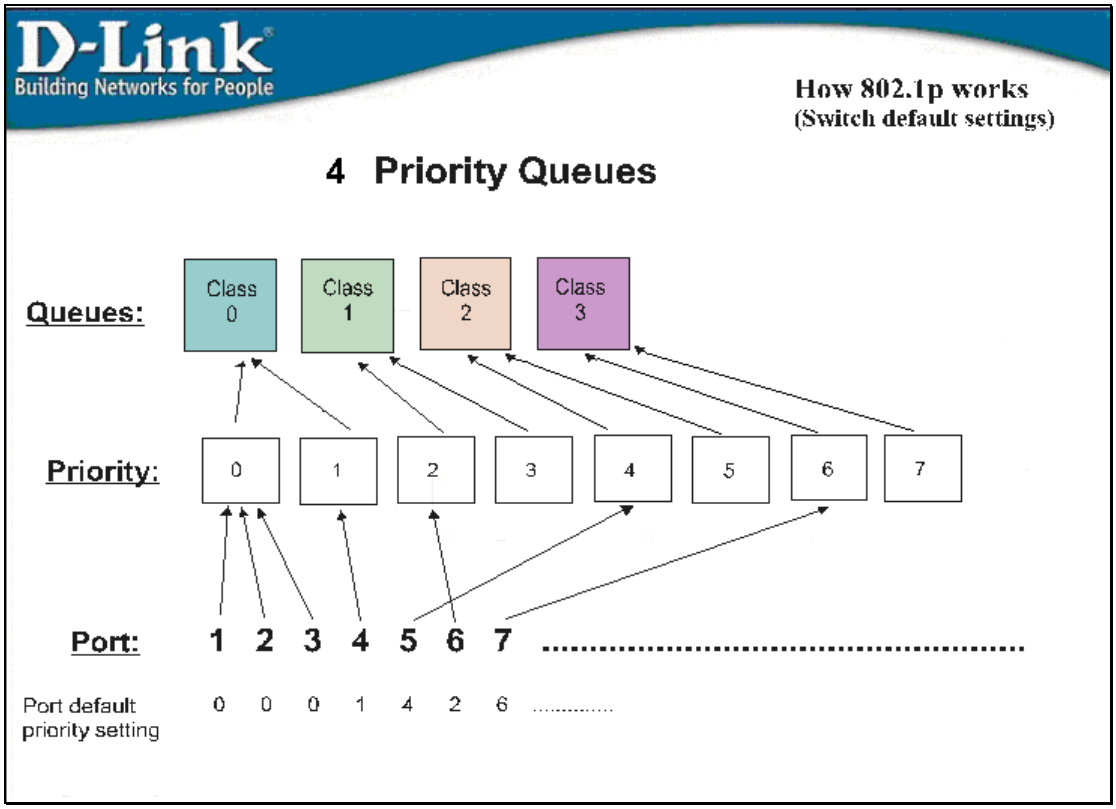


Figure 8- 1. An Example of the Default CoS Mapping on the Switch

The picture above shows the default priority setting for the Switch. Class-3 has the highest priority of the four priority classes of service on the Switch. In order to implement CoS, 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 CoS

The Switch has four priority classes of service. These priority classes of service are labeled as 3, 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 Q1 class.
- Priority 1 is assigned to the Switch's Q0 class.
- Priority 2 is assigned to the Switch's Q0 class.
- Priority 3 is assigned to the Switch's Q1 class.
- Priority 4 is assigned to the Switch's Q2 class.
- Priority 5 is assigned to the Switch's Q2 class.
- Priority 6 is assigned to the Switch's Q3 class.
- Priority 7 is assigned to the Switch's Q3 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 eight 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 Switch has four configurable priority queues (and four Classes of Service) for each port on the Switch.

Port Bandwidth

The bandwidth control settings are used to place a ceiling on the transmitting and receiving data rates for any selected port. In the **L2 Features** folder, click **CoS > Port Bandwidth**, to view the window shown below.

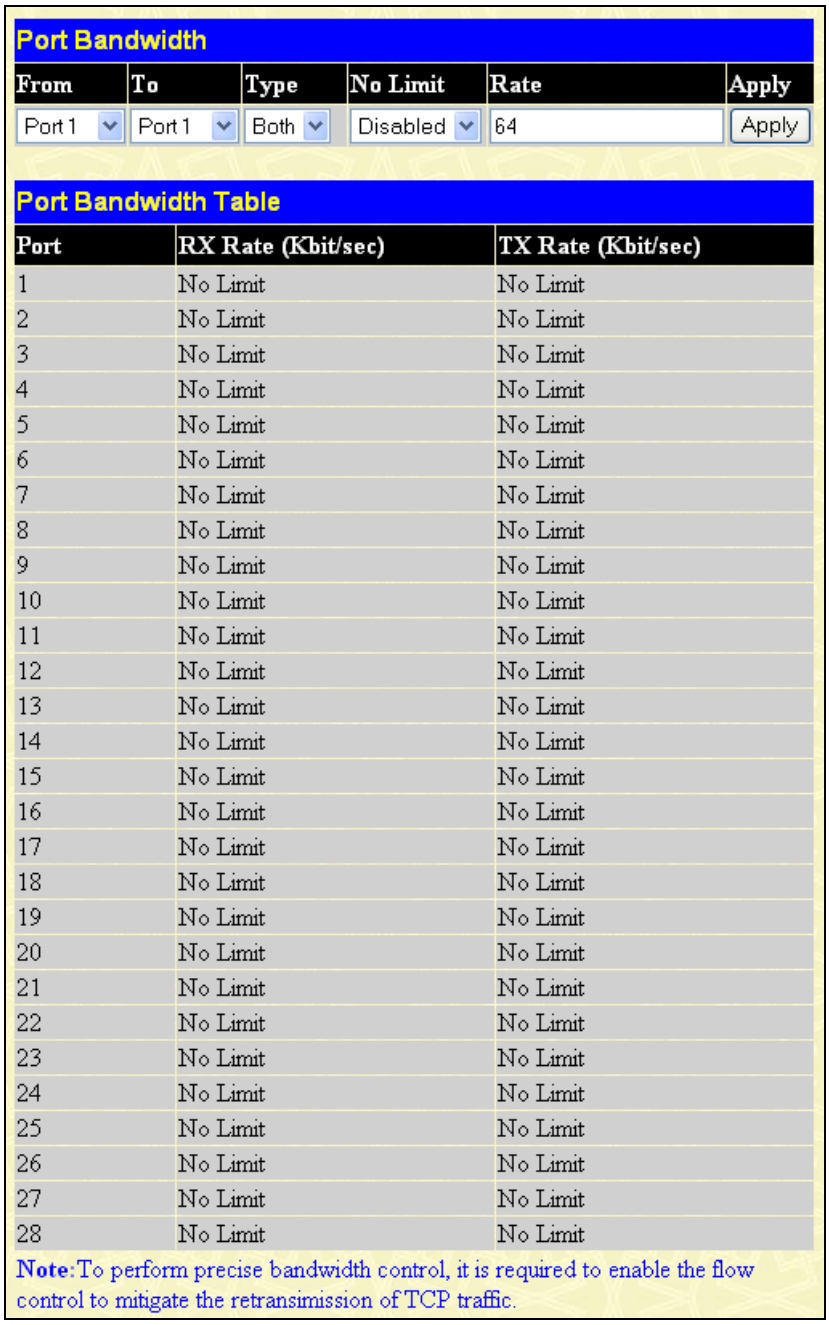


Figure 8- 2. Port Bandwidth window

The following parameters can be set or are displayed:

Parameter	Description
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 Kbit/s, that will be the limit for the selected port. The user may choose a rate between 64 and 1024000 Kbit/s.

Click **Apply** to set the bandwidth control for the selected ports. Results of configured **Bandwidth Settings** will be displayed in the **Port Bandwidth Table**.

802.1p Default Priority

The Switch allows the assignment of a default 802.1p priority to each port on the Switch. In the **CoS** folder, click **802.1p Default Priority**, to view the window shown below.

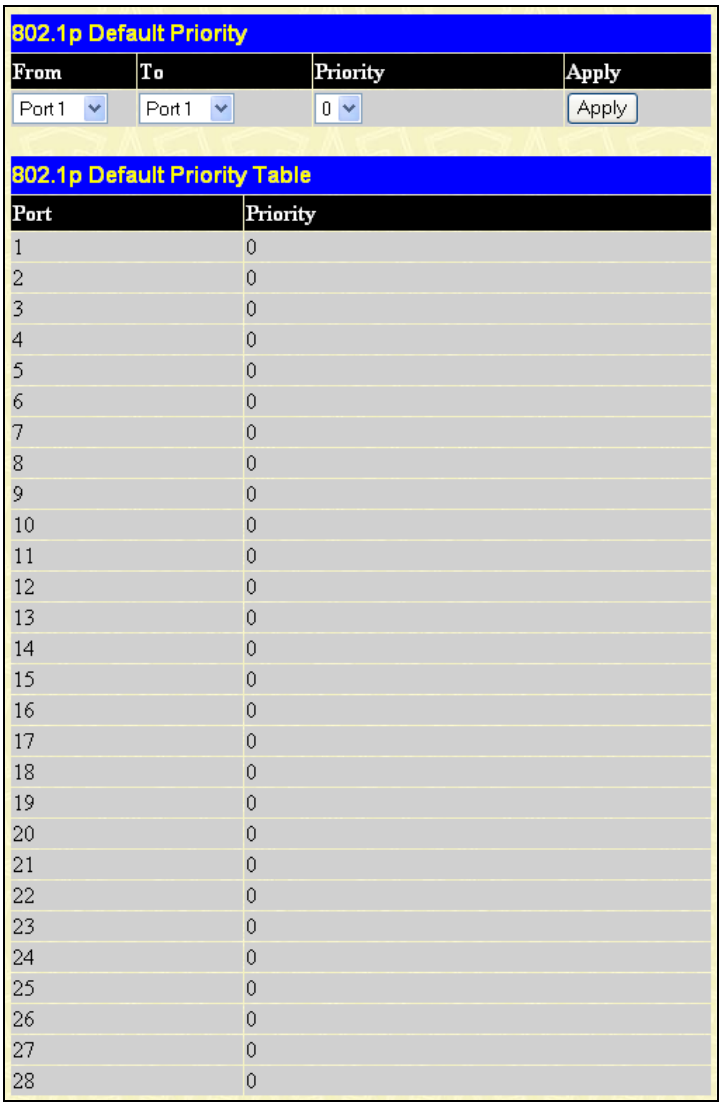


Figure 8- 3. 802.1p Default Priority window

This window allows you to assign a default 802.1p priority to any given port on the Switch. The priority tags are numbered from *0*, the lowest priority, to *7*, the highest priority. To implement a new default priority choose a port range by using the **From** and **To** pull-down menus and then insert a priority value, from *0* to *7* in the **Priority** field. Click **Apply** to implement your settings.

802.1p User Priority

When using 802.1p priority mechanism, the packet is examined for the presence of a valid 802.1p priority tag. If the tag is present, the packet is assigned to a programmable egress queue based on the value of the tagged priority. The tagged priority can be designated to any of the available queues.

The Switch allows the assignment of a class of service to each of the 802.1p priorities. In the **CoS** folder, click **802.1p User Priority** to view the window shown below.

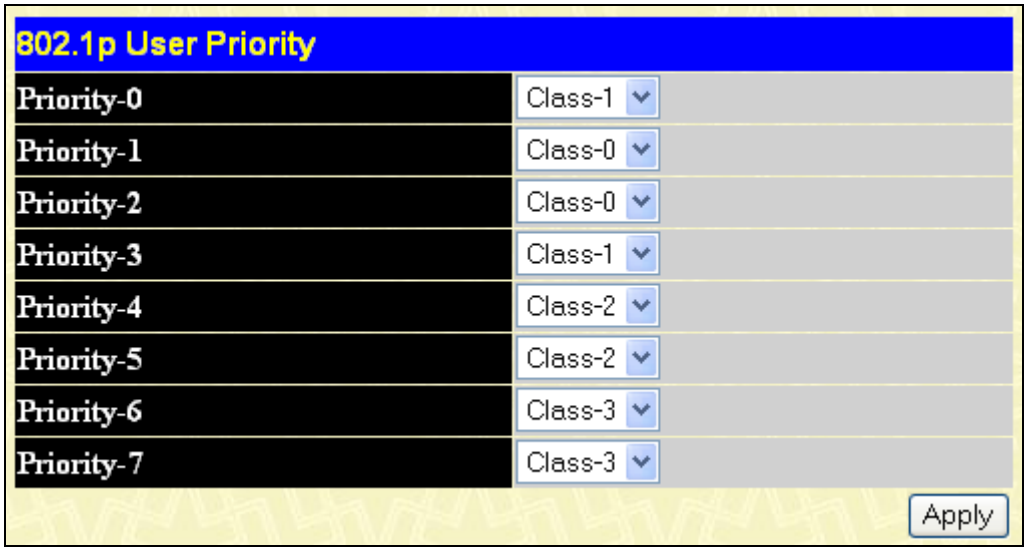


Figure 8- 4. 802.1p User Priority window

Once you have assigned a priority to the port groups on the Switch, you can then assign this Class to each of the four levels of 802.1p priorities. Click **Apply** to set your changes.

CoS Scheduling Mechanism

This drop-down menu allows you to select between a **Weight Fair** and a **Strict** mechanism for emptying the priority classes. In the **CoS** folder, click **CoS Scheduling Mechanism**, to view the window shown below.

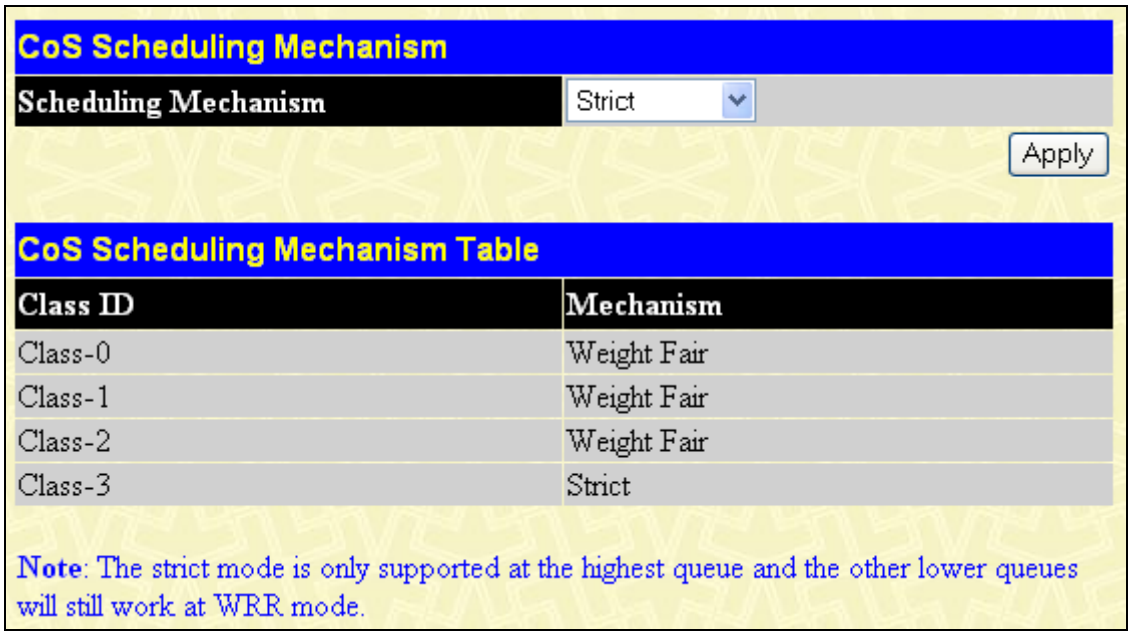


Figure 8- 5. CoS Scheduling Mechanism and CoS Scheduling Mechanism Table window

NOTICE: The default CoS scheduling arrangement is a strict priority schedule for the highest class (Class-3) which means the Switch will consider the highest class of service to have strict scheduling only, while the other queues empty in a round-robin method.

The Scheduling Mechanism has the following parameters.

Parameter	Description
Strict	Denoting a Strict scheduling will set the highest queue to be emptied first while the other queues will follow the weighted round-robin scheduling scheme.
Weight Fair	Use the weighted round-robin (*WRR*) algorithm to handle packets in an even distribution in priority classes of service.

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

CoS Output Scheduling

CoS can be customized by changing the output scheduling used for the hardware classes of service in the Switch. As with any changes to CoS implementation, careful consideration should be given to how network traffic in lower priority classes of service is 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 CoS settings are not suitable. In the **CoS** folder, click **CoS Output Scheduling,** to view the window shown below.

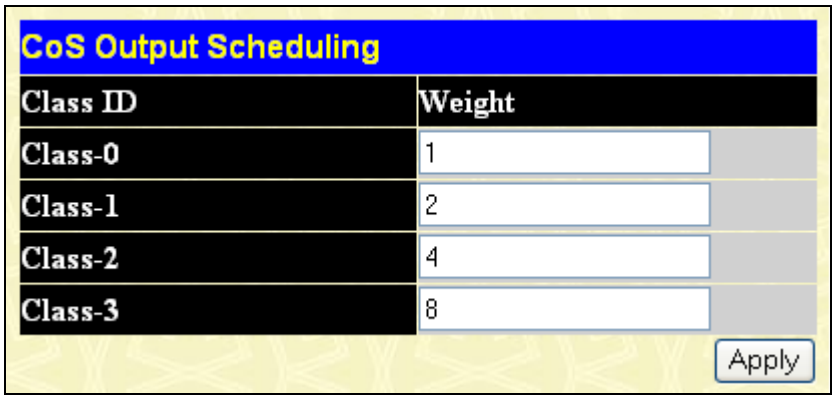


Figure 8- 6. CoS Output Scheduling window

Click **Apply** to implement changes made.

Priority Settings

Priority Settings can be specified on this window. Select a port range using the **From** and **To** drop-down menus and select a **Type** from the drop-down menu**,** *Port Mapping*, *802.1p*, *MAC Mapping*, *TOS*, *DSCP*, or *None*.

In the **CoS** folder, click **Priority Settings,** to view the window shown below:

Priority Settings

From	To	Type	Apply
Port 1	Port 1	None	Apply

Priority Settings Table

Port	Port Priority	Ethernet Priority	IP Priority
1	off	802.1p	off
2	off	802.1p	off
3	off	802.1p	off
4	off	802.1p	off
5	off	802.1p	off
6	off	802.1p	off
7	off	802.1p	off
8	off	802.1p	off
9	off	802.1p	off
10	off	802.1p	off
11	off	802.1p	off
12	off	802.1p	off
13	off	802.1p	off
14	off	802.1p	off
15	off	802.1p	off
16	off	802.1p	off
17	off	802.1p	off
18	off	802.1p	off
19	off	802.1p	off
20	off	802.1p	off
21	off	802.1p	off
22	off	802.1p	off
23	off	802.1p	off
24	off	802.1p	off
25	off	802.1p	off
26	off	802.1p	off
27	off	802.1p	off
28	off	802.1p	off

Figure 8- 7. Priority Settings window

Click **Apply** to implement changes made.

TOS Priority Settings

When using the TOS/DSCP priority mechanism, the packet is classified based on the TOS/DSCP field in the IP header. If the tag is present, the packet is assigned to a programmable egress queue based on the value of the tagged priority. The tagged priority can be designated to any of the available queues. When TOS is set to enable, DSCP cannot be used, and when DSCP is set to enable, TOS cannot be used.

TOS Priority Settings can be specified on this window. Use the drop-down menus to select a value for **TOS** and **Class ID**.

In the **CoS** folder, click **TOS Priority Settings,** to view the window shown below:

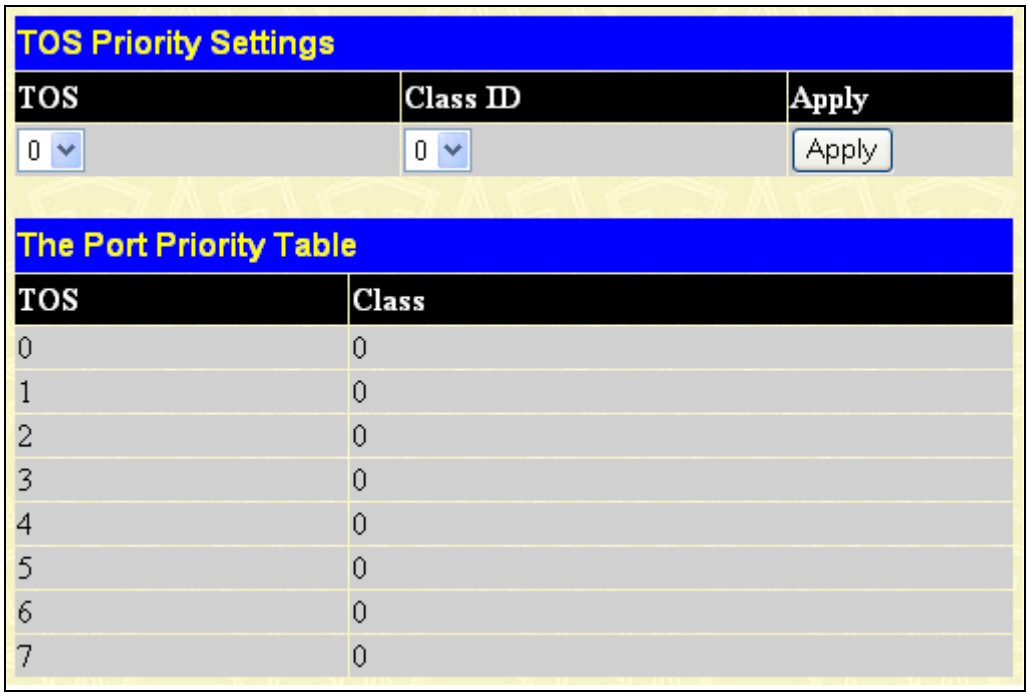


Figure 8- 8. TOS Priority Settings window

Click **Apply** to implement changes made.

DSCP Priority Settings

When using the DSCP/TOS priority mechanism, the packet is classified based on the DSCP/TOS field in the IP header. If the tag is present, the packet is assigned to a programmable egress queue based on the value of the tagged priority. The tagged priority can be designated to any of the available queues. When DSCP is set to enable, TOS cannot be used, and when TOS is set to enable, DSCP cannot be used

DSCP Priority Settings can be specified on this window. Enter a **DSCP** value and select a **Class ID** between *0* and 3.

In the **CoS** folder, click **DSCP Priority Settings,** to view the window shown below:

DSCP Priority Settings

DSCP	Class ID	Apply
	3	Apply

DSCP Priority Table

DSCP	Class ID
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
32	0
33	0
34	0

Figure 8- 9. DSCP Priority Settings window

Click **Apply** to implement changes made.

Port Mapping Priority Settings

When using the port-based priority mechanism, the port-based priority (high or low) assigned to each ingress port determines the egress queue assigned to frames arriving via the given ingress port. The frames will be assigned to either the highest queue or the lowest queue.

Please note the following limitation exists: port-based CoS only supports mapping to Queue 3.

Port mapping Priority Settings can be specified on this window. Select a port range using the **From** and **To** drop-down menus and select a **Class**.

In the **CoS** folder, click **Port Mapping Priority Settings,** to view the window shown below:

Port Mapping Priority Settings

From	To	Class	Apply
Port 1	Port 1	0	Apply

The Port Mapping 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
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0

Figure 8- 10. Port Mapping Priority Settings window

Click **Apply** to implement changes made.

MAC Priority

When using the MAC Priority mechanism, the packet is classified based on the MAC Priority field priority in the MAC config entry. Follow these steps: create a static FDB on this window, disable other Priority for that class (in the windows for **TOS Priority Settings**, **DSCP Priority Settings**, and **Port Mapping Priority Settings**), enable MAC Mapping Priority on the **Priority Settings** window, and set the static FDB designated as 0-3 priority on this window.

In the **CoS** folder, click **MAC Priority,** to view the window shown below:

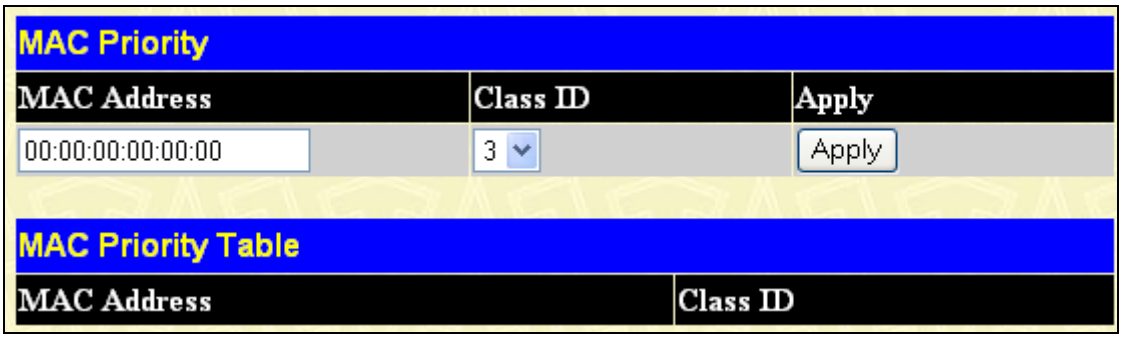


Figure 8- 11. MAC Priority window

Click **Apply** to implement changes made.

Section 9

ACL

Time Range

Access Profile Table

CPU Interface Filtering

Time Range

The DES-3028/28P/52/52P Switches allow you to configure a time period durring each Access Profile will be active. Use the window below to name the time range and then specify when the Access Profile that will be configured below will be active.

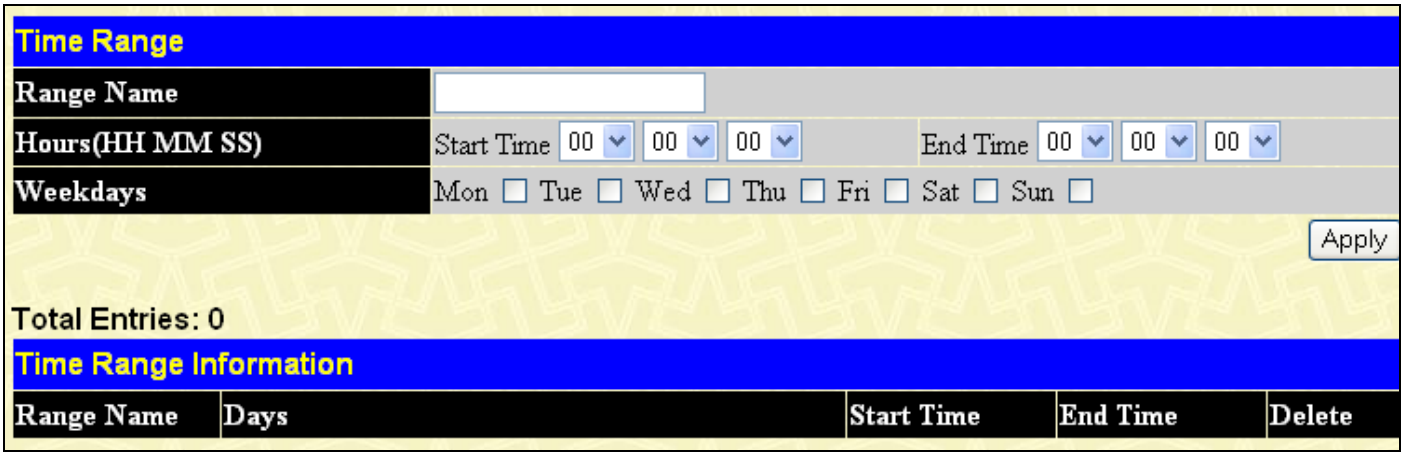


Figure 9- 1. Time Range window

Press the **Apply** button to make the time range current.

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.

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.

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.

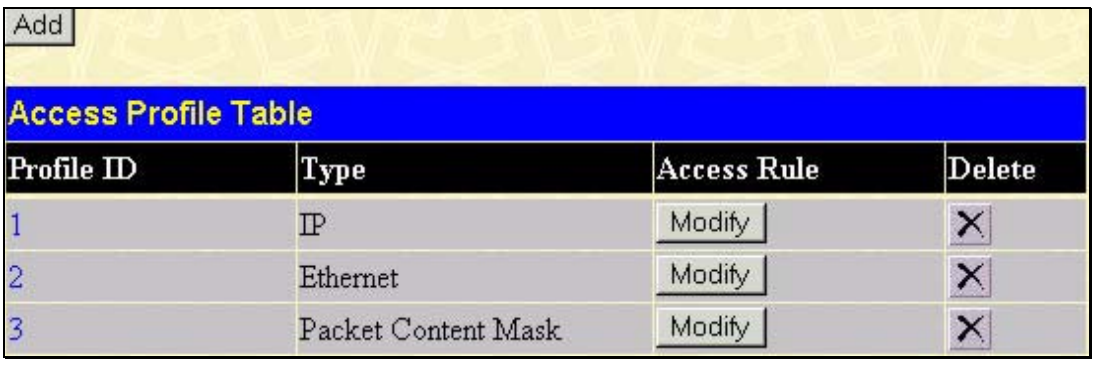


Figure 9- 2. Access Profile Table window

To add an entry to the Access Profile Table, click the **Add Profile** 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 the Packet Content Mask. You can switch

between the three **Access Profile Configuration** windows by using the **Type** drop-down menu. The window shown below is the **Access Profile Configuration** window for Ethernet.

Note: The Profile ID is used for relative priority for an Access Profile should a conflict arise between a rule created in one profile and a rule created in a different profile. Please read the CLI Reference Manual chapter discussing Access Control List (ACL) Commands.

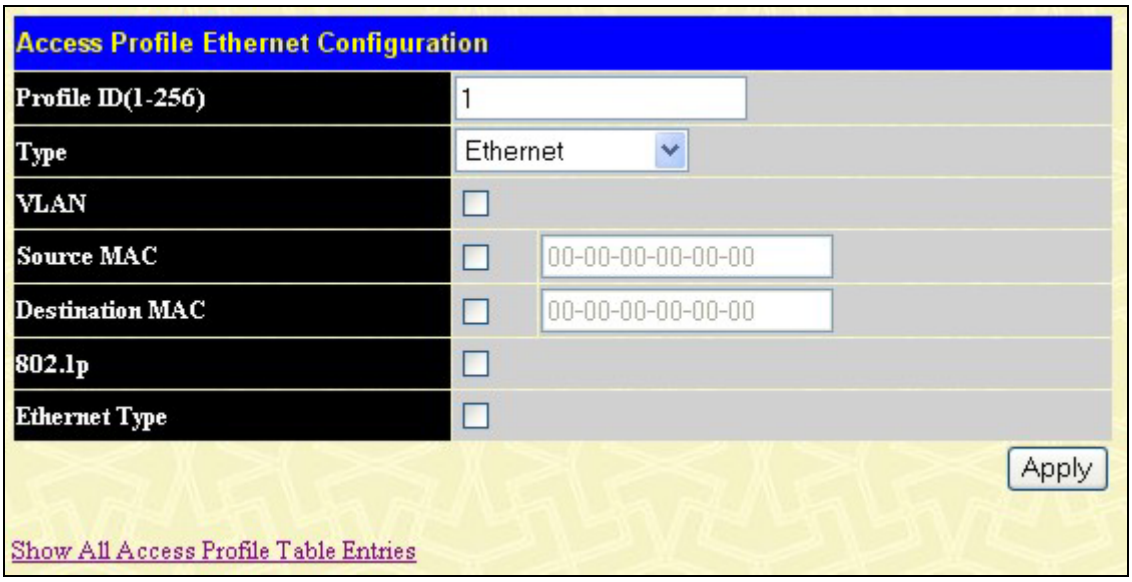


Figure 9- 3. Access Profile Configuration window (Ethernet)

The following parameters can be set, for the Ethernet type:

Parameter	Description
Profile ID (1-256)	Type in a unique identifier number for this profile set. The number is used to set the relative priority for the profile. Priority is set relative to other profiles where the lowest profile ID has the highest priority. If a conflict occurs among configured access rules, the profile ID establishes relative priority of the rules. The value can be set from *1* to *256* however there is a limit to the total number of profiles that can be created.
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 identifier of each packet header and use this as the full or partial criterion for forwarding.
Source MAC	Enter a MAC address mask for the source MAC address.
Destination MAC	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 in each frame's header.

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

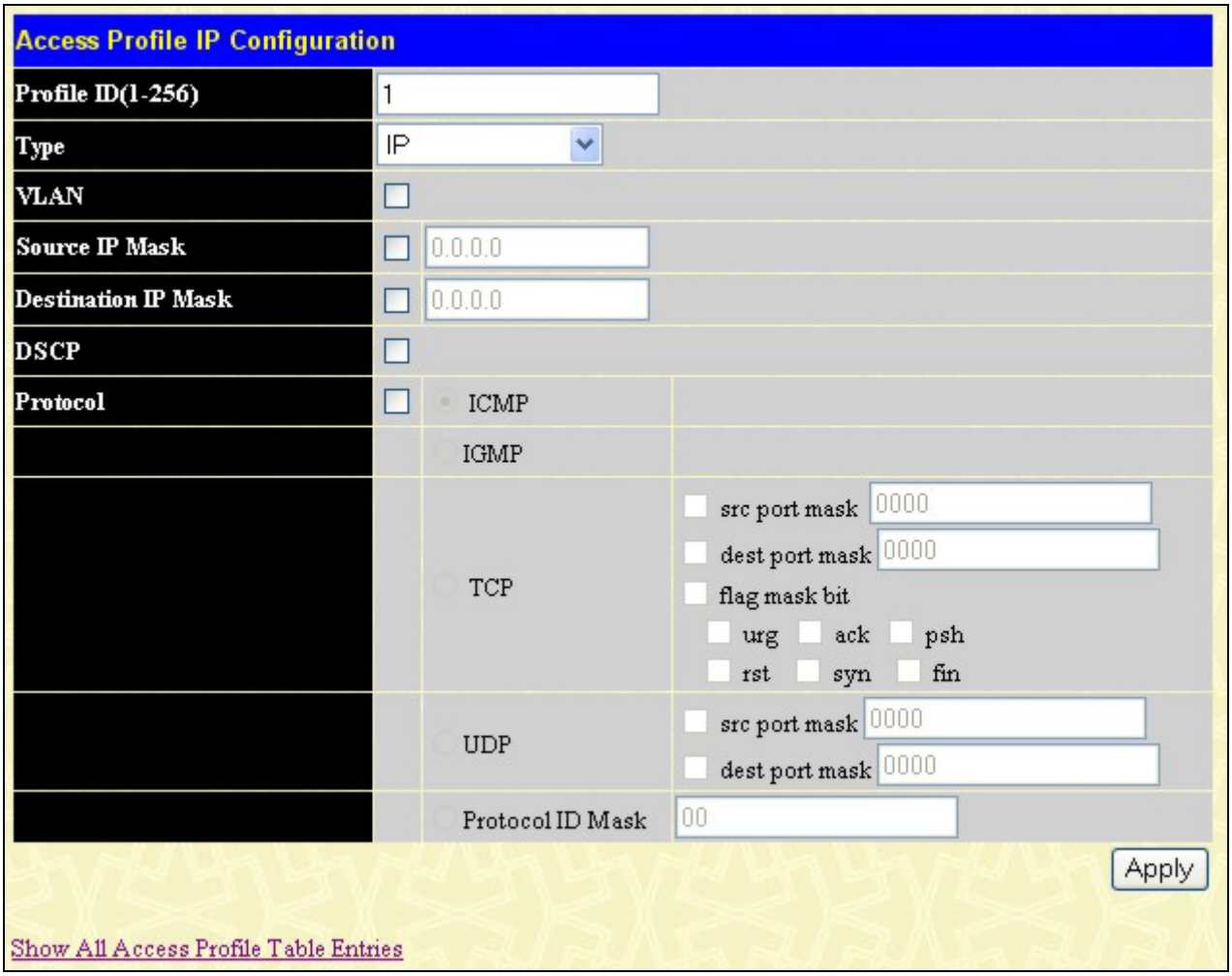


Figure 9- 4. Access Profile Configuration window (IP)

The following parameters can be set, for IP:

Parameter	Description
Profile ID (1-256)	Type in a unique identifier number for this profile set. The number is used to set the relative priority for the profile. Priority is set relative to other profiles where the lowest profile ID has the highest priority. If a conflict occurs among configured access rules, the profile ID establishes relative priority of the rules. The value can be set from *1* to *256* however there is a limit to the total number of profiles that can be created.
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 IP Mask	Enter an IP address mask for the source IP address.
Destination IP Mask	Enter an IP address mask for the destination IP 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 Messages Protocol (ICMP) field in each frame's header. Select *IGMP* to instruct the Switch to examine the Internet Group Management Protocol (IGMP) field in each frame's header. 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 and/or a destination port mask. The user may also identify which flag bits to deny. Flag bits are parts of a packet that determine what to do with the packet. The user may deny packets by denying certain flag bits within the packets, by checking the boxes corresponding to the flag bits of the TCP field. The user may choose between urg (urgent), ack (acknowledgement), psh (push), rst (reset), syn (synchronize), fin (finish). • *src port mask* - Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff), which you wish to deny. • *dest port mask* - Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff) which you wish to deny. 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 mask* - Enter a value defining the protocol ID in the packet header to mask. Specify in hex form (hex 0x0-0xf).

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

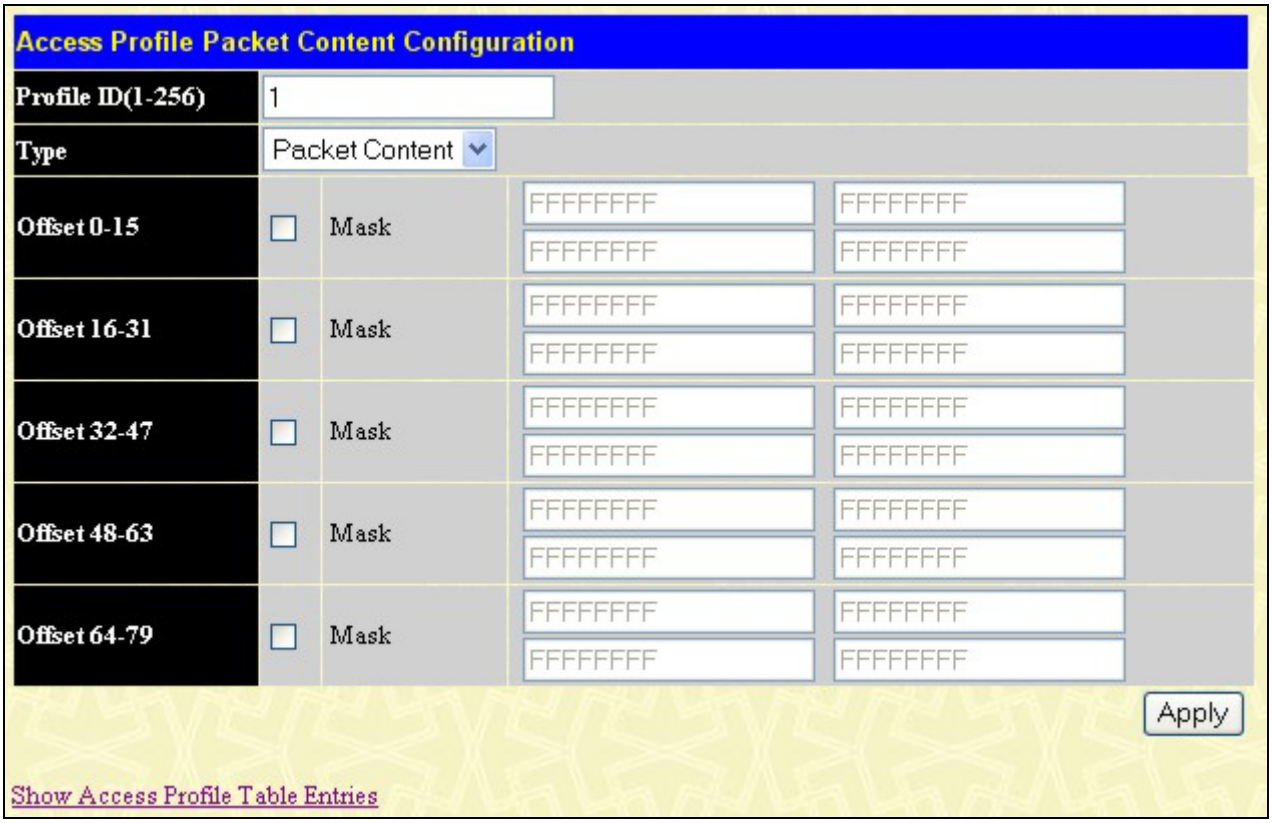


Figure 9- 5. Access Profile Configuration window (Packet Content Mask)

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

Parameter	Description
Profile ID (1-256)	Type in a unique identifier number for this profile set. This value can be set from *1* to *256*.
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 16th 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.

To establish the rule for a previously created Access Profile:

In the **Configuration** folder, click the **Access Profile Table** link opening the **Access Profile Table** window. Under the heading Access Rule, clicking **Modify**, will open the following window.

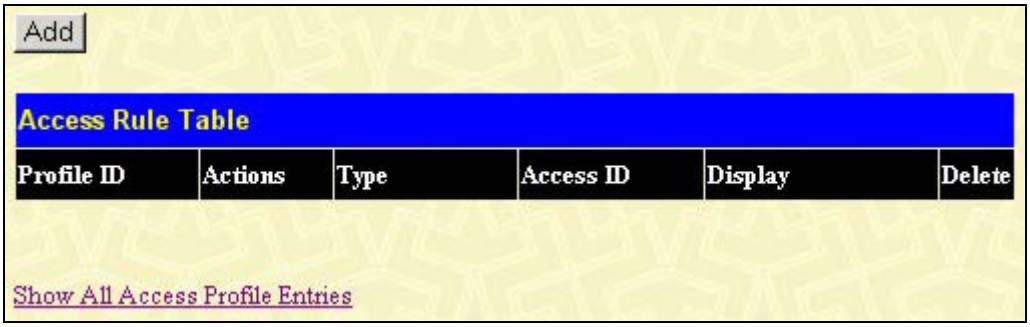


Figure 9- 6. Access Rule Table window

The user may search for the settings of a particular Access ID by entering that ID into the Access ID field above and clicking Find. The user may display all Access ID entries by clicking the View All Entry button.

To create a new rule set for an access profile click the **Add** button. A new window is displayed. To remove a previously created rule, click the corresponding ✕ button.

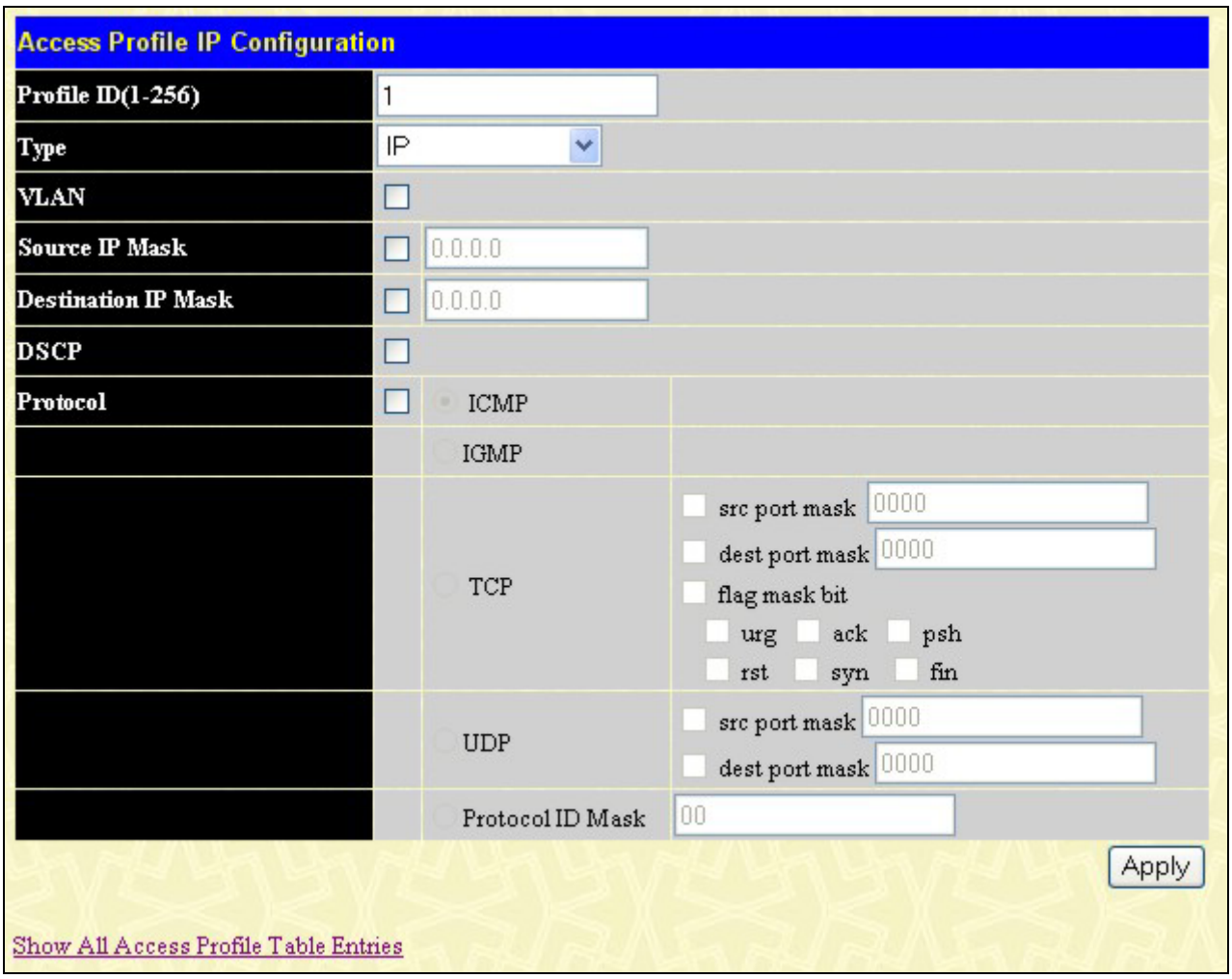


Figure 9- 7. Access Rule Configuration window (IP)

Configure the following Access Rule Configuration settings:

Parameter	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the Switch, according to any additional rule, forward the packets that match the access profile added (see below). Select *Deny* to specify that packets that match the access profile are not forwarded by the Switch and will be filtered.
Access ID (1-256)	Type in a unique identifier number for this access. This value can be set from *1* to *256*. **Auto Assign** – Checking this field will instruct the Switch to automatically assign an Access ID for the rule being created.
Type	Selected profile based on Ethernet (MAC Address), IP address or Packet Content Mask. • *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* instructs the Switch to examine 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. 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 IP	Enter an IP Address mask for the source IP address.
Destination IP	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 used to configure the Access Rule Table; depending on which protocol the user has chosen, or configured in the Access Profile Table.
Port Number	Enter the switch port number(s) to which you wish this rule to apply.

To view the settings of a previously correctly configured rule, click View in the Access Rule Table to view the following window:

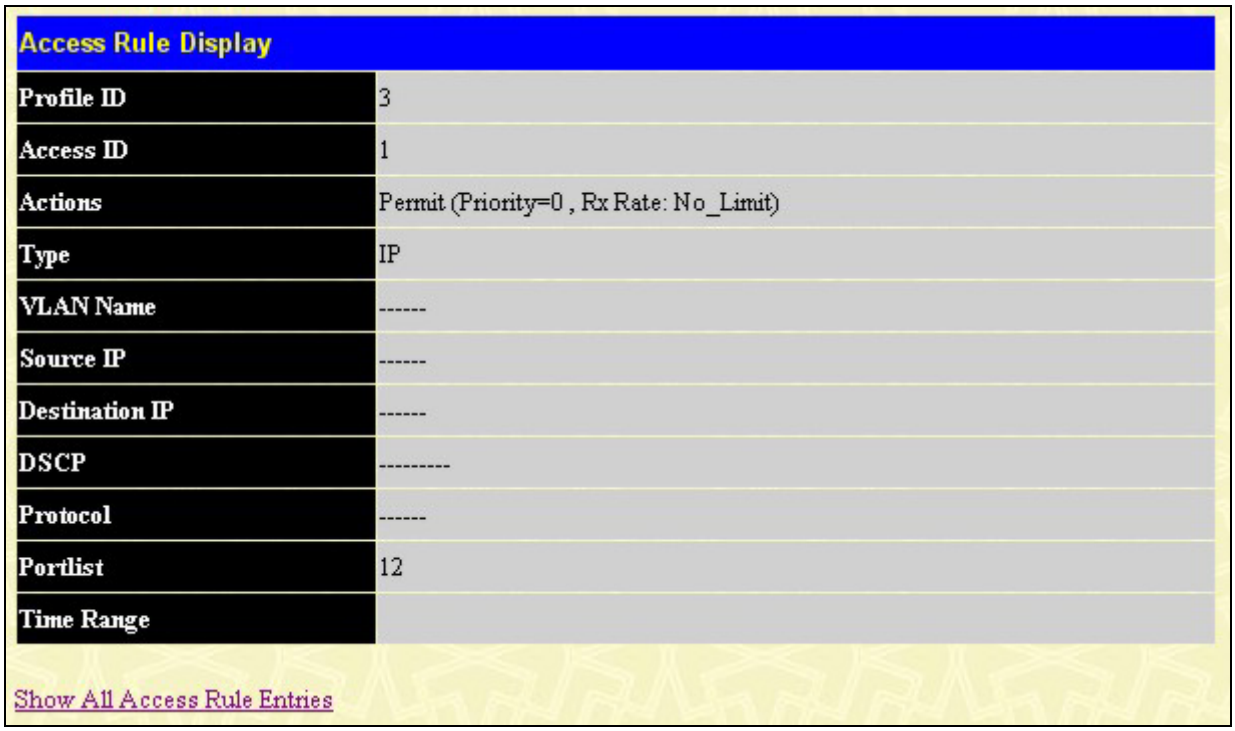


Figure 9- 8. Access Rule Display window (IP)

To configure the Access Rule for *Ethernet*, open the Access Profile Table and click **Modify** for an Ethernet entry. This will open the following window:

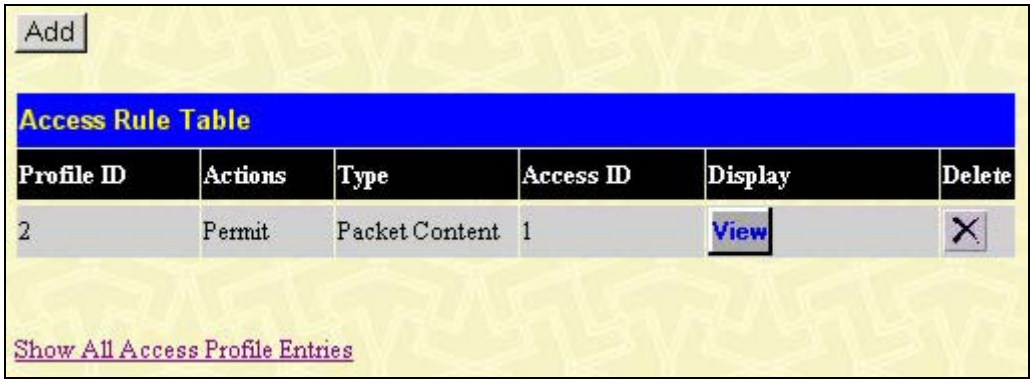


Figure 9- 9. Access Rule Table window (Ethernet)

The user may search for the settings of a particular Access ID by entering that ID into the Access ID field above and clicking Find. The user may display all Access ID entries by clicking the Show All Access Profile Entries link.

To remove a previously created rule, select it and click the ✕ button. To add a new Access Rule, click the **Add** button:

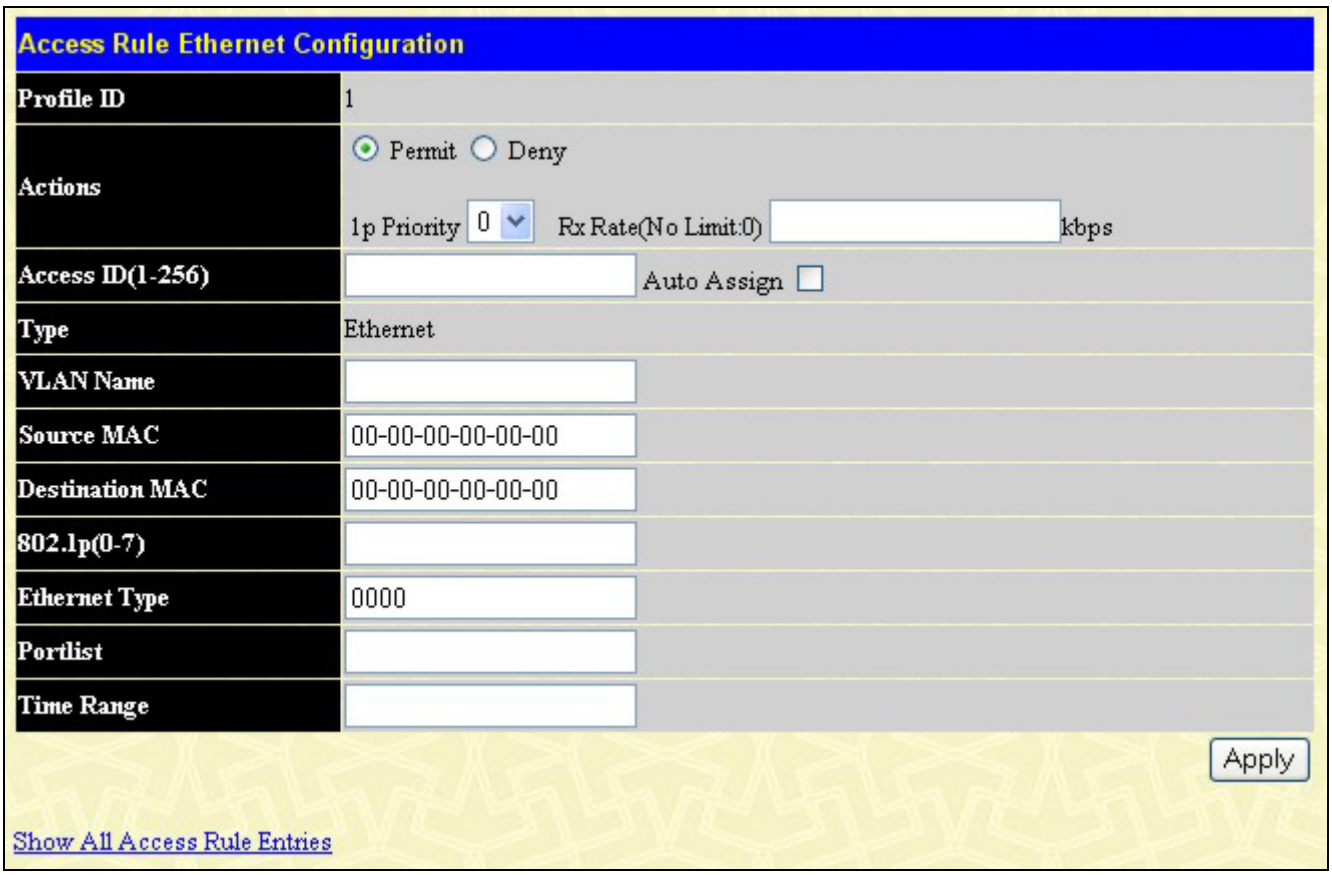


Figure 9- 10. Access Rule Configuration window (Ethernet)

To set the Access Rule for Ethernet, adjust the following parameters and click **Apply**.

Parameters	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the Switch, according to any additional rule, forwards the packets that match the access profile added (see below). Select *Deny* to specify that packets that match the access profile are not forwarded by the Switch and will be filtered.
Access ID (1-256)	Type in a unique identifier number for this access. This value can be set from 1 - 256. *Auto Assign* – Checking this field will instruct the Switch to automatically assign an Access ID for the rule being created.
Type	Selected profile based on Ethernet (MAC Address), IP address or Packet Content Mask. • *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* instructs the Switch to examine 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. 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	Enter a MAC Address for the source MAC address.
Destination MAC	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.
Port Number	Enter the switch port number(s) to which you wish this rule to apply.

To view the settings of a previously correctly configured rule, click View in the **Access Rule Table** to view the following window:

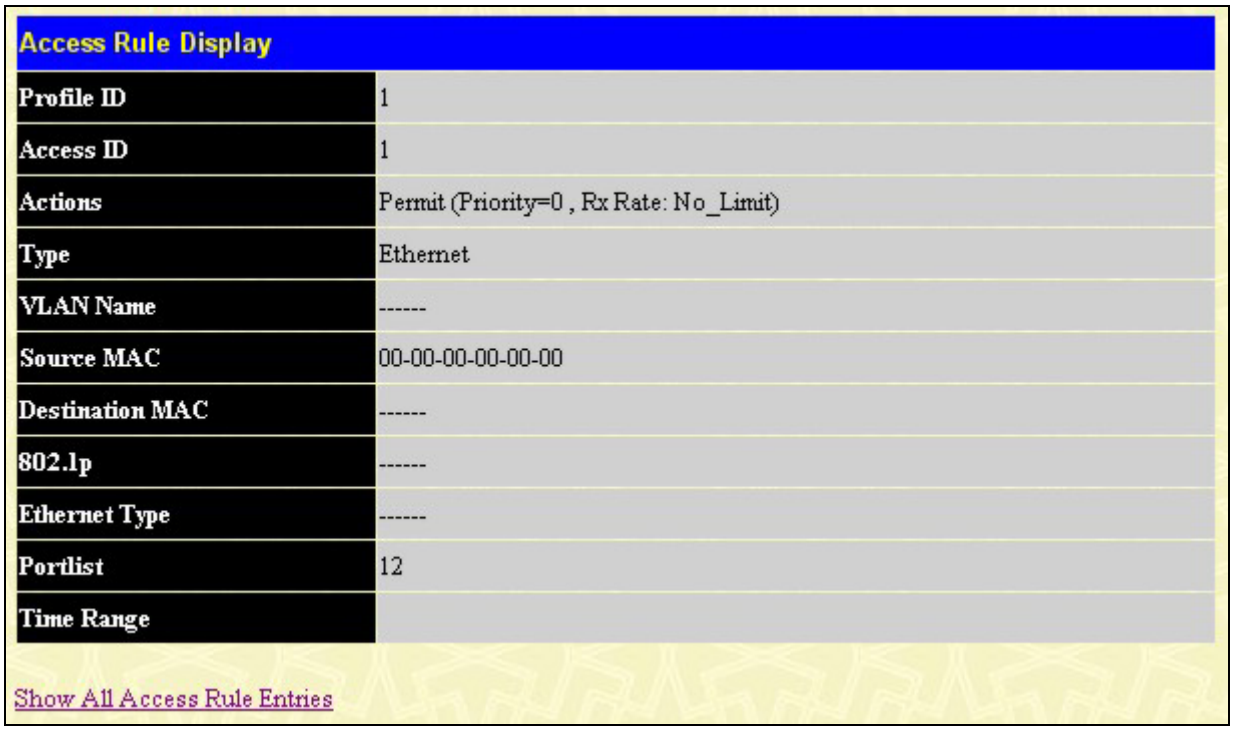


Figure 9- 11. Access Rule Display window (Ethernet)

To configure the Access Rule for Packet Content Mask, open the Access Profile Table and click **Modify** for a Packet Content Mask entry. This will display the Access Rule Table.

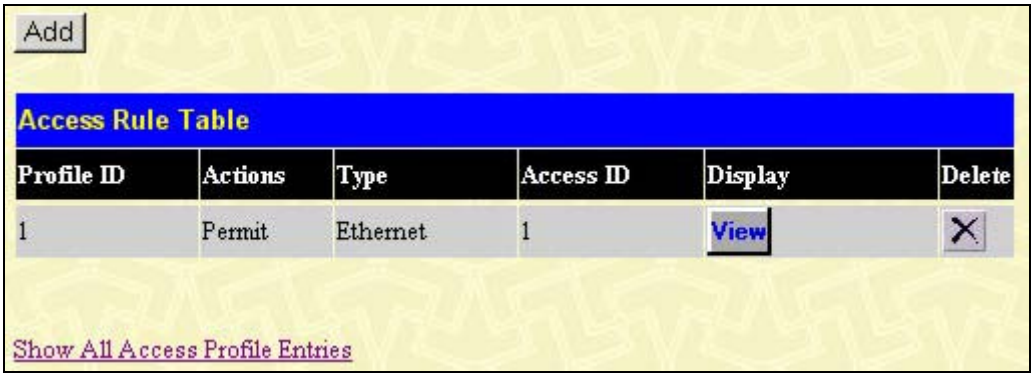


Figure 9- 12. Access Rule Table window (Packet Content Mask)

The user may search for the settings of a particular Access ID by entering that ID into the Access ID field above and clicking Find. The user may display all Access ID entries by clicking the View All Entry button.

To remove a previously created rule, select it and click the ✕ button. Access rules are indexed using the Access ID number. To locate a specific Access Rule in the table, enter the Access ID and click **Find**. To display all rules in the table, click the **View All Entries** button.

To add a new Access Rule, click the **Add** button above the **Access Rule Table** window to view the **Access Rule Packet Content Configuration** window.

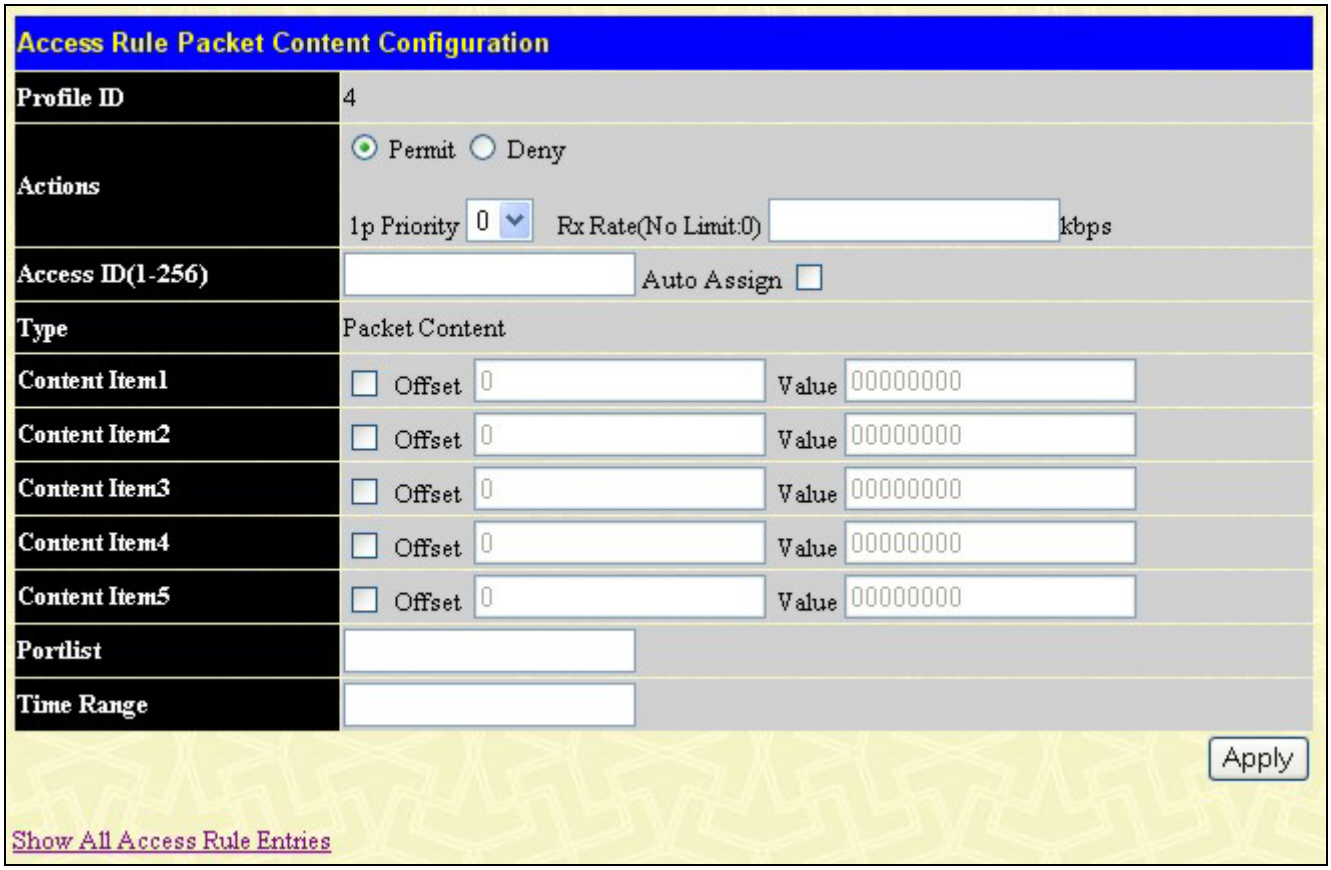


Figure 9- 13. Access Rule Packet Content Configuration window

To set the Access Rule for the Packet Content Mask, adjust the following parameters and click **Apply**.

Parameter	Description
Profile ID	This is the identifier number for this profile set.
Mode	Select *Permit* to specify that the Switch, according to any additional rule, forwards the packets that match the access profile added (see below). Select *Deny* to specify that packets that match the access profile are not forwarded by the Switch and will be filtered.
Access ID	Type in a unique identifier number between *1* and *256* for this access or use **Auto Assign**.
Type	Selected profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content Mask*. • *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* instructs the Switch to examine 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. 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 mask the packet header beginning with the offset value specified: • You can specify an offset of between 0 and 76 bytes.
Port Number	Enter the switch port number(s) to which you wish this rule to apply.

To view the settings of a previously correctly configured rule, click View in the **Access Rule Table** to view the following window:

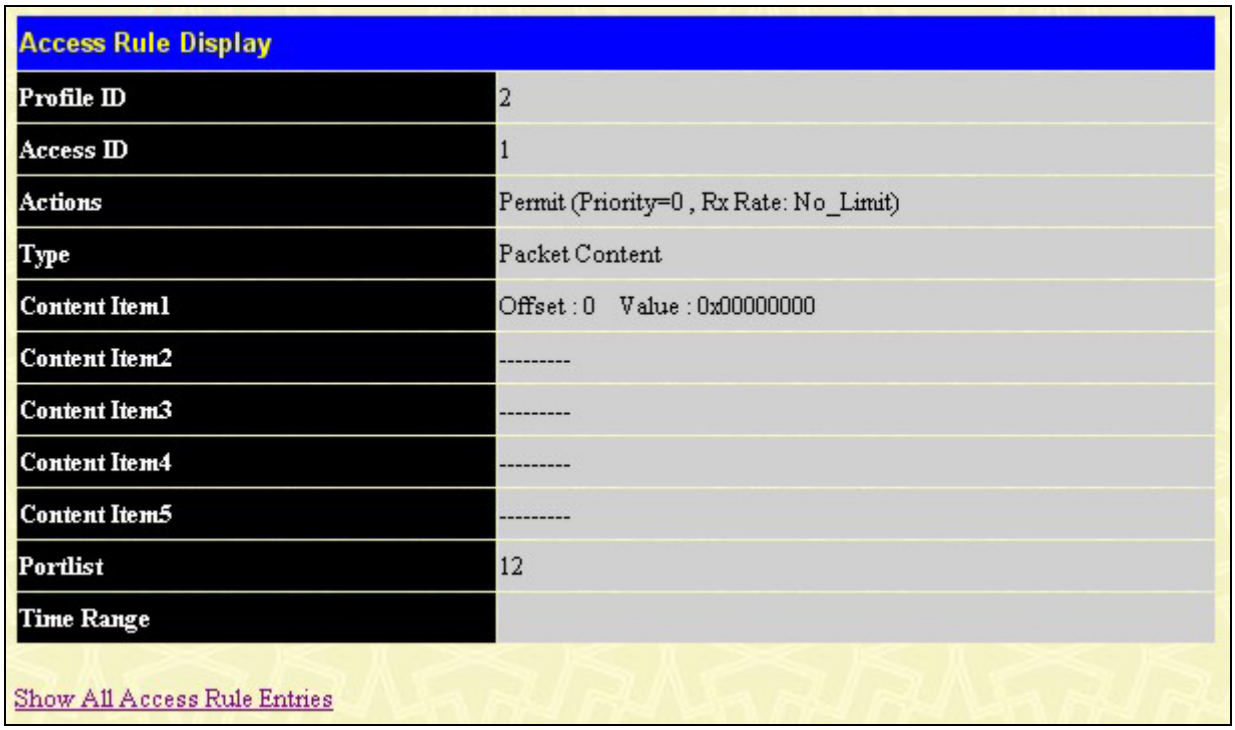


Figure 9- 14. Access Rule Display window (Packet Content)

CPU Interface Filtering

Due to a chipset limitation and the need for extra switch security, the DES-30xx switch series incorporates CPU Interface filtering. This added feature increases the running security of the Switch by enabling the user to create a list of access rules for packets destined for the Switch's CPU interface. Employed similarly to the Access Profile feature previously mentioned, CPU interface filtering examines Ethernet, IP and Packet Content Mask packet headers destined for the CPU and will either forward them or filter them, based on the user's implementation. As an added feature for the CPU Filtering, the Switch allows the CPU filtering mechanism to be enabled or disabled globally, permitting the user to create various lists of rules without immediately enabling them.

Creating an access profile for the CPU 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.

CPU Interface Filtering State

In the following window, the user may globally enable or disable the CPU Interface Filtering mechanism by using the pull-down menu to change the running state. To access this window, click **ACL > CPU Interface Filtering > CPU Interface Filtering State**. Choose *Enabled* to enable CPU packets to be scrutinized by the Switch and *Disabled* to disallow this scrutiny.

Figure 9- 15. CPU Interface Filtering State window

CPU Interface Filtering Profile Table

Click **ACL** > **CPU Interface Filtering** > **CPU Interface Filtering Table** to display the CPU Access Profile Table entries created on the Switch. To view the configurations for an entry, click the hyperlinked **Profile ID** number.

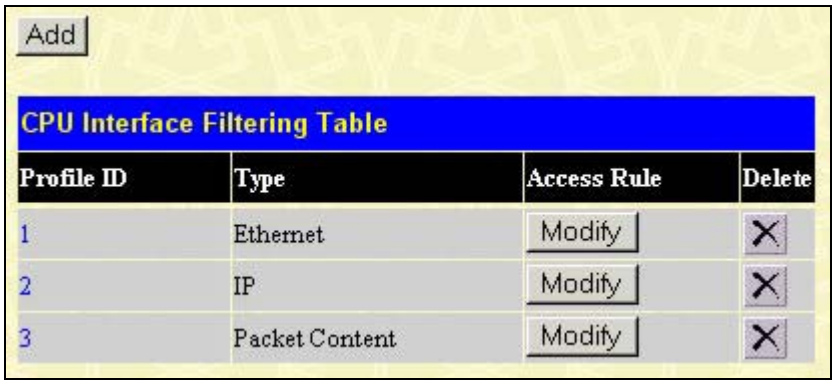


Figure 9- 16. CPU Interface Filtering Table window

To add an entry to the **CPU Interface Filtering Profile Table** window, click the **Add** button. This will open the **CPU Interface Filtering Profile Configuration** window, as shown below. There are three **CPU Access Profile Configuration** windows; one for **Ethernet** (or MAC address-based) profile configuration, one for **IP** address-based profile configuration and one for the **Packet Content Mask**. Users can switch between the three **CPU Access Profile Configuration** windows by using the **Type** drop-down menu. The window shown below is for **Ethernet CPU Interface Filtering Configuration**.

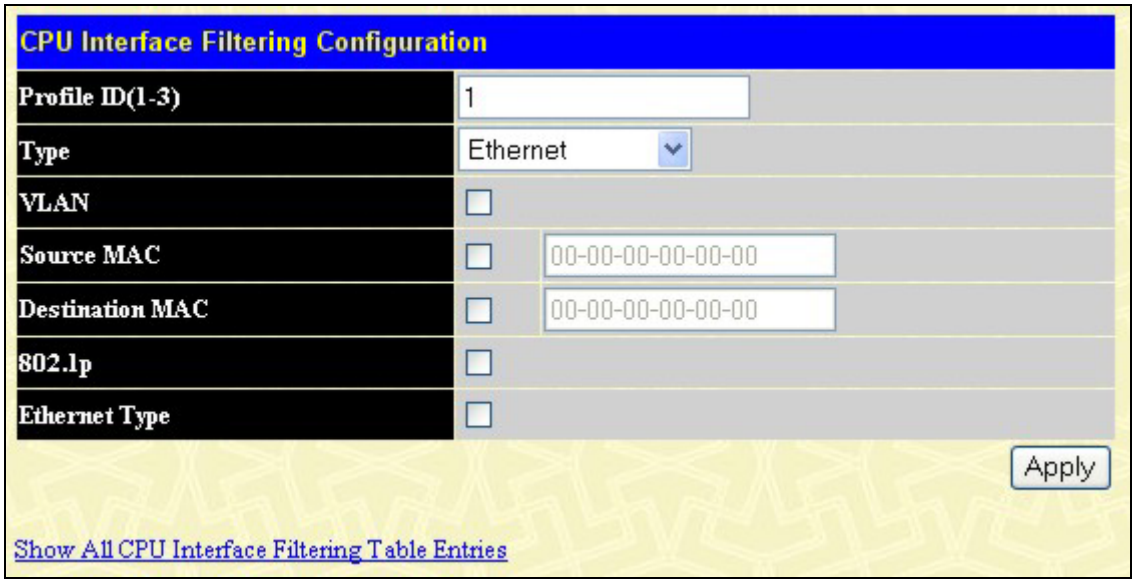


Figure 9- 17. CPU Interface Filtering Configuration window – Ethernet

Parameter	Description
Profile ID (1-3)	Type in a unique identifier number for this profile set. This value can be set from *1 to 3*.
Type	Select profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content Mask*. This will change the window 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 identifier of each packet header and use this as the full or partial criterion for forwarding.
Source MAC	Enter a MAC address mask for the source MAC address.
Destination MAC	Enter a MAC address mask for the destination MAC address.
802.1p	Selecting this option instructs the Switch to examine 802.1p priority value packets.
Ethernet type	Selecting this option instructs the Switch to examine the Ethernet type value in each frame's header.

Click **Apply** to set this entry in the Switch's memory.

The following is the **CPU Interface Filtering Configuration** window for **IP**.

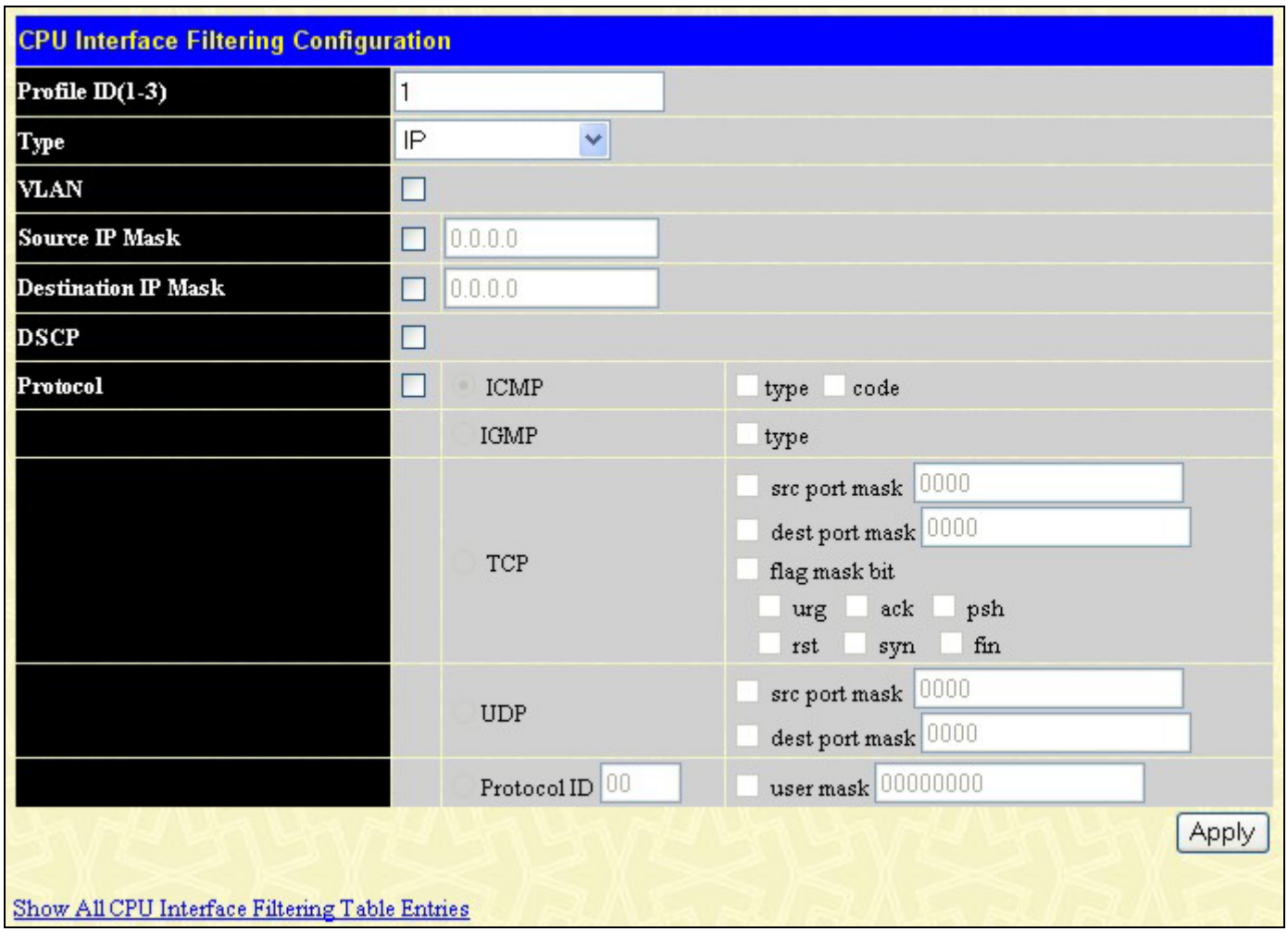


Figure 9- 18. CPU Interface Filtering Configuration window - IP

The following parameters can be modified:

Parameter	Description
Profile ID (1-3)	Type in a unique identifier number for this profile set. This value can be set from 1 - 3.
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 criterion, or part of the criterion for forwarding.
Source IP Mask	Enter an IP address mask for the source IP address.
Destination IP Mask	Enter an IP address mask for the destination IP 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 (IGMP) 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 and/or a destination port mask. The user may also identify which flag bits to filter. Flag bits are parts of a packet that determine what to do with the packet. The user may filter packets by filtering certain flag bits within the packets, by checking the boxes corresponding to the flag bits of the TCP field. The user may choose between *urg* (urgent), *ack* (acknowledgement), *psh* (push), *rst* (reset), *syn* (synchronize), *fin* (finish). • *src port mask* - Specify a TCP port mask for the source port in hex form (hex 0x0-0xffff), which you wish to filter. • *dest port mask* - Specify a TCP port mask for the destination port in hex form (hex 0x0-0xffff) which you wish to filter. 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 UDP port mask for the source port in hex form (hex 0x0-0xffff). • *dest port mask* - Specify a UDP 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 0x0-0xff).

Click **Apply** to set this entry in the Switch's memory.

The following is the **CPU Interface Filtering Configuration** window for the **Packet Content Mask**.

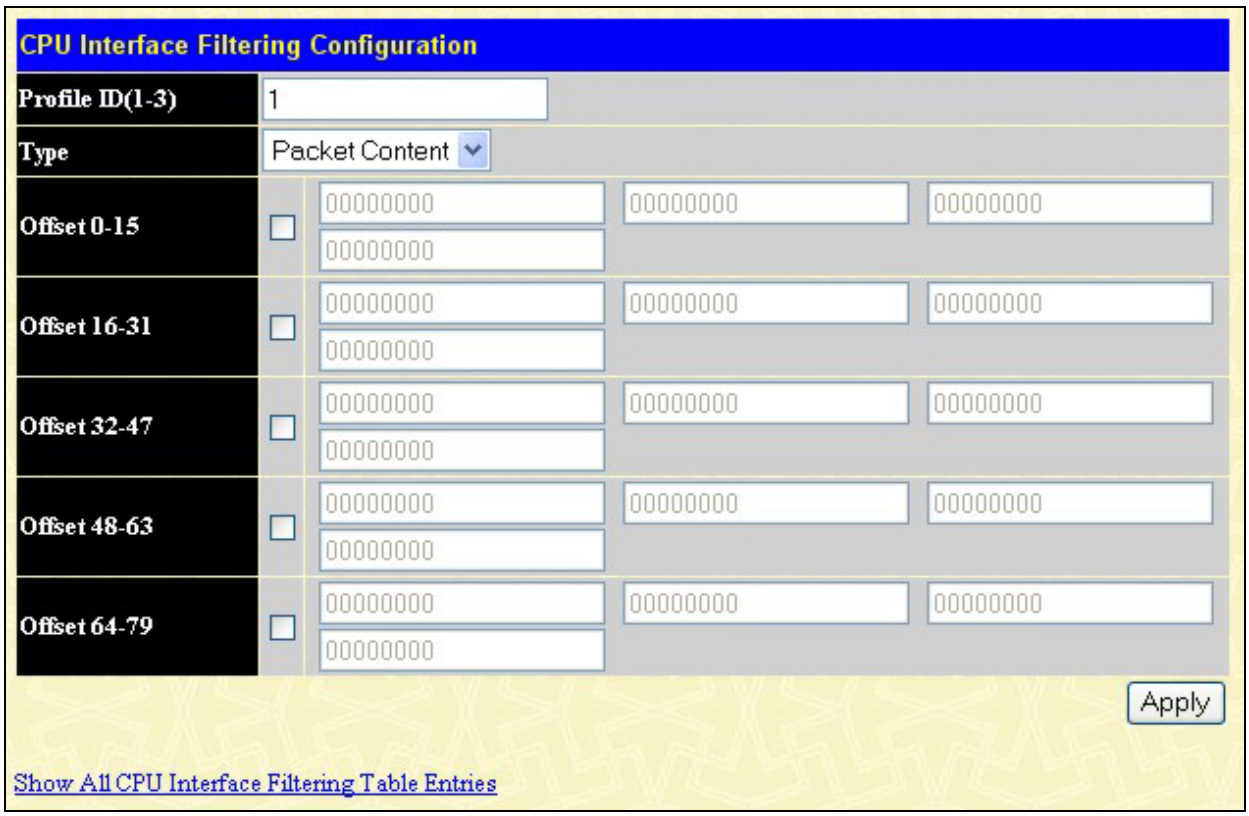


Figure 9- 19. CPU Interface Filtering Configuration window - Packet Content

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**:

Parameter	Description
Profile ID (1-3)	Type in a unique identifier number for this profile set. This value can be set from *1 to 3*.
Type	Select profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content Mask*. This will change the window 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.

Click **Apply** to implement changes made.

To establish the rule for a previously created CPU Access Profile:

In the **ACL** folder, click **CPU Interface Filtering** to open the **CPU Interface Filtering Profile Table** window.

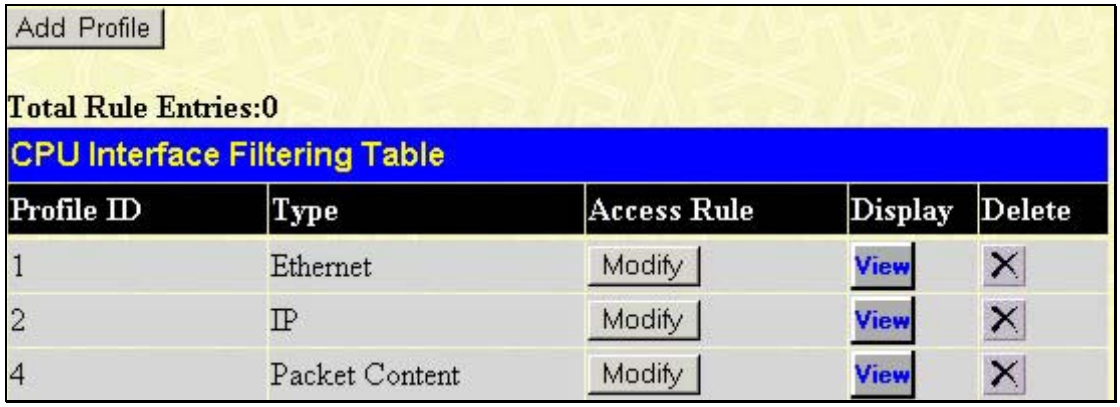


Figure 9- 20. CPU Interface Filtering Profile Table window - Add

In this window, the user may add a rule to a previously created CPU access profile by clicking the corresponding **Modify** button of the entry to configure **Ethernet, IP** or **Packet Content Mask**.

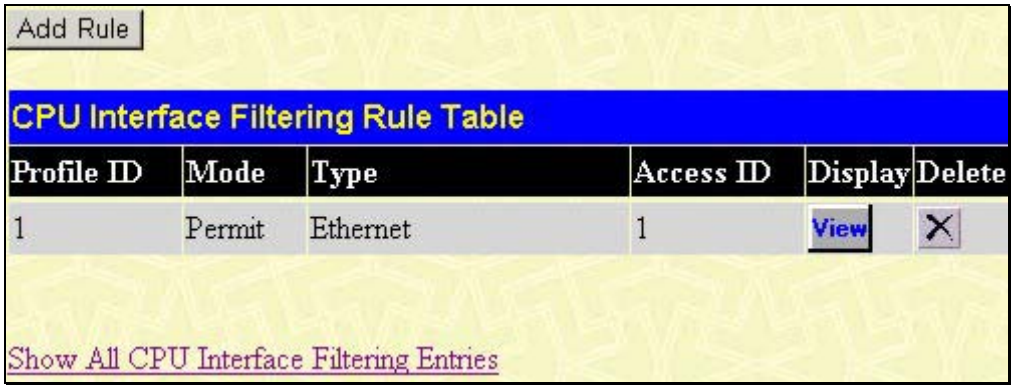


Figure 9- 21. CPU Interface Filtering Rule Table window

Click the **Add Profile** button to continue on to the **CPU Interface Filtering Rule Table** window. A new and unique window, for Ethernet, IP and Packet Content will open as shown in the examples below.

To change a rule for a previously created CPU Access Profile Rule:

The **CPU Interface Filtering Rule Configuration** window allows the user to create a rule for a previously created CPU Access Profile.

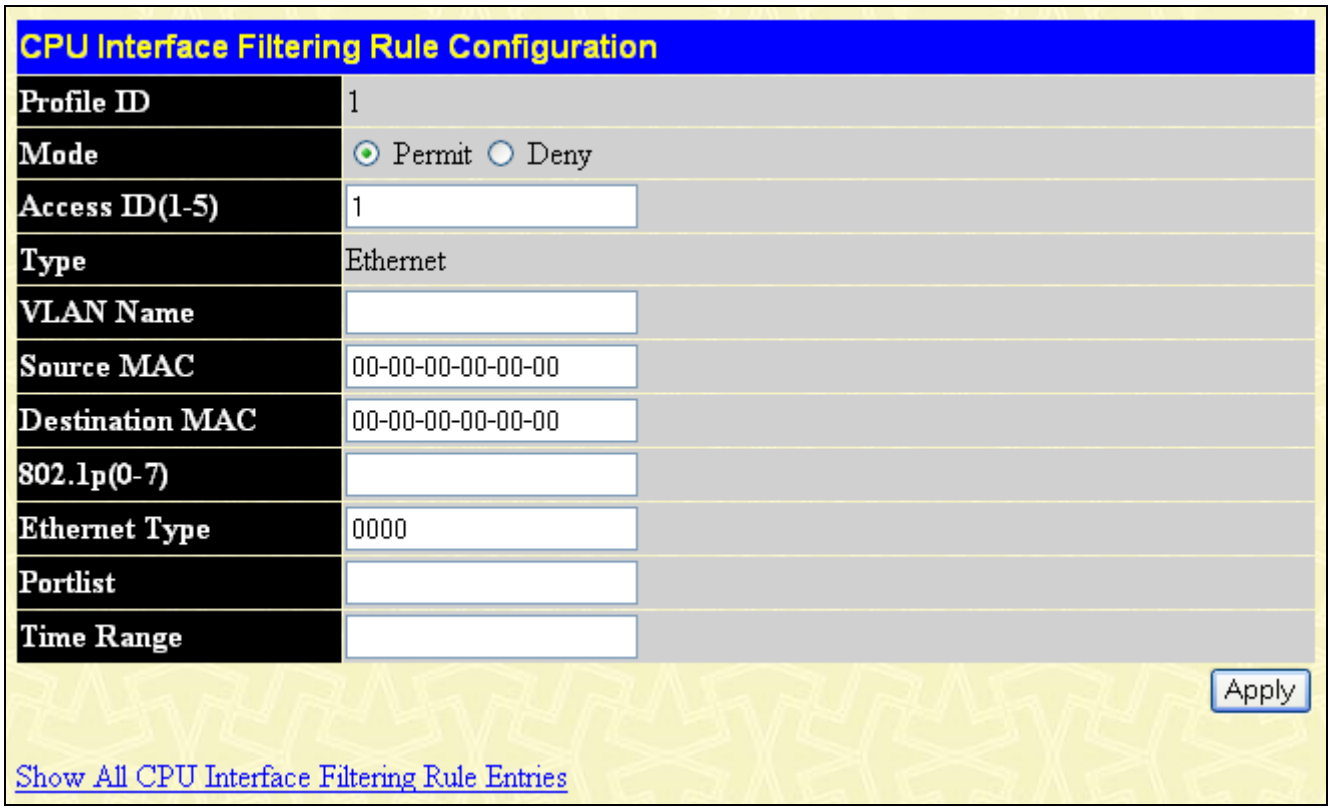


Figure 9- 22. CPU Interface Filtering Rule Configuration window – Ethernet

To set the CPU Access Rule for Ethernet, adjust the following parameters and click **Apply**.

Parameters	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 and priority. This value can be set from *1 to 5*.

Type	Selected profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content*. • *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* instructs the Switch to examine the packet header.
VLAN Name	Allows the entry of a name for a previously configured VLAN.
Source MAC	Enter a MAC Address for the source MAC address.
Destination MAC	Enter a MAC Address mask for the destination MAC address.
802.1P (0-7)	Enter a value from 0-7 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 0-9.
Port	The CPU Access Rule may be configured on a per-port basis by entering the port number of the Switch.
Time Range	Click the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range** window. This will set specific times when this CPU access rule will be implemented on the Switch.

To view the settings of a previously configured rule, click View in the **Access Rule Table** to view the following window:

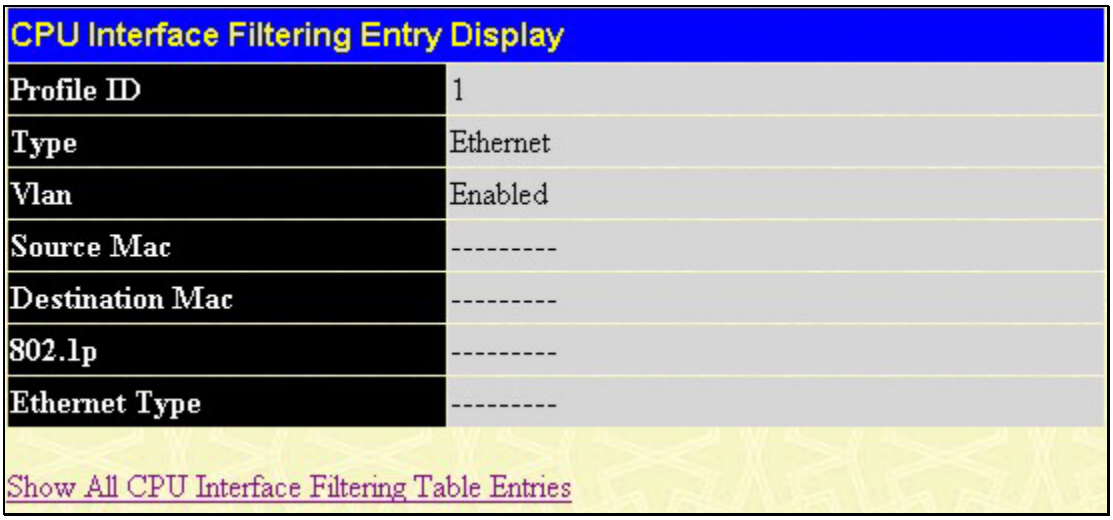


Figure 9- 23. CPU Interface Filtering Entry Display window – Ethernet

The following window is the **CPU Interface Filtering Rule Table** for IP.

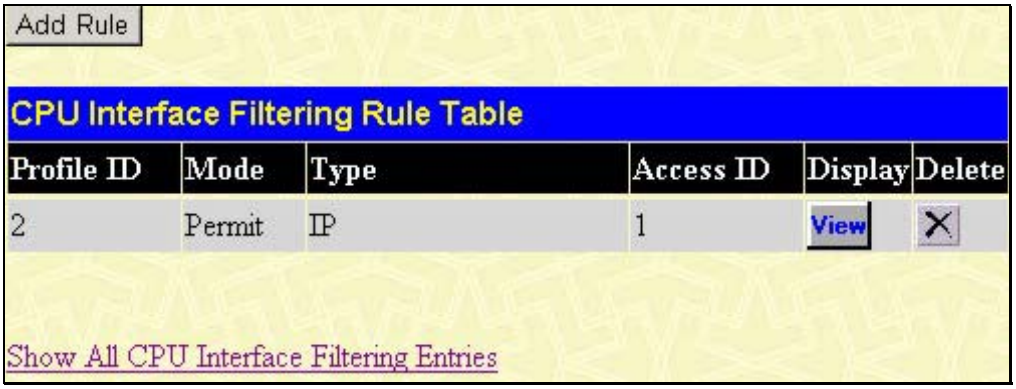


Figure 9- 24. CPU Interface Filtering Rule Table window – IP

To create a new rule set for an access profile click the **Add** button. A new window is displayed. To remove a previously created rule, click the corresponding button. The following window is used for the CPU IP Rule configuration.

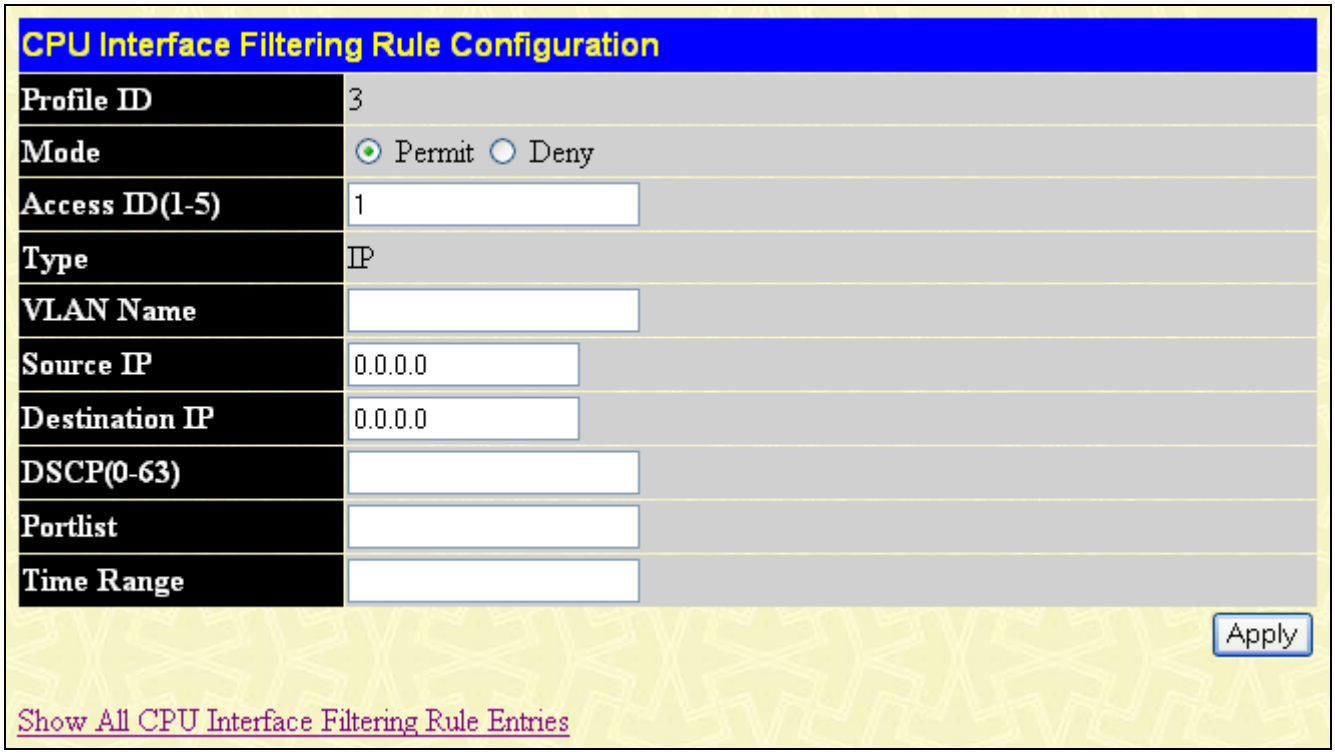


Figure 9- 25. CPU Interface Filtering Rule Configuration window – IP

Configure the following **Access Rule Configuration** settings for IP:

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 and priority. This value can be set from *1* to *5*.
Type	Selected profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content*. • *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* instructs the Switch to examine the packet header.

VLAN Name	Allows the entry of a name for a previously configured VLAN.
Source IP	Enter an IP Address mask for the source IP address.
Destination IP	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*.
Port	The CPU Access Rule may be configured on a per-port basis by entering the port number of the Switch.
Time Range	Click the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range** window. This will set specific times when this CPU access rule will be implemented on the Switch.

To view the settings of a previously correctly configured rule, click View in the **Access Rule Table** to view the following window:

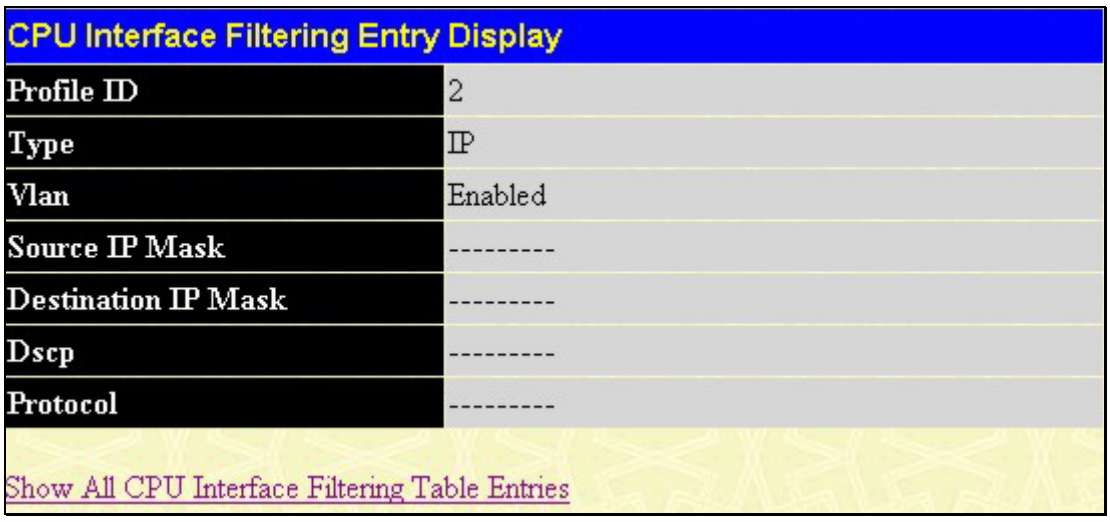


Figure 9- 26. CPU Interface Filtering Entry Display window - IP

The following window is the **CPU Interface Filtering Rule Table** for Packet Content.

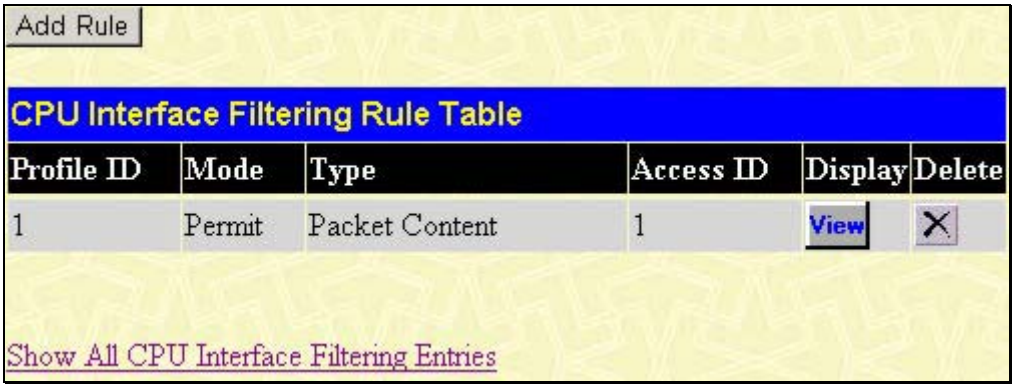


Figure 9- 27. CPU Interface Filtering Rule Table window – Packet Content

To remove a previously created rule, select it and click the button. To add a new CPU Access Rule, click the **Add** button:

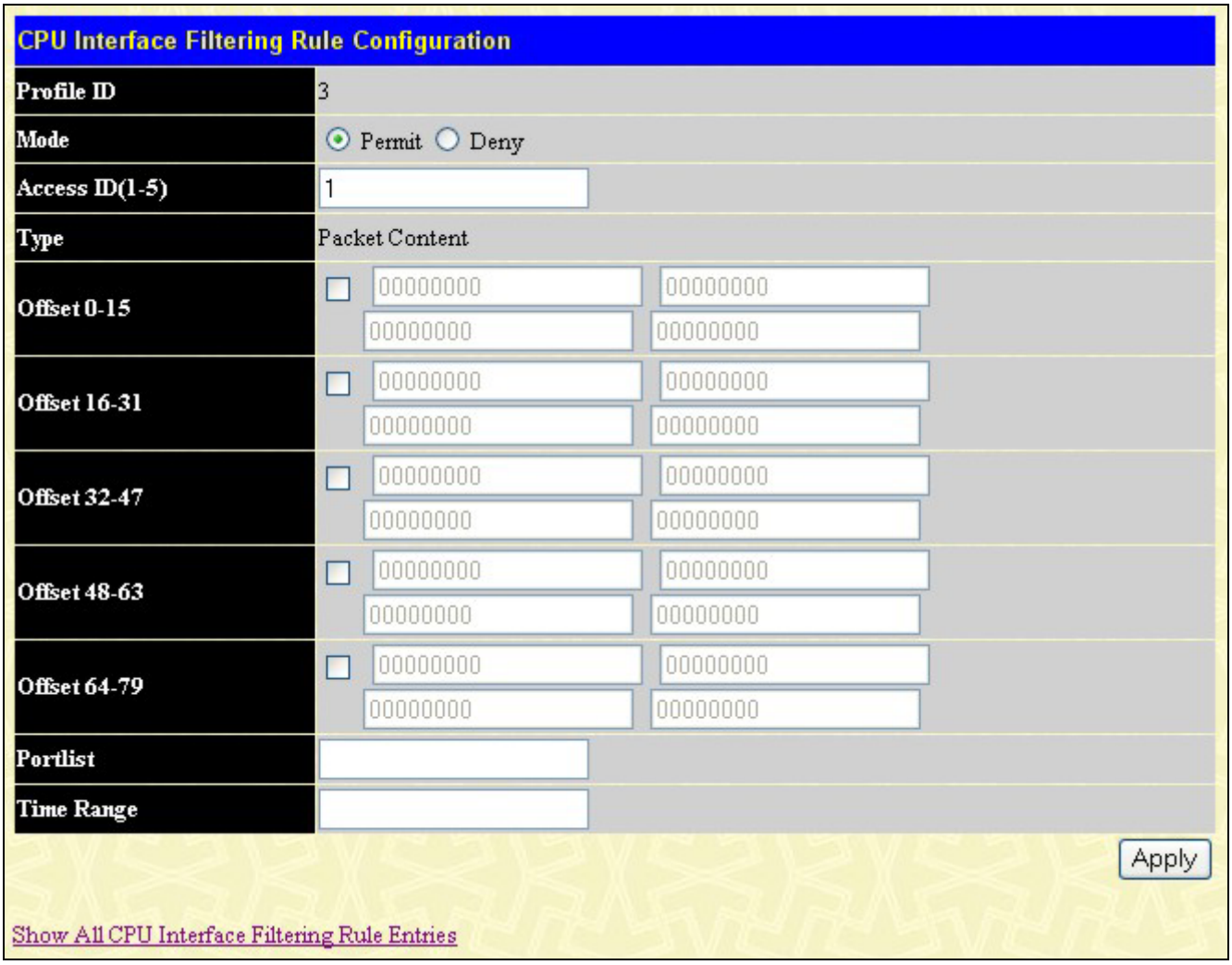


Figure 9- 28. CPU Interface Filtering Rule Configuration window - Packet Content Mask

To set the Access Rule for Ethernet, adjust the following parameters and click **Apply**.

Parameters	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 5*.
Type	Selected profile based on *Ethernet* (MAC Address), *IP* address or *Packet Content*. • *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* instructs the Switch to examine 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 CPU Access Rule may be configured on a per-port basis by entering the port number of the Switch.
Time Range	Click the check box and enter the name of the Time Range settings that has been previously configured in the **Time Range** window. This will set specific times when this CPU access rule will be implemented on the Switch.

To view the settings of a previously correctly configured rule, click View in the **Access Rule Table** to view the following window:

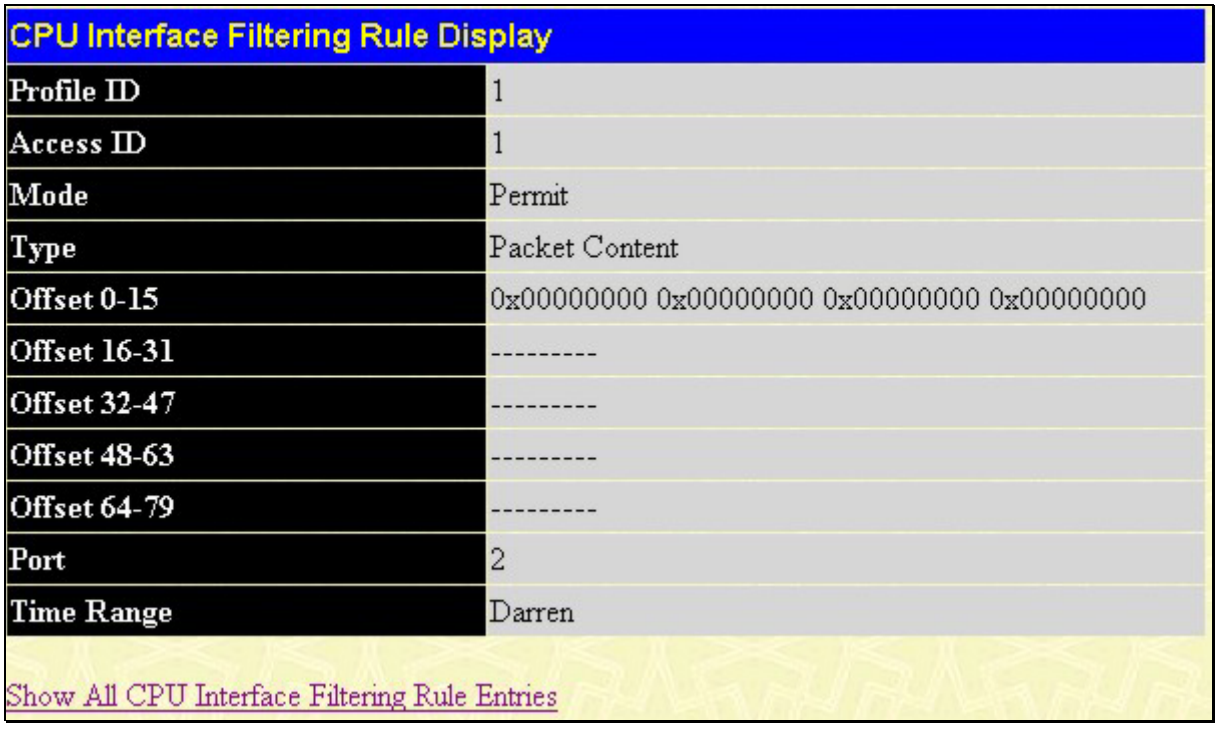


Figure 9- 29. CPU Interface Filtering Rule Display window – Packet Content

Section 10

Security

Traffic Control

Port Security

Port Lock Entries

SSL

SSH

802.1X

Trusted Host

Access Authentication Control

Traffic Segmentation

Traffic Control

On a computer network, packets such as Multicast packets and Broadcast packets continually flood the network as normal procedure. At times, this traffic may increase do to a malicious endstation on the network or a malfunctioning device, such as a faulty network card. Thus, switch throughput problems will arise and consequently affect the overall performance of the switch network. To help rectify this packet storm, the Switch will monitor and control the situation.

The packet storm is monitored to determine if too many packets are flooding the network, based on the threshold level provided by the user. Once a packet storm has been detected, the Switch will drop packets coming into the Switch until the storm has subsided. This method can be utilized by selecting the *Drop* option of the **Action** field in the window below.

The Switch will also scan and monitor packets coming into the Switch by monitoring the Switch's chip counter. This method is only viable for Broadcast and Multicast storms because the chip only has counters for these two types of packets. Once a storm has been detected (that is, once the packet threshold set below has been exceeded), the Switch will shutdown the port to all incoming traffic with the exception of STP BPDU packets, for a time period specified using the CountDown field.

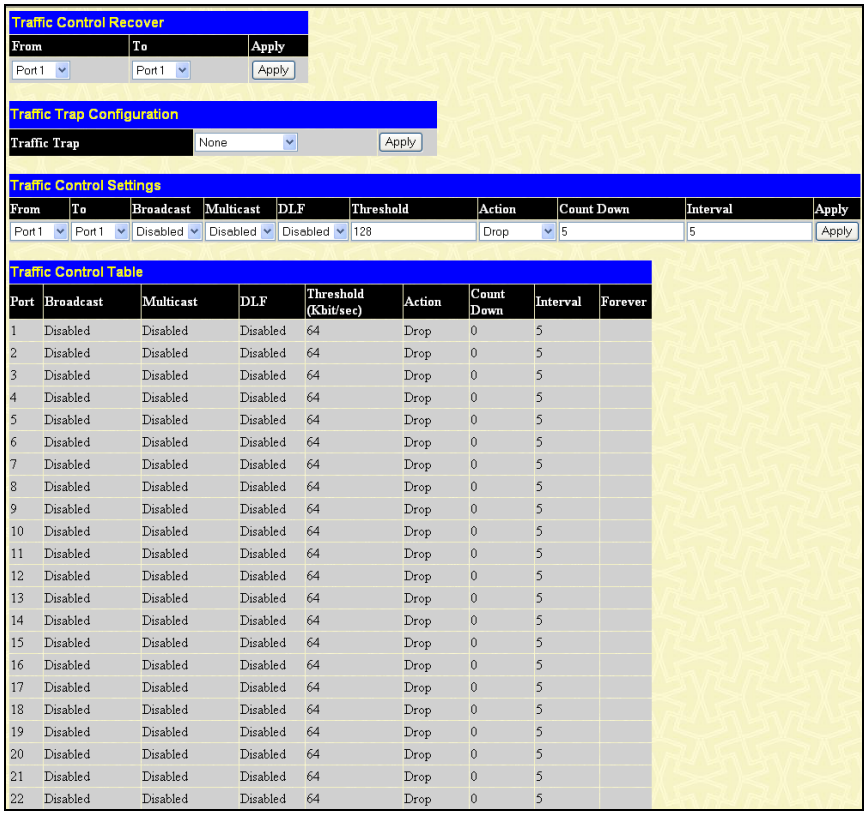


Figure 10- 1. Traffic Control Settings window

If this field times out and the packet storm continues, the port will be placed in a Shutdown Forever mode which will produce a warning message to be sent to the Trap Receiver. Once in Shutdown Forever mode, the only method of recovering this port is to manually recoup it using the **Port Configuration** window in the **Administration** folder and selecting the disabled port and returning it to an Enabled status. To utilize this method of Storm Control, choose the *Shutdown* option of the **Action** field in the window below. To view this window to configure Traffic Control, click **Security > Traffic Control**.

The user may set the following parameters:

Parameter	Description
Traffic Control Recover	
From… To	Select the ports to be recovered.
Traffic Trap Configuration	
Traffic Trap	Enable sending of Storm Trap messages when the type of action taken by the Traffic Control function in handling a Traffic Storm is one of the following: • *None* – Will send no Storm trap warning messages regardless of action taken by the Traffic Control mechanism. • *Storm Occurred* – Will send Storm Trap warning messages upon the occurrence of a Traffic Storm only. • *Storm Cleared* – Will send Storm Trap messages when a Traffic Storm has been cleared by the Switch only. • *Both* – Will send Storm Trap messages when a Traffic Storm has been both detected and cleared by the Switch. This function cannot be implemented in the Hardware mode. (When *Drop* is chosen in the **Action** field.
Traffic Control Settings	
From…To	Select the ports of this Switch to configure for Storm Control.
Broadcast	Enables or disable Broadcast Storm Control.
Multicast	Enables or disables Multicast Storm Control.
DLF	Enables or disables Destination Lookup Failure (DLF) storm control. (Not available for Software based Traffic Control {Shutdown}).
Threshold	Specifies the maximum number of packets per second that will trigger the Traffic Control function to commence.
Action	Select the method of traffic Control from the pull down menu. The choices are: *Drop* – Utilizes the hardware Traffic Control mechanism, which means the Switch's hardware will determine the Packet Storm based on the Threshold value stated and drop packets until the issue is resolved. *Shut Down* – Utilizes the Switch's software Traffic Control mechanism to determine the Packet Storm occurring. Once detected, the port will deny all incoming traffic to the port except STP BPDU packets, which are essential in keeping the Spanning Tree operational on the Switch. If the Countdown timer has expired and yet the Packet Storm continues, the port will be placed in Shutdown Forever mode and is no longer operational until the user manually resets the port using the Storm Control Recover setting at the top of this window. Choosing this option obligates the user to configure the Interval setting as well, which will provide packet count samplings from the Switch's chip to determine if a Packet Storm is occurring.
Count Down	The Count Down timer is set to determine the amount of time, in minutes, that the Switch will wait before shutting down the port that is experiencing a traffic storm. This parameter is only useful for ports configured as Shutdown in their Action field and therefore will not operate for Hardware based Traffic Control implementations. The possible time settings for this field are *0*, *5-30* minutes. *0* denotes that the port will never shutdown.
Interval	The Interval will set the time between Multicast and Broadcast packet counts sent from the Switch's chip to the Traffic Control function. These packet counts are the determining factor in deciding when incoming packets exceed the Threshold value. The Interval may be set between *5*

	and *30* seconds with the default setting of *5* seconds.

Click **Apply** to implement the settings made.

NOTE: Traffic Control cannot be implemented on ports that are set for Link Aggregation (Port Trunking).

NOTE: Ports that are in the Shutdown forever mode will be seen as Discarding in Spanning Tree windows and implementations though these ports will still be forwarding BPDUs to the Switch's CPU.

NOTE: Ports that are in Shutdown Forever mode will be seen as link down in all windows and screens until the user recovers these ports.

Port Security

A given ports' (or a range of ports') 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. Using the **Admin State** pull-down menu to *Enabled*, and clicking **Apply** can lock the port.

Port Security 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. To view the following window, open the **Security** folder and click **Port Security**.

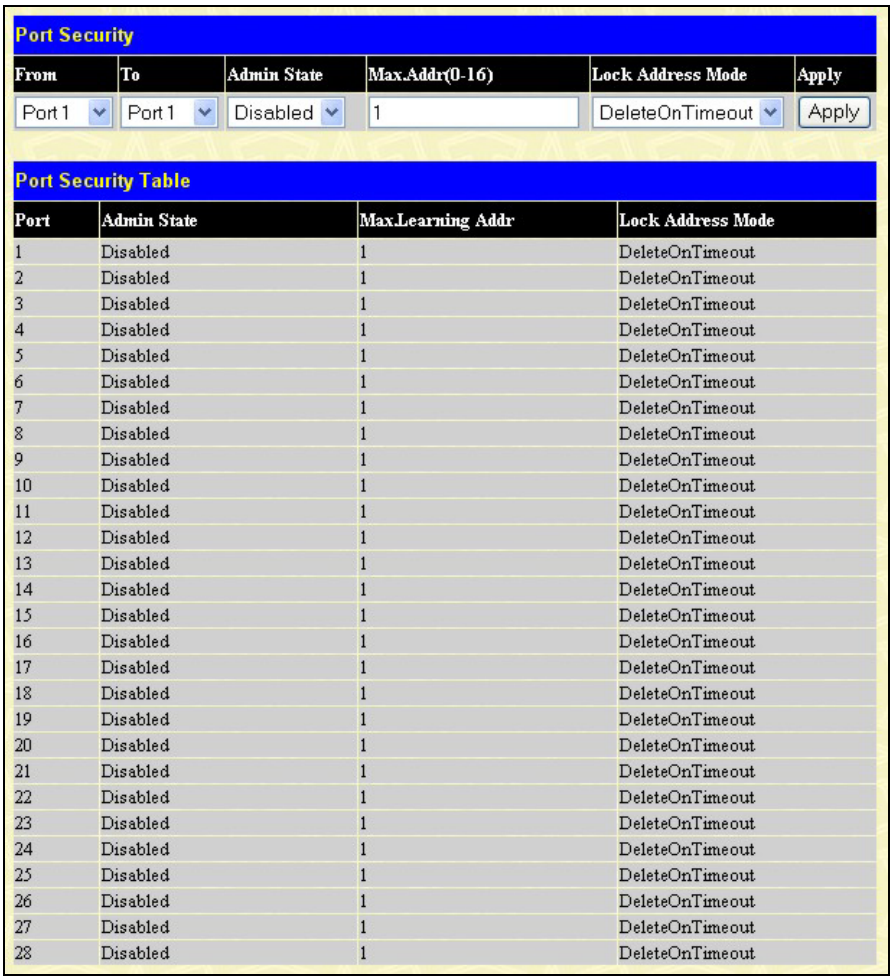


Figure 10- 2. Port Security window

The following parameters can be set:

Parameter	Description
From/To	A consecutive group of ports may be configured starting with the selected port.
Admin State	This pull-down menu allows users to enable or disable Port Security (locked MAC address table for the selected ports).
Max. Learning Addr. (0-16)	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.

Click **Apply** to implement changes made.

Port Lock Entries

The **Port Lock Entries Table** 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 **Security > Port Lock Entries**:

Figure 10- 3. Port Lock Entries 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 the ✕ under the **Delete** heading of the corresponding MAC address to be deleted. Only entries marked *Secured_Permanent* can be deleted. Click the **Next** button to view the next page of entries listed in this table. This window displays the following information:

Parameter	Description
VID	The VLAN ID of the entry in the forwarding database table that has been permanently learned by the Switch.
VLAN Name	The VLAN Name of the entry in the forwarding database table that has been permanently learned by the Switch.
MAC Address	The MAC address of the entry in the forwarding database table that has been permanently learned by the Switch.
Port	The ID number of the port that has permanently learned the MAC address.
Type	The type of MAC address in the forwarding database table. Only entries marked *Secured_Permanent* can be deleted.
Delete	Click the ✕ in this field to delete the corresponding MAC address that was permanently learned by the Switch.

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:

1. **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.
2. **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.
3. **Hash Algorithm**: This part of the ciphersuite allows the user to choose a message digest function which 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. The Switch is shipped with a certificate pre-loaded though the user may need to download more, depending on user circumstances.

Ciphersuite

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 windows for Download Certificate and Ciphersuite, click **Security > SSL**:

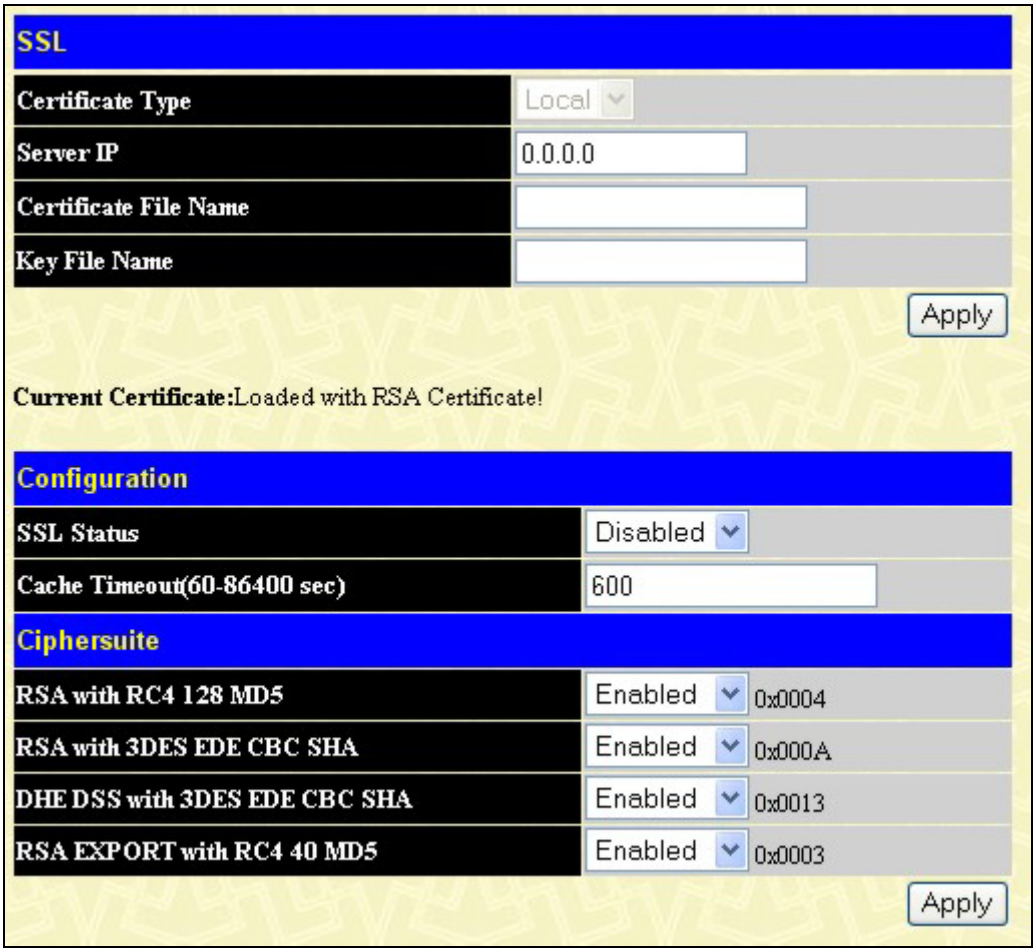


Figure 10- 4. Download Certificate and Ciphersuite window

To download certificates, set the following parameters and click **Apply**.

Parameter	Description
Certificate Type	Enter the type of certificate to be downloaded. This type refers to the server responsible for issuing certificates. This field has been limited to Local for this firmware release.
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 to download. This file must have a .der extension (Ex. c:/pkey.der)

To set up the SSL function on the Switch, configure the following parameters and click **Apply**.

Parameter	Description
Configuration	
SSL Status	Use the pull-down menu to enable or disable the SSL status on the switch. The default is *Disabled*.
Cache Timeout (60-86400 sec)	This field will set the time between a new key exchange between a client and a host using the SSL function. A new SSL session is established every time the client and host go through a key exchange. Specifying a longer timeout will allow the SSL session to reuse the master key on future connections with that particular host, therefore speeding up the negotiation process. The default setting is *600* seconds.

Ciphersuite	
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.
DHS 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.

NOTE: For more information on SSL and its functions, see the *DES-3028/28P/52/52P CLI 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.

SSH

SSH is an abbreviation of Secure Shell, which is a program allowing secure remote login and secure network services over an insecure network. It allows a secure login to remote host computers, a safe method of executing commands on a remote end node, and will provide secure encrypted and authenticated communication between two non-trusted hosts. SSH, with its array of unmatched security features is an essential tool in today's networking environment. It is a powerful guardian against numerous existing security hazards that now 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 **Security Management** folder. This is identical to creating any other admin-level User Account on the Switch, including specifying a password. This password is used to logon to the Switch, once a secure communication path 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, which are *Host Based*, *Password* and *Public Key*.
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 Configuration** window.

After completing the preceding steps, a SSH Client on a remote PC can be configured to manage the Switch using a secure, in band connection.

SSH Server Configuration

The following window is used to configure and view settings for the SSH server and can be opened by clicking **Security > SSH > SSH Server Configuration**:

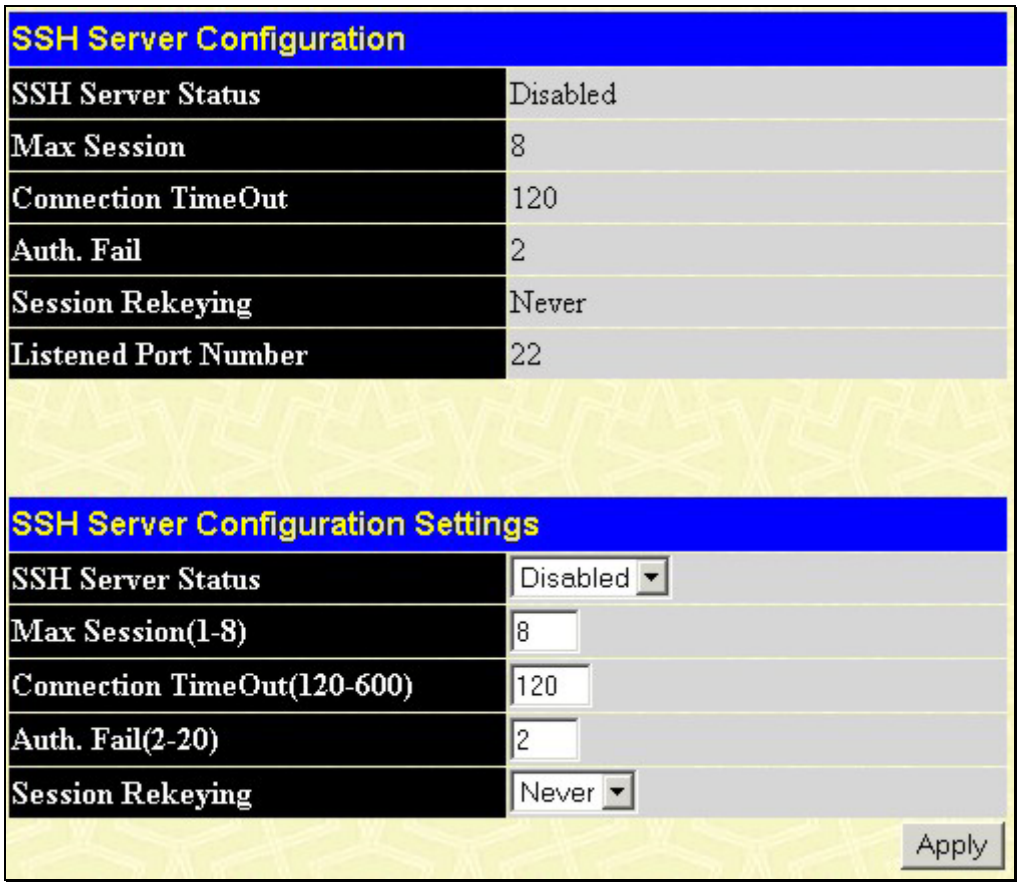


Figure 10- 5. SSH Server Configuration window

To configure the SSH server on the Switch, modify 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 setting is *8*.
Time Out (120-600)	Allows the user to set the connection timeout. The use may set a time between *120* and *600* seconds. The default setting is *120* 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 the SSH authentication. After the maximum number of attempts has been 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 setting is *2*.
Session Rekeying	Using the pull-down menu uses this field to set the time period that the Switch will change the security shell encryptions. The available options are *Never*, *10 min*, *30 min*, and *60 min*. The default setting is *Never*.

SSH Authentication Mode and Algorithm Settings

The SSH Algorithm window allows the configuration of the desired types of SSH algorithms used for authentication encryption. There are four categories of algorithms listed and specific algorithms of each may be enabled or disabled by using their corresponding pull-down menus. All algorithms are enabled by default. To open the following window, click **Security > SSH > SSH Authentication Mode and Algorithm Settings**:

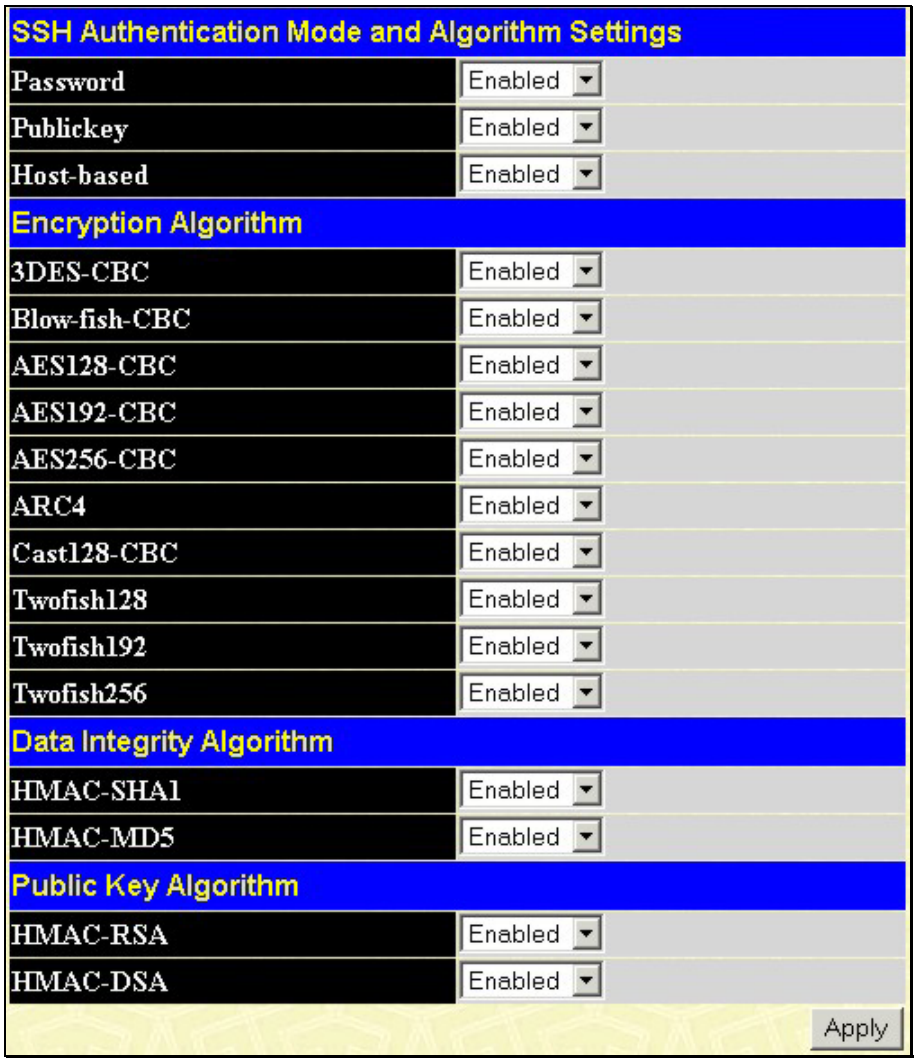


Figure 10- 6. Encryption Algorithm window

The following algorithms may be set:

Parameter	Description
SSH Authentication Mode and Algorithm Settings	
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 public key configuration set on a SSH server, for authentication on the Switch. 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*.
Encryption Algorithm	
3DES-CBC	Use the pull-down 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 to enable or disable the Blowfish encryption algorithm with Cipher Block Chaining. The default is *Enabled*.
AES128-CBC	Use the pull-down 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 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 to enable or disable the Advanced Encryption Standard AES-256 encryption algorithm with Cipher Block Chaining. The default is *Enabled*.
ARC4	Use the pull-down to enable or disable the Arcfour encryption algorithm with Cipher Block Chaining. The default is *Enabled*.
Cast128-CBC	Use the pull-down to enable or disable the Cast128 encryption algorithm with Cipher Block Chaining. The default is *Enabled*.
Twofish128	Use the pull-down to enable or disable the twofish128 encryption algorithm. The default is *Enabled*.
Twofish192	Use the pull-down to enable or disable the twofish192 encryption algorithm. The default is *Enabled*.
Twofish256	Use the pull-down to enable or disable the twofish256 encryption algorithm. The default is *Enabled*.
Data Integrity Algorithm	
HMAC-SHA1	Use the pull-down to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Secure Hash algorithm. The default is *Enabled*.
HMAC-MD5	Use the pull-down 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 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 to enable or disable the HMAC (Hash for Message Authentication Code) mechanism utilizing the Digital Signature Algorithm encryption. The default is *Enabled*.

Click **Apply** to implement changes made.

SSH User Authentication

The following windows are used to configure parameters for users attempting to access the Switch through SSH. To access the following window, click **Security > SSH > SSH User Authentication Mode**.

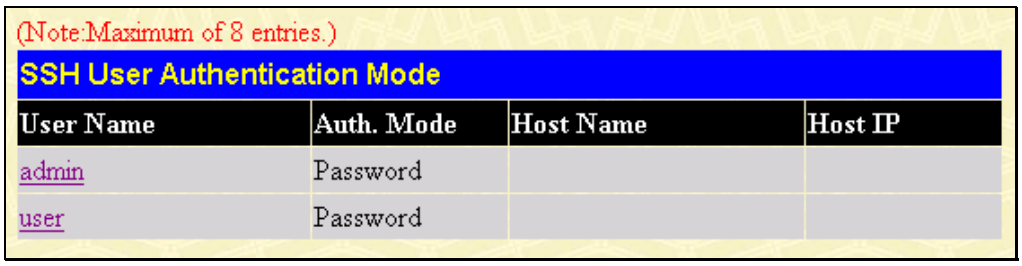


Figure 10- 7. SSH User Authentication Mode window

In the example window to the right, the User Account "admin" has been previously set using the User Accounts window in the **Administration** folder. A User Account MUST be set in order to set the parameters for the SSH user. To configure the parameters for a SSH user, click on the hyperlinked User Name in the **SSH User Authentication Mode** window, which will reveal the following window to configure.

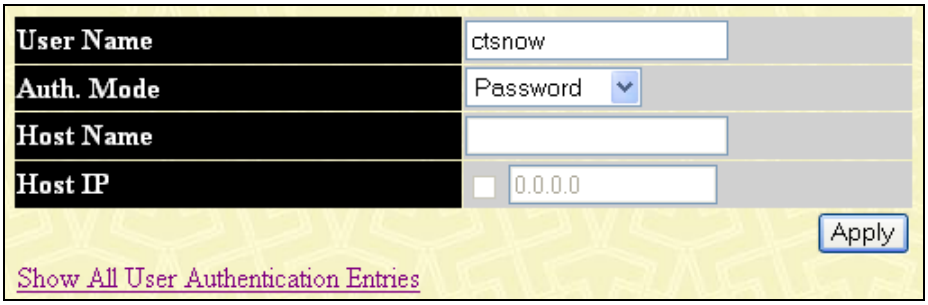


Figure 10- 8. SSH User window

The user may set the following parameters:

Parameter	Description
User Name	Enter a User Name 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 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 no more than 31 characters to identify the remote SSH user. • *Host IP* – Enter the corresponding IP address of the SSH user. *Password* – This parameter should be chosen to use an administrator-defined password for authentication. Upon entry of this parameter, the Switch will prompt the administrator for a password, and then to re-type the password for confirmation. *Public Key* – This parameter should be chosen to use the publickey on a SSH server for authentication.
Host Name	Enter an alphanumeric string of no more than 32 characters to identify the remote SSH user. This parameter is only used in conjunction with the Host Based choice in the Auth. Mode field.
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 field.

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 User Accounts section of this manual located in the Administration section.

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:

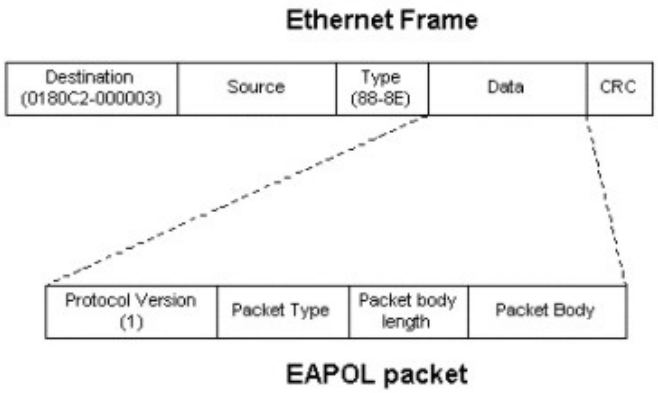


Figure 10- 9. The EAPOL Packet

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.

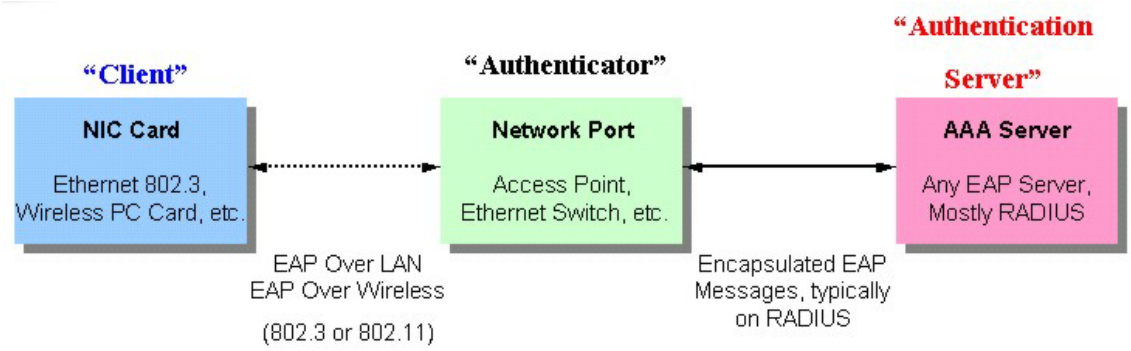


Figure 10- 10. The three roles of 802.1x

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 is connected to the same network as the Client and Authenticator, 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.

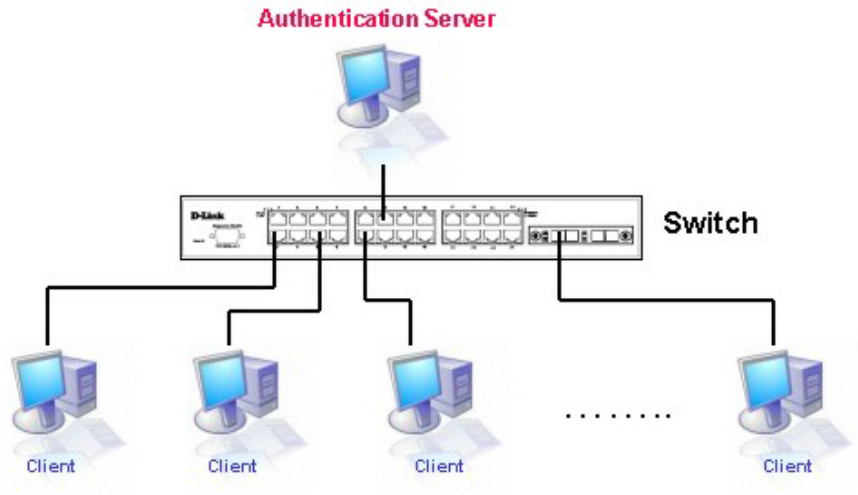


Figure 10- 11. The Authentication Server

Authenticator

The Authenticator (the Switch) is an intermediary between the Authentication Server and the Client. The Authenticator servers 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*. (**DES-30xx Web Management Tool**)
2. The 802.1x settings must be implemented by port (**Security** / **802.1x** / **Configure 802.1X Authenticator Parameter**)
3. A RADIUS server must be configured on the Switch. (**Security** / **802.1x** / **Authentic RADIUS Server**)

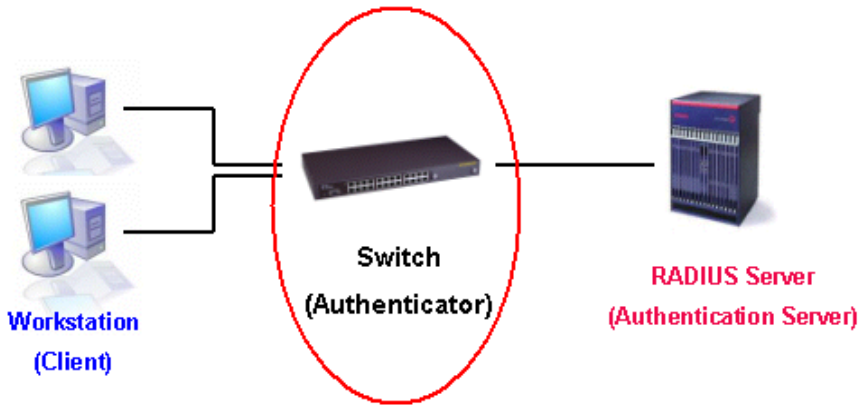


Figure 10- 12. The Authenticator

Client

The Client is simply the endstation that wishes to gain access to the LAN or switch services. All endstations 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.

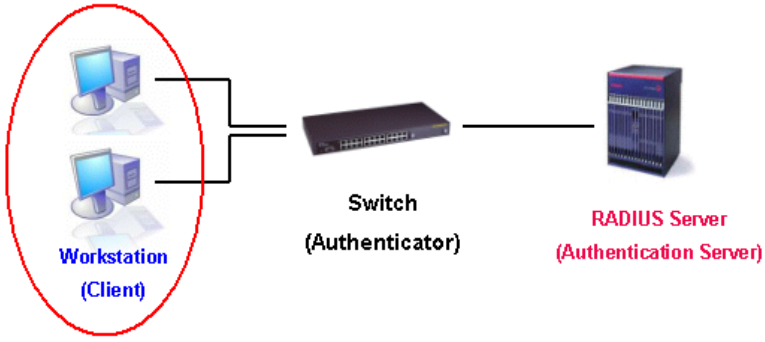


Figure 10- 13. The Client

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.

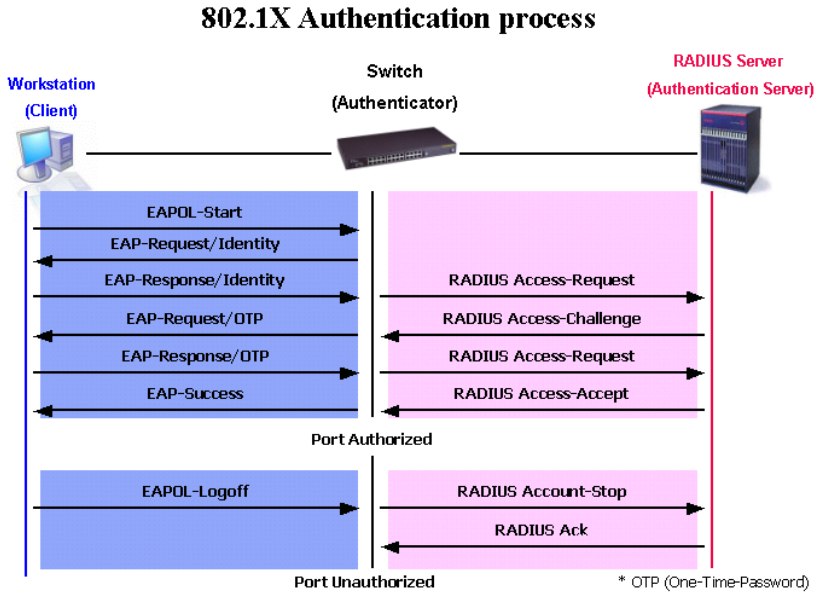


Figure 10- 14. The 802.1x Authentication Process

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 sixteen 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

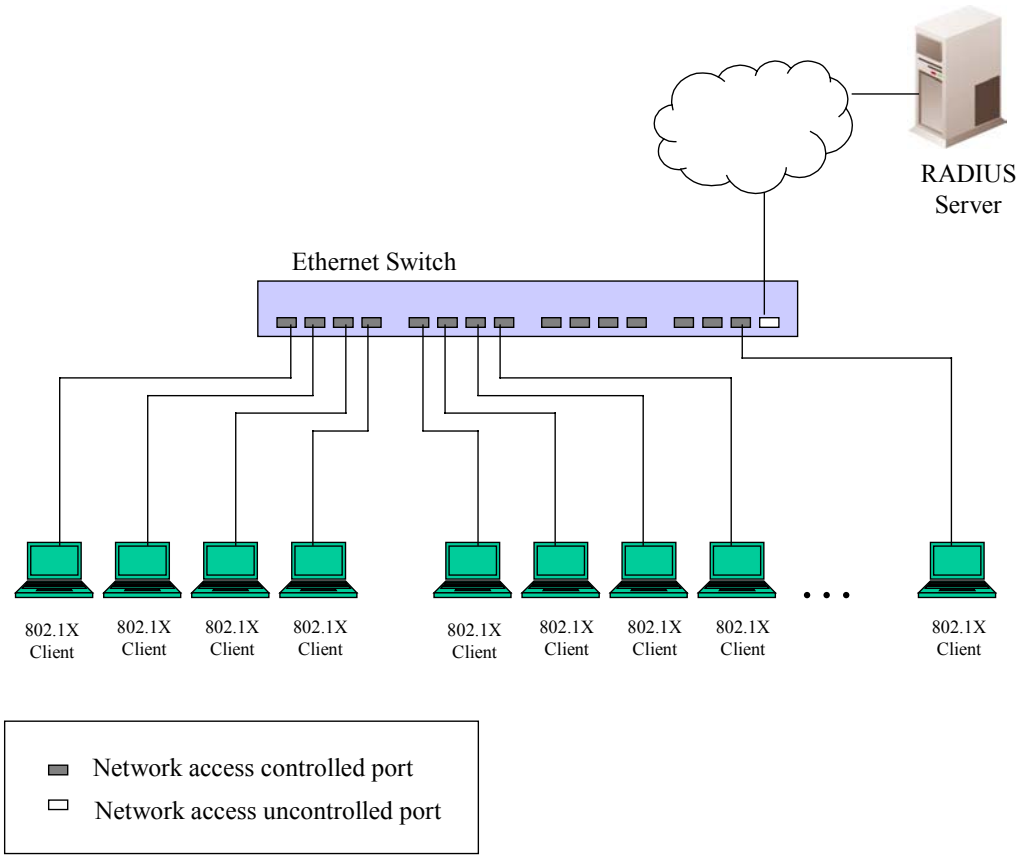


Figure 10- 15. Example of Typical Port-Based Configuration

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

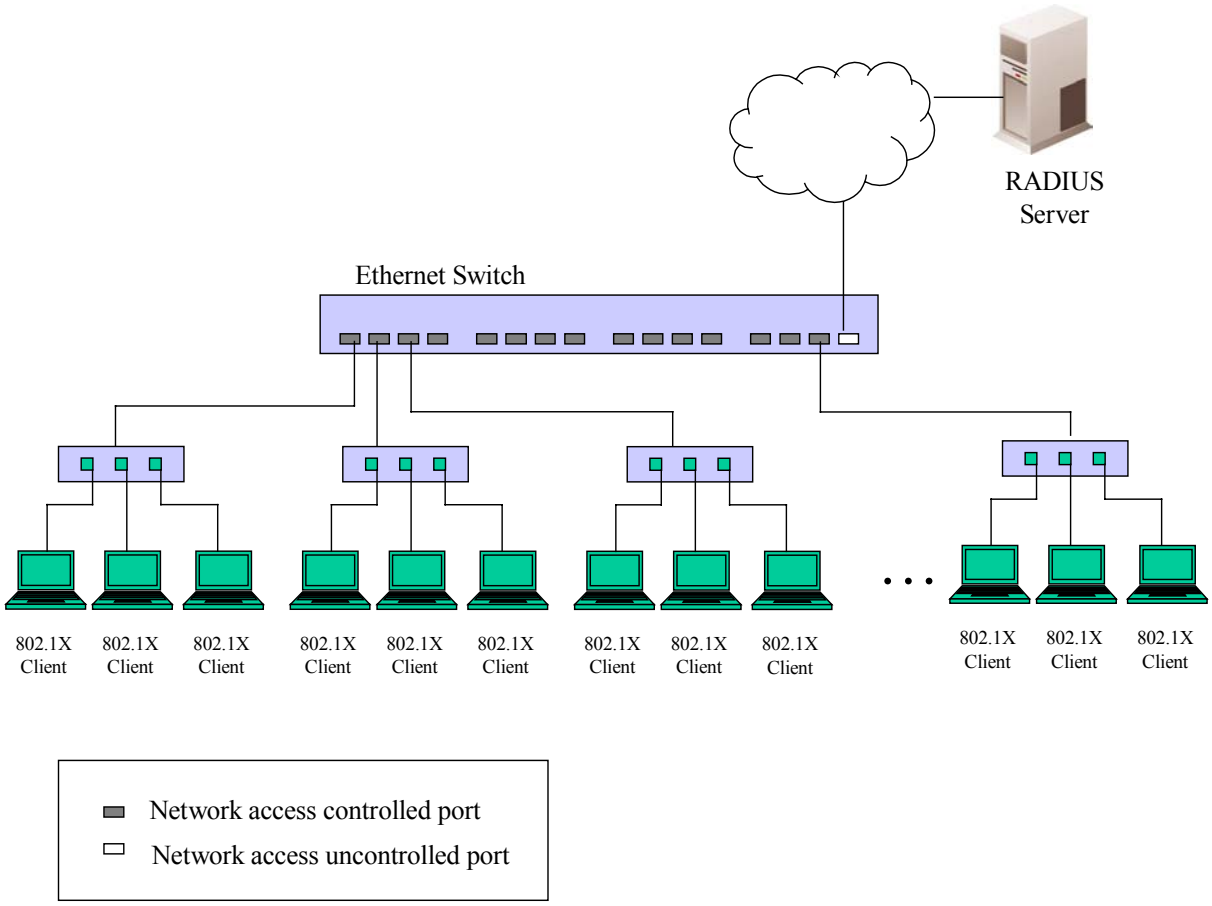


Figure 10- 16. Example of Typical MAC-Based Configuration

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.

Guest VLANs

On 802.1x security enabled networks, there is a need for non 802.1x supported devices to gain limited access to the network, due to lack of the proper 802.1x software or incompatible devices, such as computers running Windows 98 or lower operating systems, or the need for guests to gain access to the network without full authorization. To supplement these circumstances, this switch now implements Guest 802.1x VLANs. These VLANs should have limited access rights and features separate from other VLANs on the network.

To implement Guest 802.1x VLANs, the user must first create a VLAN on the network with limited rights and then enable it as an 802.1x guest VLAN. Then the administrator must configure the guest accounts accessing the Switch to be placed in a Guest VLAN when trying to access the Switch. Upon initial entry to the Switch, the client wishing services on the Switch will need to be authenticated by a remote RADIUS Server on the Switch to be placed in a fully operational VLAN. If authenticated and the authenticator posseses the VLAN placement information, that client will be accepted into the fully operational target VLAN and normal switch functions will be open to the client. If the authenticator does not have target VLAN placement information, the swtich will create a VLAN and the client will be placed in this VLAN. Yet, if the client is denied authentication by the authenticator, it will be placed in the Guest VLAN where it has limited rights and access. The adjacent figure should give the user a better understanding of the Guest VLAN process.

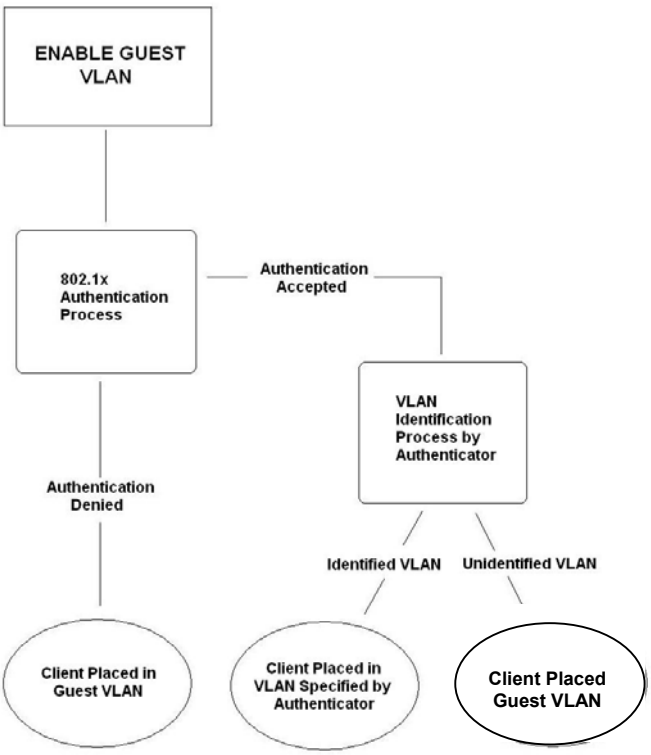


Figure 10- 17. Guest VLAN Authentication Process

Limitations Using the Guest VLAN

1. Guest VLANs are only supported for port-based VLANs. MAC-based VLANs cannot undergo this procedure.
2. Ports supporting Guest VLANs cannot be GVRP enabled and vice versa.
3. A port cannot be a member of a Guest VLAN and a static VLAN simultaneously.
4. Once a client has been accepted into the target VLAN, it can no longer access the Guest VLAN.
5. If a port is a member of multiple VLANs, it cannot become a member of the Guest VLAN.

Configure 802.1x Guest VLAN

In the **Security** menu, open the **802.1x** folder and click **Configure 802.1x Guest VLAN**, which will display the following window for the user to configure. Remember, to set a Guest 802.1x VLAN, the user must first configure a normal VLAN which can be enabled here for Guest VLAN status.

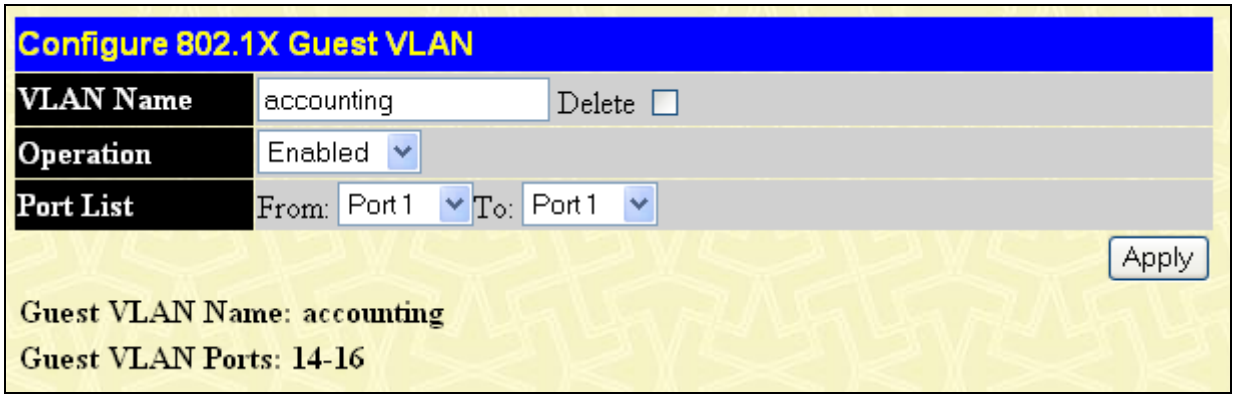


Figure 10- 18. Configure 802.1x Guest VLAN window

The following fields may be modified to enable the guest 802.1x VLAN:

Parameter	Description
VLAN Name	Enter the pre-configured VLAN name to create as a Guest 802.1x VLAN.
Operation	The user has two choices in configuring the Guest 802.1X VLAN, which are: *Enabled* – Selecting this option will enable ports listed in the Port List below, as part of the Guest VLAN. Be sure that these ports are configured for this VLAN or users will be prompted with an error message. *Disabled* - Selecting this option will disable ports listed in the Port List below, as part of the Guest VLAN. Be sure that these ports are configured for this VLAN or users will be prompted with an error message.
Port List	Set the port list of ports to be enabled for the Guest 802.1x VLAN using the pull-down menus.

Click **Apply** to implement the guest 802.1x VLAN settings entered. Only one VLAN may be assigned as the 802.1X Guest VLAN.

802.1x Authenticator Settings

To configure the 802.1X Authenticator Settings, click **Security > 802.1X > 802.1X Authenticator Settings**:

802.1X Authenticator Settings

Port	AdmDir	Ctrl Stat	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
13	both	auto	30	60	30	30	2	3600	no
14	both	auto	30	60	30	30	2	3600	no
15	both	auto	30	60	30	30	2	3600	no
16	both	auto	30	60	30	30	2	3600	no
17	both	auto	30	60	30	30	2	3600	no
18	both	auto	30	60	30	30	2	3600	no
19	both	auto	30	60	30	30	2	3600	no
20	both	auto	30	60	30	30	2	3600	no
21	both	auto	30	60	30	30	2	3600	no
22	both	auto	30	60	30	30	2	3600	no
23	both	auto	30	60	30	30	2	3600	no
24	both	auto	30	60	30	30	2	3600	no
25	both	auto	30	60	30	30	2	3600	no
26	both	auto	30	60	30	30	2	3600	no
27	both	auto	30	60	30	30	2	3600	no
28	both	auto	30	60	30	30	2	3600	no

Figure 10- 19. 802.1x Authenticator Settings window

To configure the settings by port, click on its corresponding **Ports** link, which will display the following table to configure:

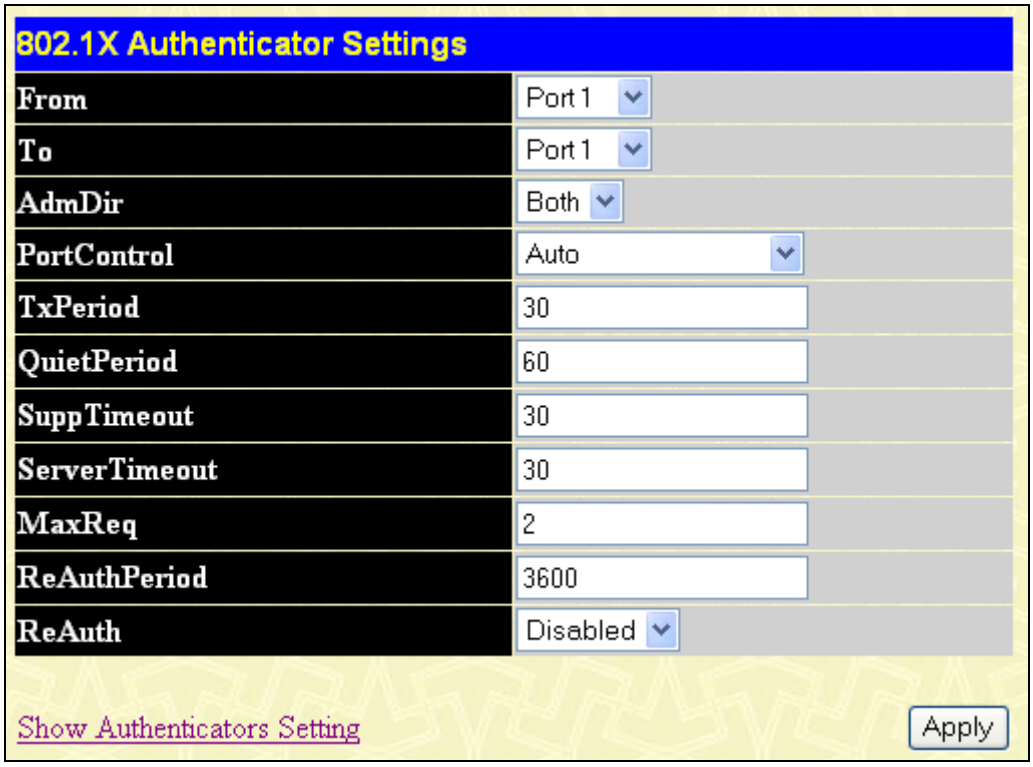


Figure 10- 20. 802.1X Authenticator Settings window (Modify)

This window allows users to set the following features:

Parameter	Description
From/To]	Enter the port or ports to be set.
AdmDir	Sets the administrative-controlled direction to either *In* or *Both*. If *In* is selected, control is only exerted over incoming traffic through the port you selected in the first field. If *Both* are selected, control is exerted over both incoming and outgoing traffic through the controlled port selected in the first field.
PortControl	This allows you to control the port authorization state. Select *forceAuthorized* 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 *forceUnauthorized* 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	This sets the TxPeriod of time for the authenticator PAE state machine. This value determines the period of an EAP Request/Identity packet transmitted to the client. The default setting is *30* seconds.
QuietPeriod	This allows you to set the number of seconds that the Switch remains in the quiet state following a failed authentication exchange with the client. The default setting is *60* seconds.

SuppTimeout	This value determines timeout conditions in the exchanges between the Authenticator and the client. The default setting is *30* seconds.
ServerTimeout	This value determines timeout conditions in the exchanges between the Authenticator and the authentication server. The default setting is *30* seconds.
MaxReq	The maximum number of times that the Switch will retransmit an EAP Request to the client before it times out of the authentication sessions. The default setting is *2*.
ReAuthPeriod	A constant that defines a nonzero number of seconds between periodic reauthentication of the client. The default setting is *3600* seconds.
ReAuth	Determines whether regular reauthentication will take place on this port. The default setting is *Disabled*.

Click **Apply** to implement configuration changes.

Local Users

In the **Security** folder, open the **802.1x** folder and click **802.1X User** to open the **802.1x User** window. This window will allow the user to set different local users on the Switch.

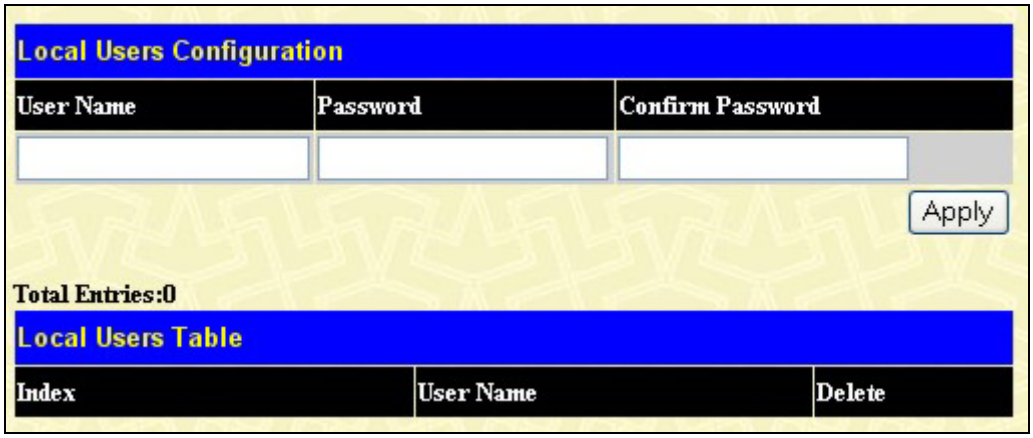


Figure 10- 21. Local Users Configuration window

Enter a **User Name**, **Password** and confirmation of that password. Properly configured local users will be displayed in the **Local Users Table** at the bottom of the same window.

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 **Security > 802.1x > Initialize Port(s)** to open the following window:

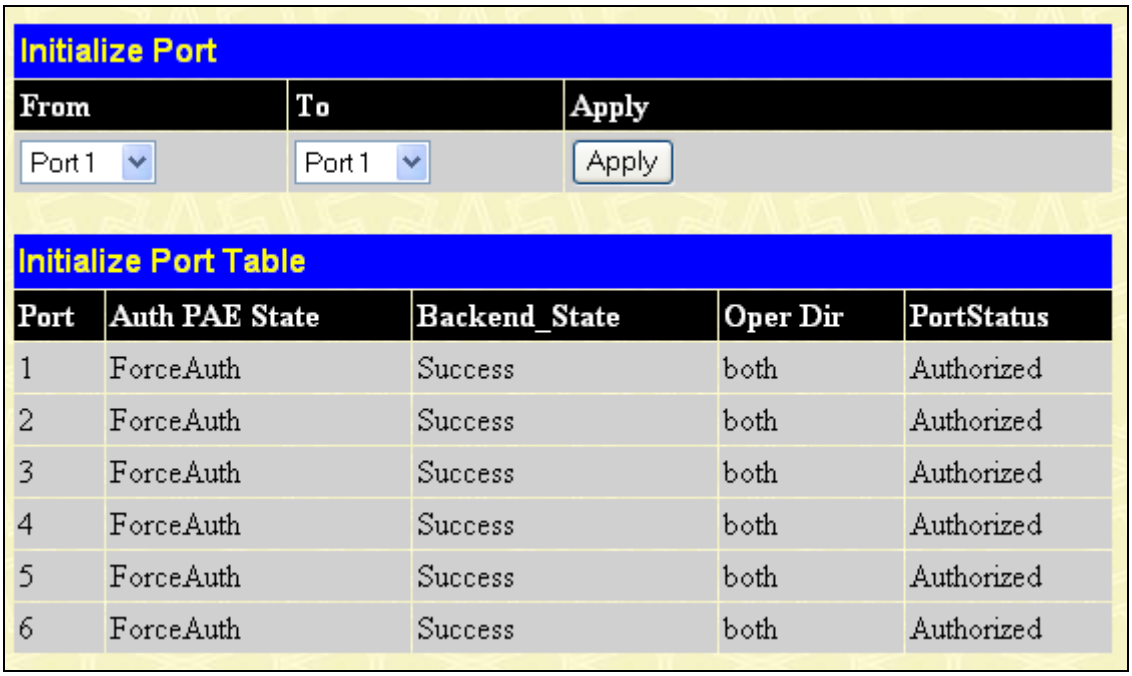


Figure 10- 22. Initialize Port window

This window allows initialization of 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
From and To	Select ports to be initialized.
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*

	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.*
Oper Dir	The status of the administrative-controlled direction, either *In* or *Both.*
Port Status	A read-only field indicating a port on the Switch.

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 **DES-30xx Web Management Tool** window. Click **Security > 802.1x > Initialize Port(s)** to open the following window:

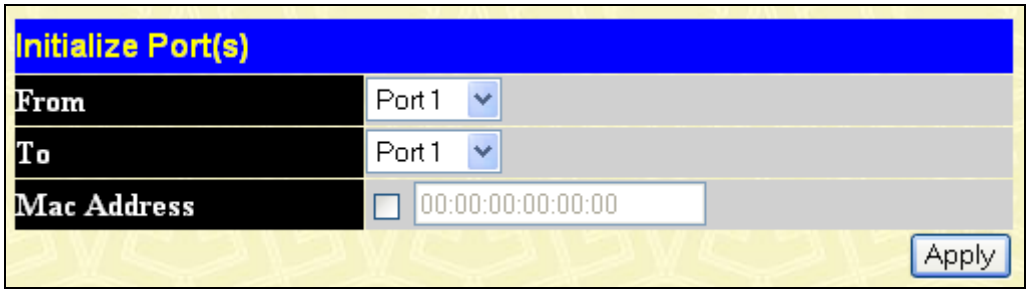


Figure 10- 23. Initialize Ports (MAC based 802.1x)

To initialize ports, choose 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 **DES-30xx Web Management Tool** window 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 reauthentication of 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 **Apply** has been clicked**.**

Click **Security > 802.1x > Reauthenticate Port(s)** to open the **Reauthenticate Port(s)** window:

Reauthenticate Port

From	To	Apply
Port 1	Port 1	Apply

Reauthenticate Port Table

Port	Auth State	BackendState	OperDir	PortStatus
1	ForceAuth	Success	both	Authorized
2	ForceAuth	Success	both	Authorized
3	ForceAuth	Success	both	Authorized
4	ForceAuth	Success	both	Authorized
5	ForceAuth	Success	both	Authorized
6	ForceAuth	Success	both	Authorized
7	ForceAuth	Success	both	Authorized
8	ForceAuth	Success	both	Authorized
9	ForceAuth	Success	both	Authorized
10	ForceAuth	Success	both	Authorized

Figure 10- 24. Reauthenticate Port and Reauthenticate Port Table window

This window displays the following information:

Parameter	Description
Port	The port number of the reauthenticated port.
Auth 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.*
OperDir	The status of the administrative-controlled direction, either *In* or *Both*.

NOTE: The user must first globally enable 802.1X in the **DES-30xx Web Management Tool** window before initializing ports. Information in the **Initialize 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 **DES-30xx Web Management Tool** window. Click **Security > 802.1x > Reauthenticate Port(s)** to open the following window:

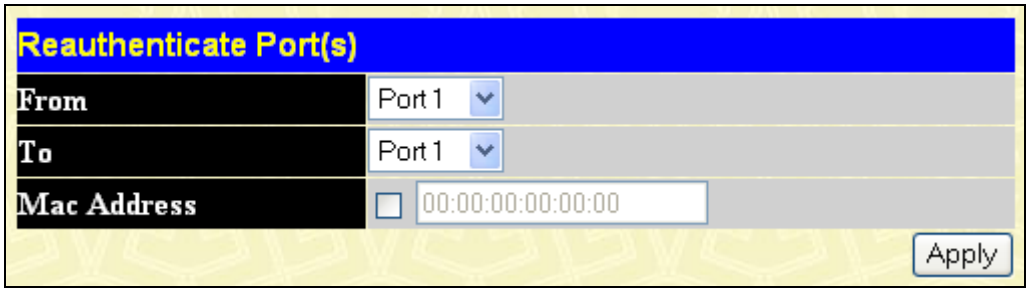


Figure 10- 25. Reauthenticate Ports window – MAC based 802.1x

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. The Web Manager offers three windows.

Click **Security** > **802.1x** > **RADIUS Server** to open the **RADIUS Server** window shown below:

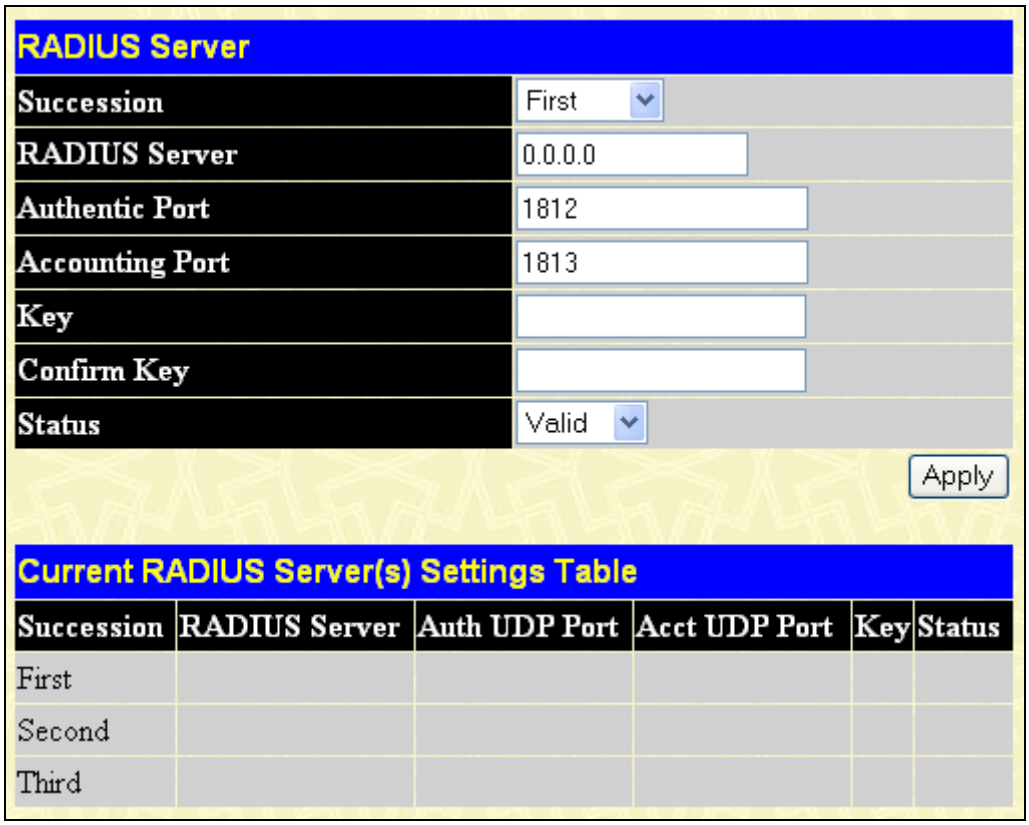


Figure 10- 26. RADIUS Server window

This window displays the following information:

Parameter	Description
Succession	Choose the desired RADIUS server to configure: *First, Second* or *Third*.
RADIUS Server	Set the RADIUS server IP.

Authentic Port	Set the RADIUS authentic server(s) UDP port. The default port is *1812*.
Accounting Port	Set the RADIUS account server(s) UDP port. The default port is *1813*.
Key	Set the key the same as that of the RADIUS server.
Confirm Key	Confirm the shared key is the same as that of the RADIUS server.
Status	This allows users to set the RADIUS Server as *Valid* (Enabled) or *Invalid* (Disabled).

Trusted Host

Go to the **Security** folder and click on the **Trusted Host** link; the following window will appear.

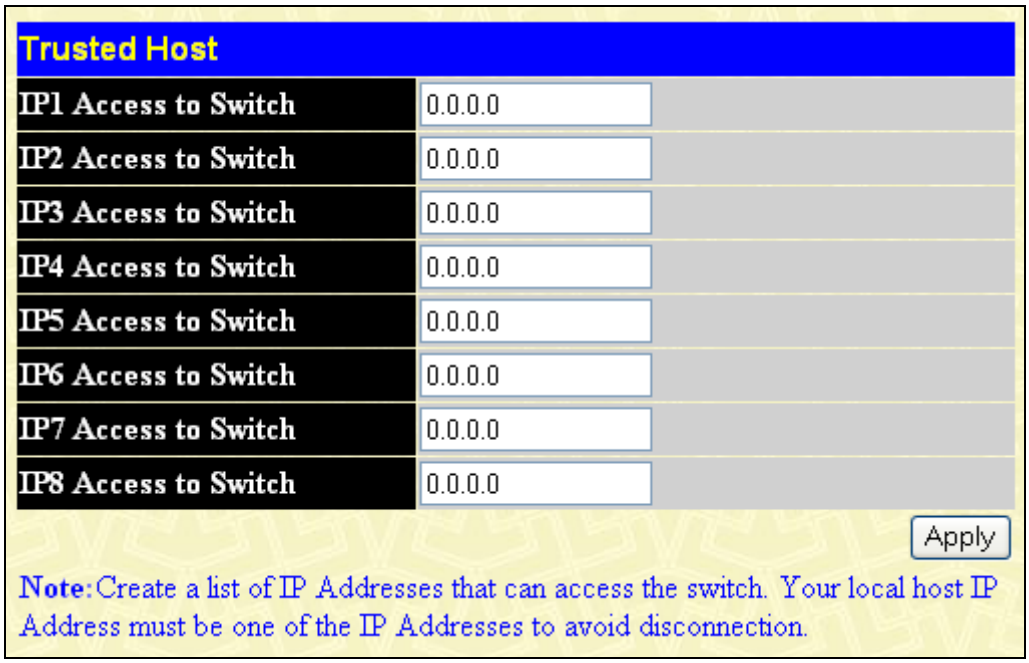


Figure 10- 27. Trusted Host window

Use 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. To define a management station IP setting, type in the IP address and click the **Apply** button.

Access Authentication Control

The TACACS/XTACACS/TACACS+/RADIUS commands allow users to 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.)

Authentication Policy and Parameter Settings

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 > Authentication Policy and Parameter Settings**:

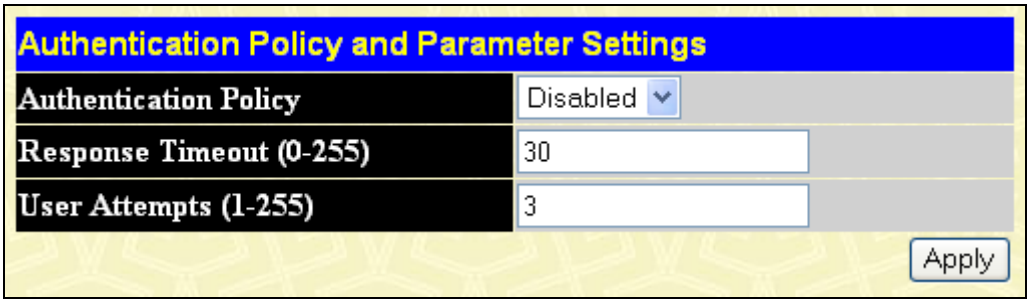


Figure 10- 28. Authentication Policy and Parameters Settings window

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 (0-255)	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 *0* 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, web) for login at the user level and at the administration level (Enable Admin**)** utilizing a previously configured method list. To view the following window, click **Security > Access Authentication Control > Application Authentication Settings**:

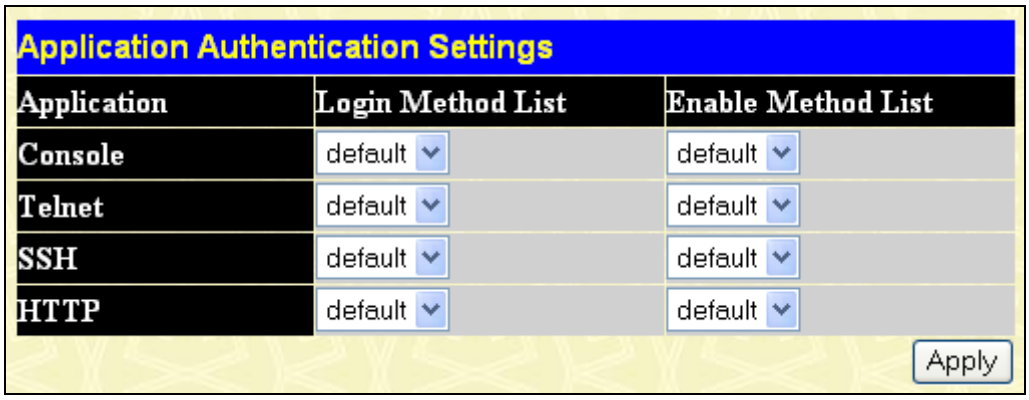


Figure 10- 29. Application Authentication Settings window

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, SSH 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 Lists** 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 Lists** 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 TACACS/XTACACS/TACACS+/RADIUS 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 three built-in Authentication Server Groups that cannot be removed but can be modified. Up to eight authentications server hosts may be added to any particular group.

To view the following window, click **Security > Access Authentication Control > Authentication Server Group**:

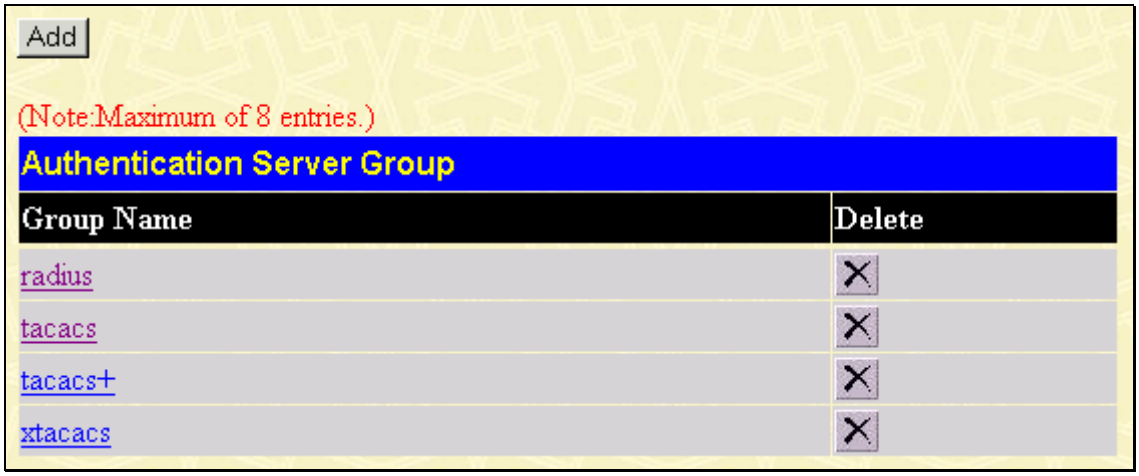


Figure 10- 30. Authentication Server Group window

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.

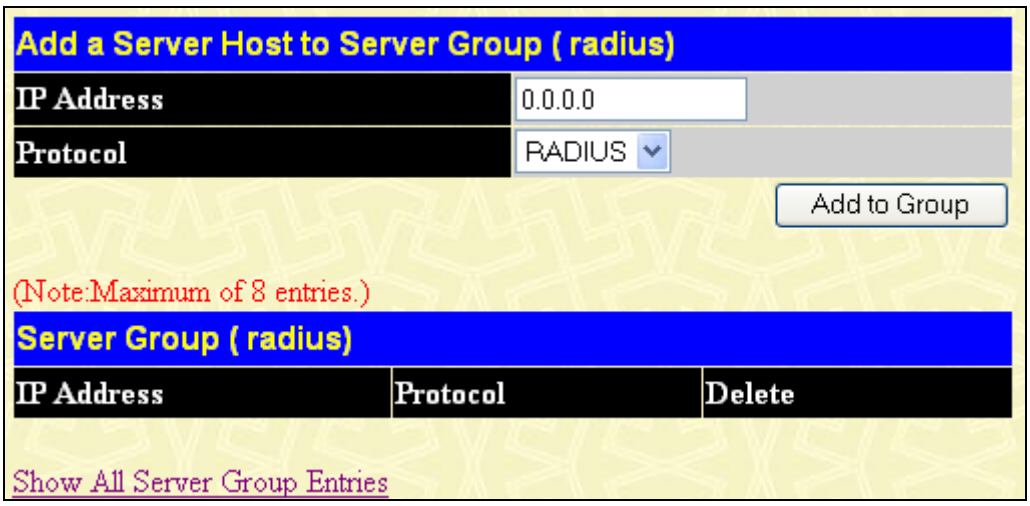


Figure 10- 31. Add a Server Host to Server Group (radius) window

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 and click **Add to Group** to add this Authentication Server Host to the group.

To add a user-defined group to the list, click the **Add** button in the **Authentication Server Group** window, which will display the following window.

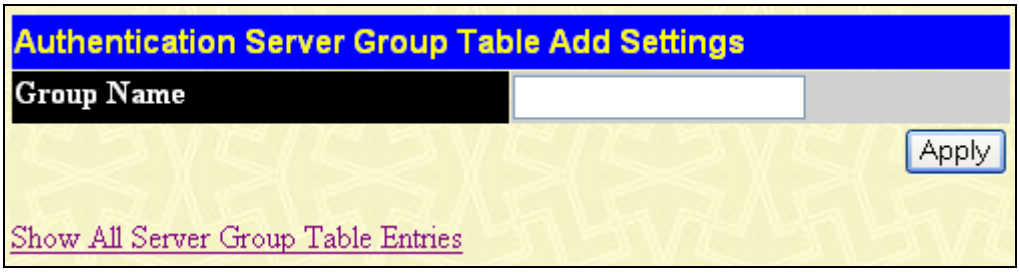


Figure 10- 32. Authentication Server Group Table Add Settings

Simply enter a group name of no more than 15 alphanumeric characters to define the user group to add. After clicking **Apply**, the new user-defined group will be displayed in the **Authentication Server Group** window. Here, it can be configured as the user desires.

NOTE: The user must configure Authentication Server Hosts using the Authentication Server Hosts 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 daemon. TACACS/XTACACS/TACACS+ 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 TACACS/XTACACS/TACACS+/RADIUS 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 TACACS/XTACACS/TACACS+/RADIUS server host on a remote host. The TACACS/XTACACS/TACACS+/RADIUS 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 TACACS/XTACACS/TACACS+/RADIUS 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**:

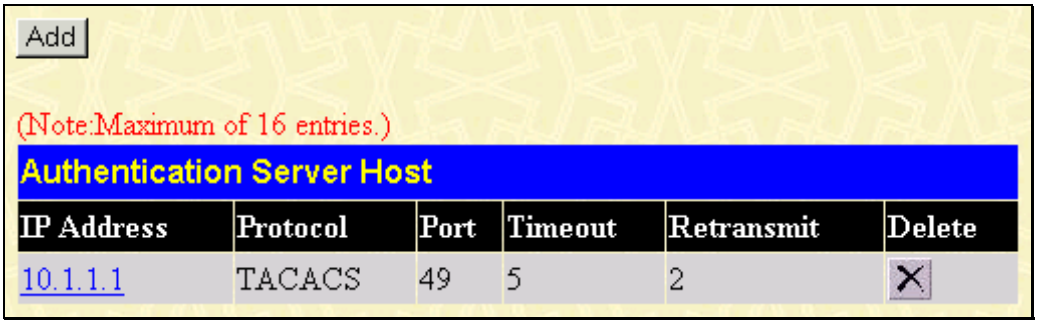


Figure 10- 33. Authentication Server Host Settings window

To add an Authentication Server Host, click the **Add** button, revealing the following window:

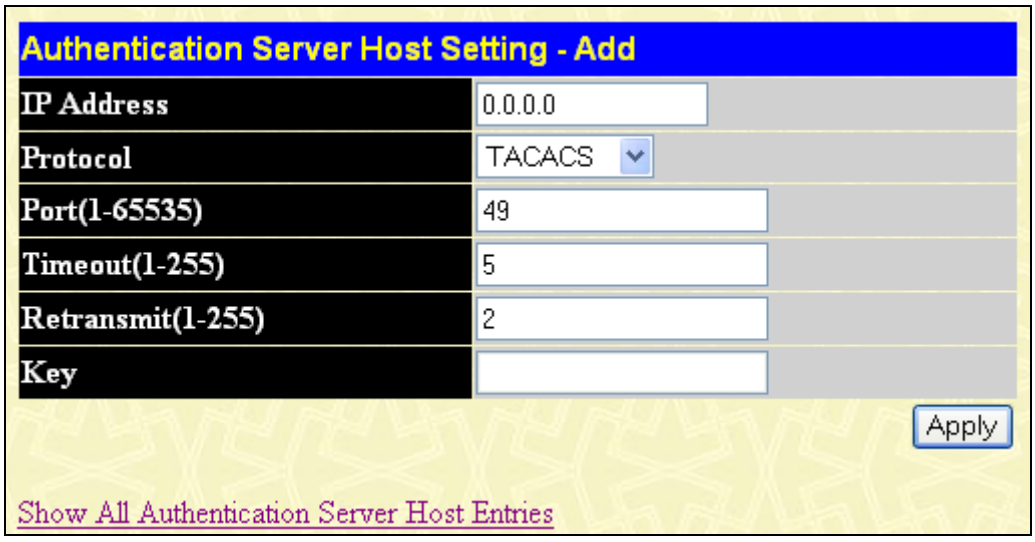


Figure 10- 34. Authentication Server Host Settings – Add window

To edit an Authentication Server Host, click the IP address hyperlink, revealing the following window:

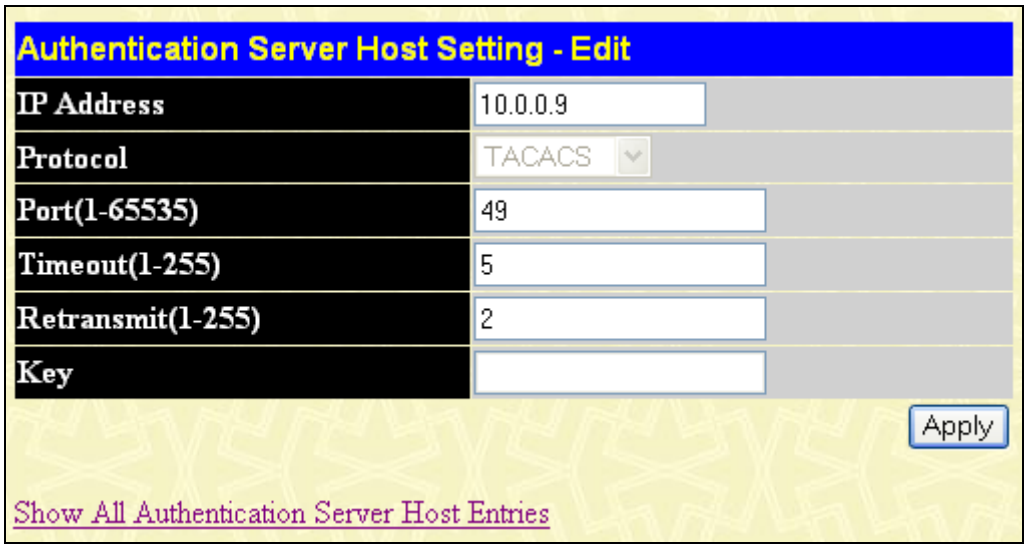


Figure 10- 35. Authentication Server Host Setting – Edit window

Configure the following parameters to add 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+ servers and *1813* 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 server does not respond.
Key	Authentication key to be shared with a configured TACACS+ or RADIUS servers 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 TACACS/XTACACS/TACACS+ 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. 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**:

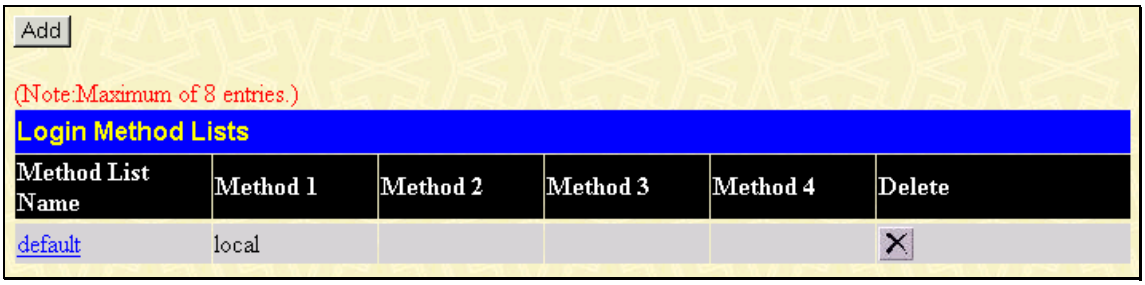


Figure 10- 36. Login Method Lists Settings window

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 new Method List, click the **Add** button.

Both actions will result in the same window to configure:

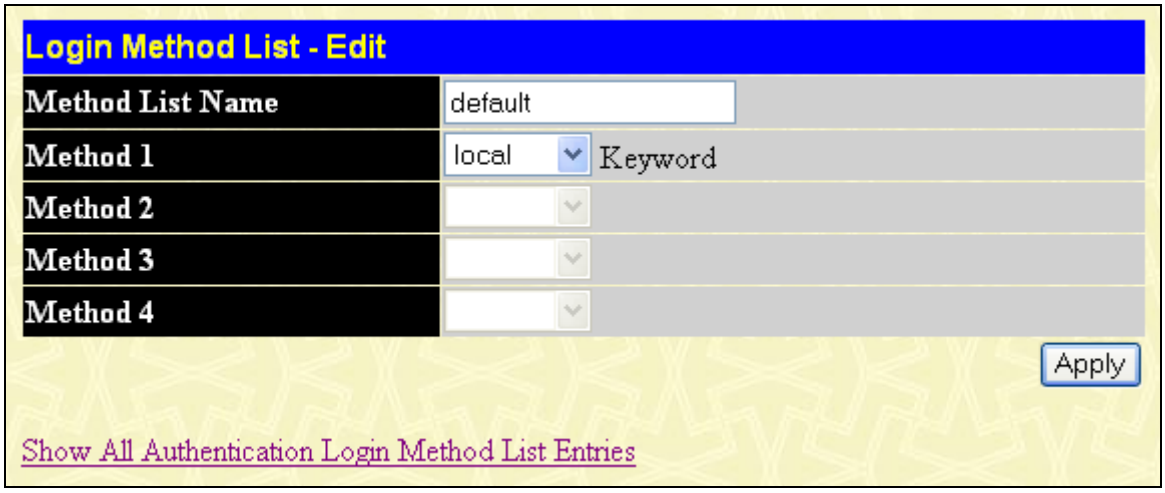


Figure 10- 37. Login Method List - Edit window (default)

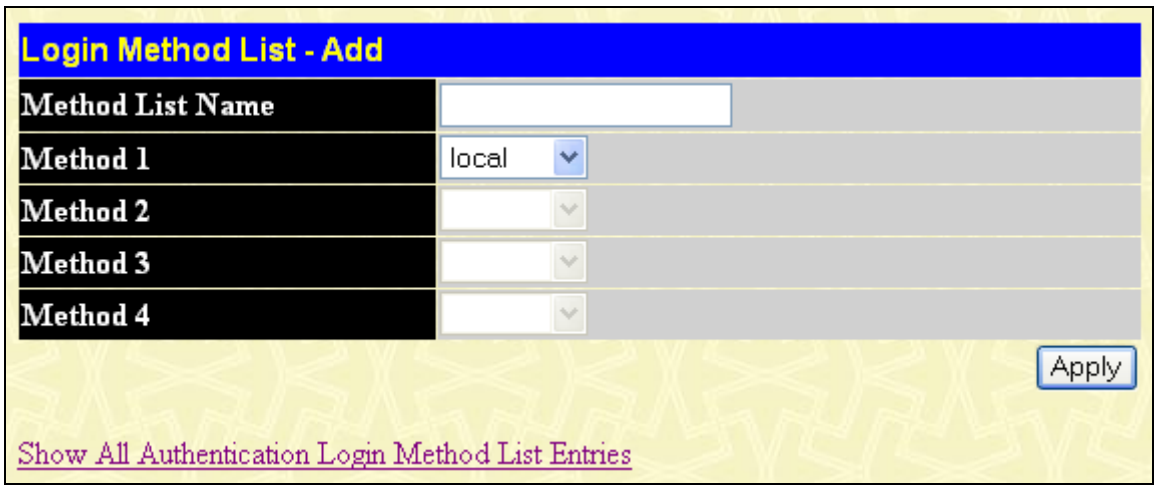


Figure 10- 38. Login Method List – Add window

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: • *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. • *tacacs+* - Adding this parameter will require the user to be authenticated using the TACACS+ protocol from a remote TACACS+ server. • *radius* - Adding this parameter will require the user to be authenticated using the RADIUS protocol from a remote RADIUS server. • *server_group* - Adding this parameter will require the user to be authenticated using a user-defined server group previously configured on the Switch. • *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 an authentication to access the Switch.

Enable Method Lists

The **Enable Method List Settings** window is used to set up Method Lists to promote users with user level privileges to Administrator (Admin) 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**:

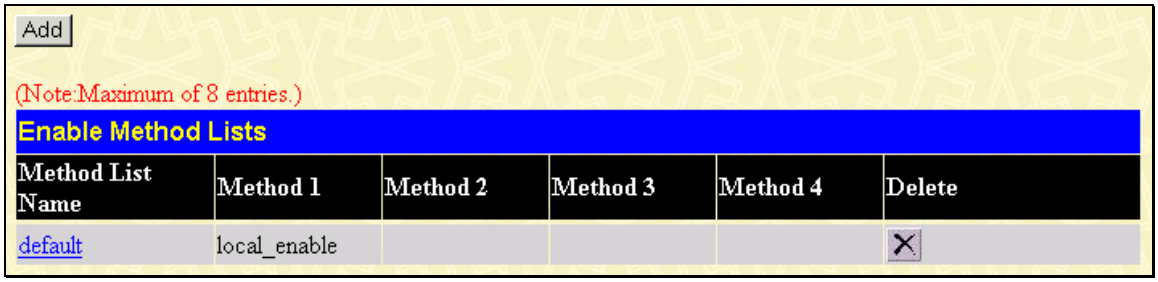


Figure 10- 39. Enable Method List Settings window

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 Method List Name. To configure a Method List, click the **Add** button.

Both actions will result in the same window to configure:

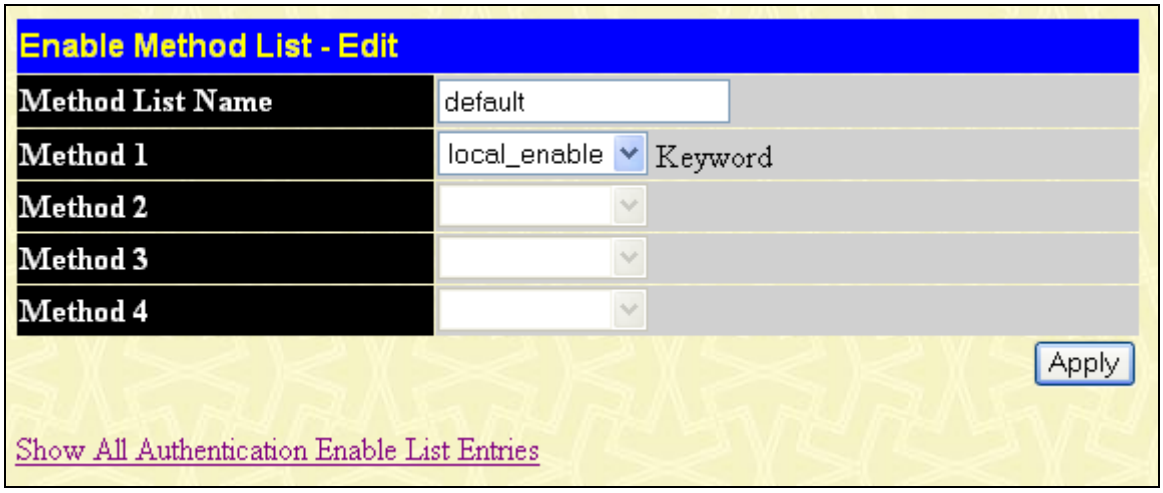


Figure 10- 40. Enable Method List - Edit window

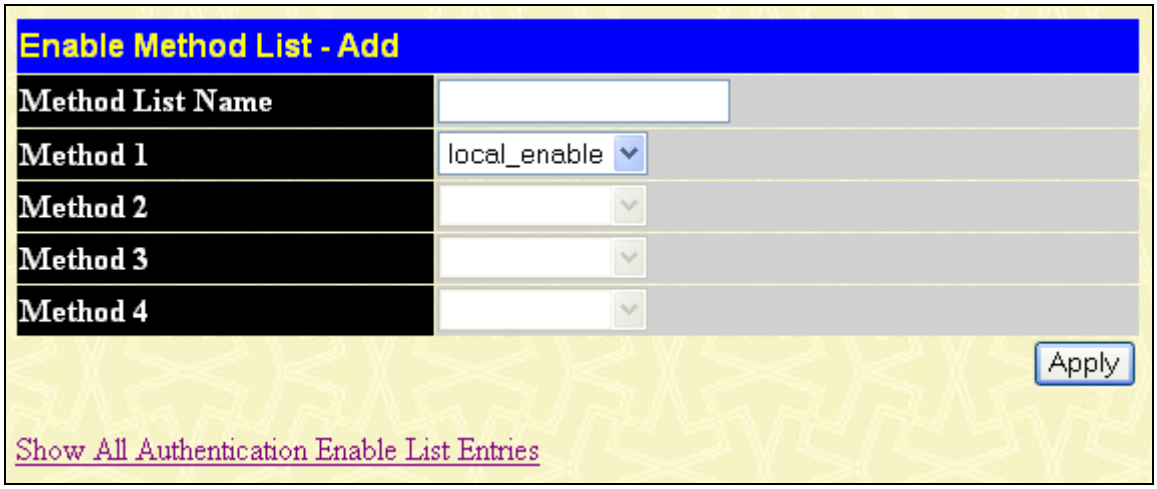


Figure 10- 41. Enable Method List - Add window

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 user in the next

	section entitled Local Enable Password must set the local enable password. • *none* - Adding this parameter will require an 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. • *xtacacs* - Adding this parameter will require the user to be authenticated using the XTACACS protocol from a remote XTACACS server. • *tacacs+* - Adding this parameter will require the user to be authenticated using the TACACS protocol from a remote TACACS server. • server_group - Adding a previously configured server group will require the user to be authenticated using a user-defined server group previously configured on the Switch.

Configure Local Enable Password

This window will configure the locally enabled password for the Enable Admin command. 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 > Configure Local Enable Password**:

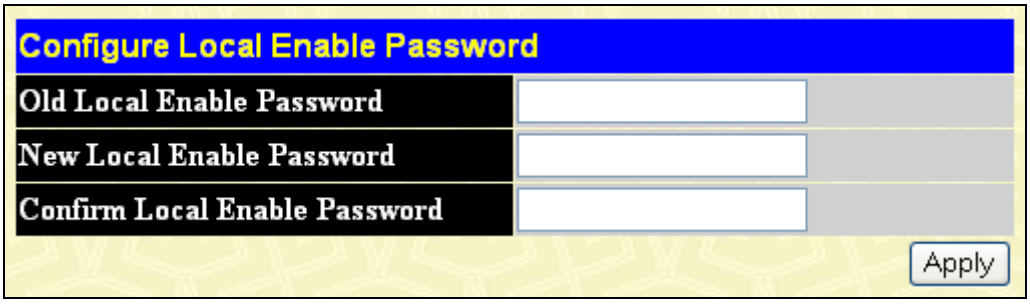


Figure 10- 42. Configure Local Enable Password window

To set the Local Enable Password, set the following parameters and click **Apply**.

Parameter	Description
Old Local Enabled	If a password was previously configured for this entry, enter it here in order to change it to a new password
New Local Enabled	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 15 characters.
Confirm Local Enabled	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

The **Enable Admin** 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 TACACS/XTACACS/TACACS+/RADIUS, user defined server groups, 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.

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.

To view the following window, click **Security > Access Authentication Control > Enable Admin**:

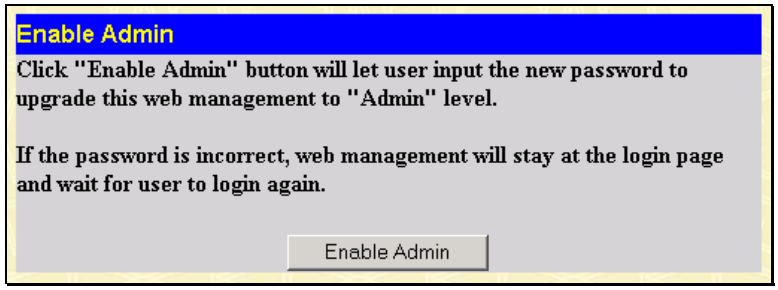


Figure 10- 43. Enable Admin window

Figure 10- 44. Enter Network Password dialog box

Traffic Segmentation

Traffic segmentation is used to limit traffic flow from a single port to a group of ports on a single Switch. 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.

In the **Security** folder, click **Traffic Segmentation**, to view the window shown below:

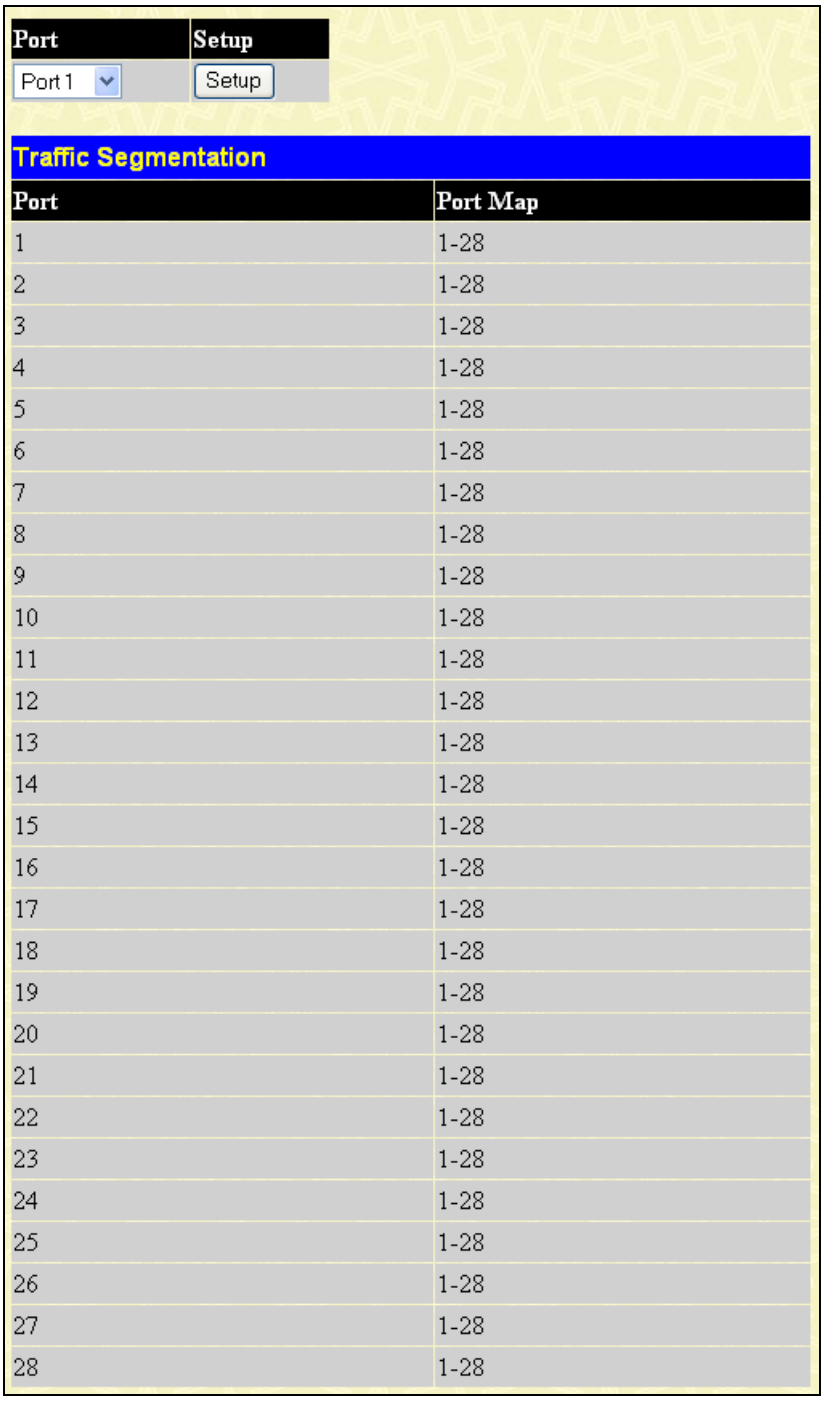


Figure 10- 45. Traffic Segmentation window

Click on the **Setup** button to open the **Setup Forwarding ports** window, as shown below:

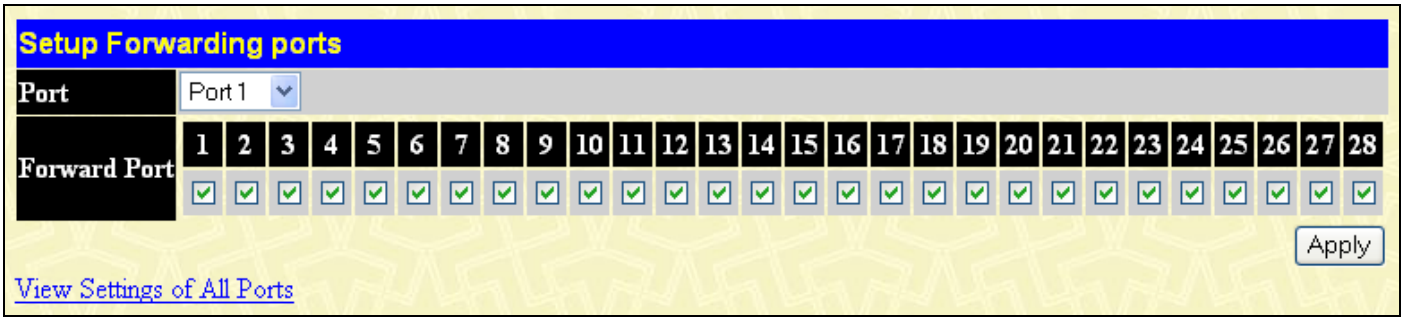


Figure 10- 46. Setup Forwarding ports window

This window allows the user to determine which port on a given switch will be allowed to forward packets to other ports on that switch.

To configure traffic segmentation specify a port from that switch, using the **Port** pull-down menu. Click **Apply** to enter the settings into the Switch's **Traffic Segmentation** table.

Section 11

Monitoring

CPU Utilization
Port Utilization
Packets
Packet Errors
Packet Size
MAC Address
Switch Log
IGMP Snooping Group
Browse Router Port
Static ARP Settings
Session Table
Port Access Control

CPU Utilization

The **CPU Utilization** displays the percentage of the CPU being used, expressed as an integer percentage and calculated as a simple average by time interval. To view the **CPU Utilization** window, open the **Monitoring** folder and click the **CPU Utilization** link.

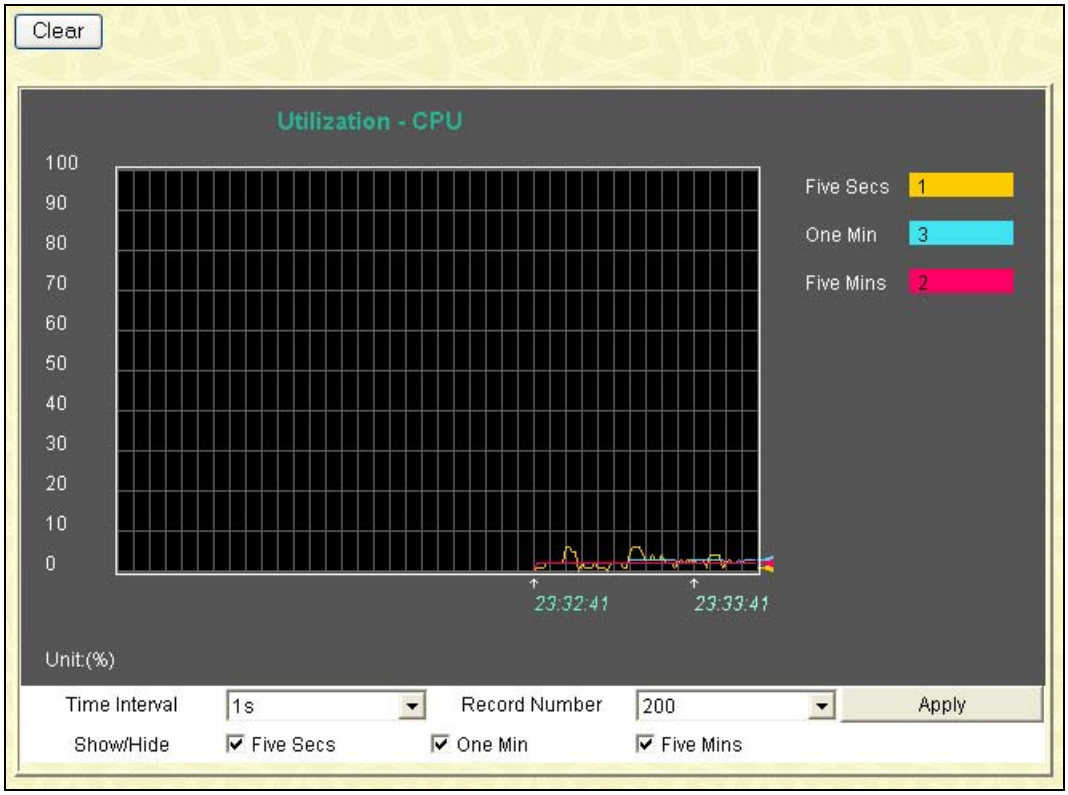


Figure 11- 1. CPU Utilization graph

To view the CPU utilization by port, use the real-time graphic of the Switch at the top of the web page by simply clicking on a port. Click **Apply** to implement the configured settings. The window will automatically refresh with new updated statistics.

The information is described as follows:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Show/Hide	Check whether to display Five Secs, One Min, and/or Five Mins.
Clear	Clicking this button clears all statistics counters on this window.

Port Utilization

The **Port Utilization** page displays the percentage of the total available bandwidth being used on the port.

To view the port utilization, open the **Monitoring** folder and then the **Port Utilization** link:

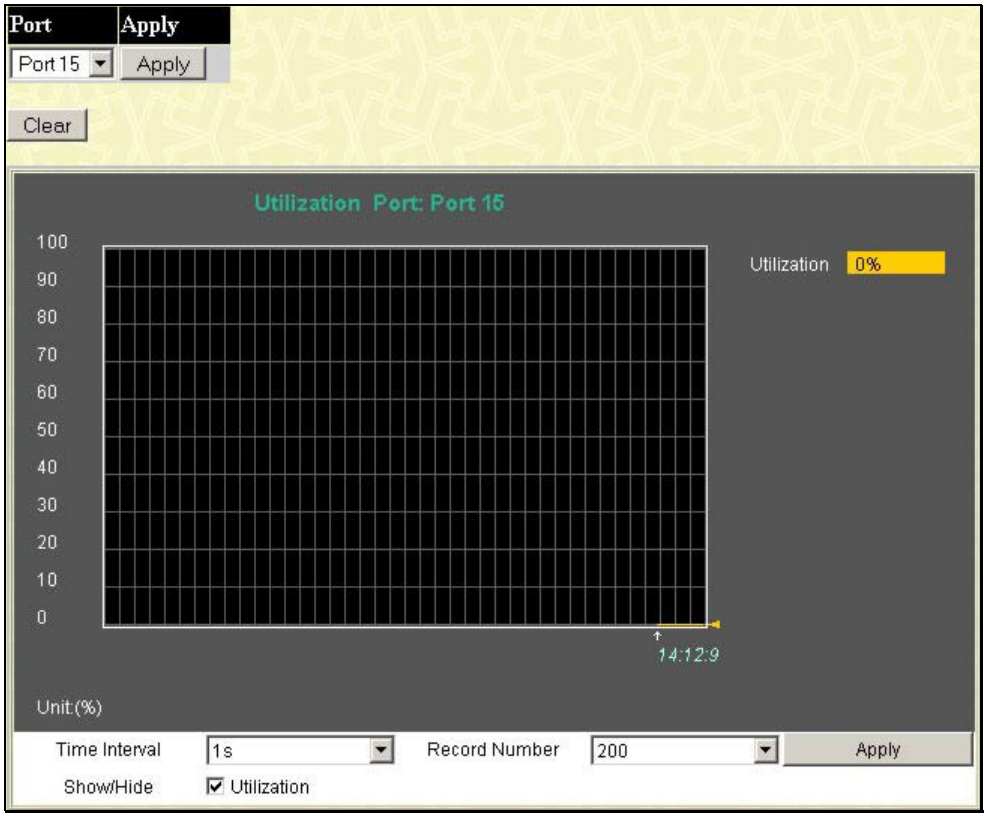


Figure 11- 2. Port Utilization window

The user may use the real-time graphic of the Switch at the top of the web page to view utilization statistics per port by clicking on a port. Click **Apply** to implement changes made. The following field can be set:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where “s” stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.
Show/Hide	Check whether to display Utilization.

Clear	Clicking this button clears all statistics counters on this window.

Packets

The Web Manager allows various packet statistics to be viewed as either a line graph or a table. Six windows are offered.

Received (RX)

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, use the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

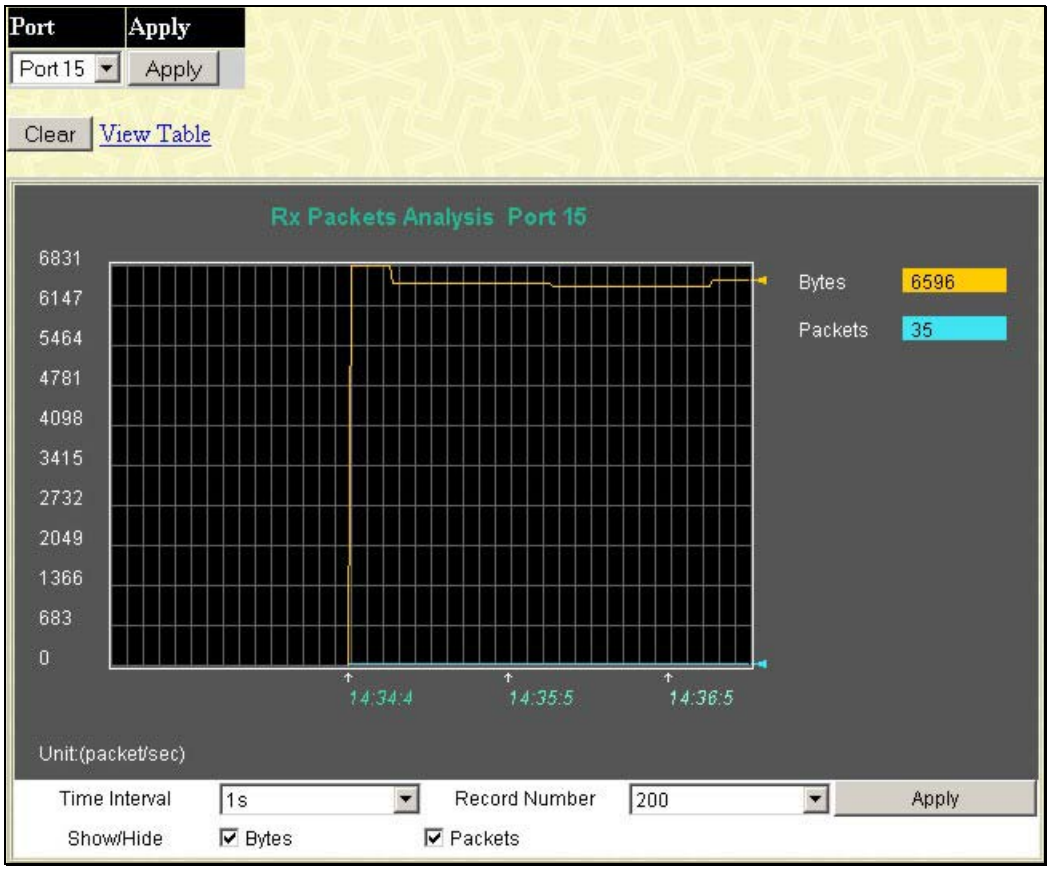


Figure 11- 3. Rx Packets Analysis window (line graph for Bytes and Packets)

To view the **Received Packets Table**, click the link View Table, which will show the following table:

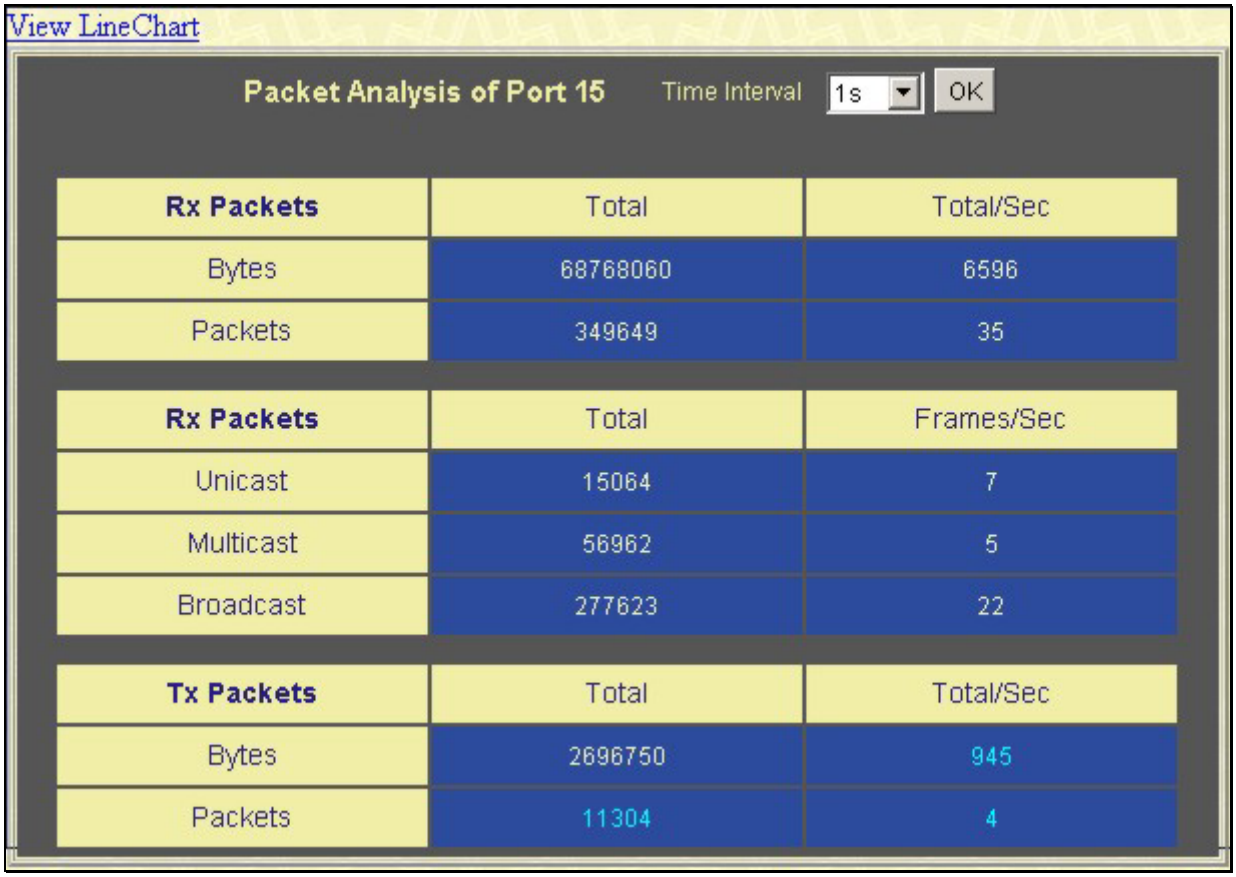


Figure 11- 4. Rx Packets Analysis Table

The following fields may be set or viewed:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	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.

UMB Cast (RX)

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, use the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

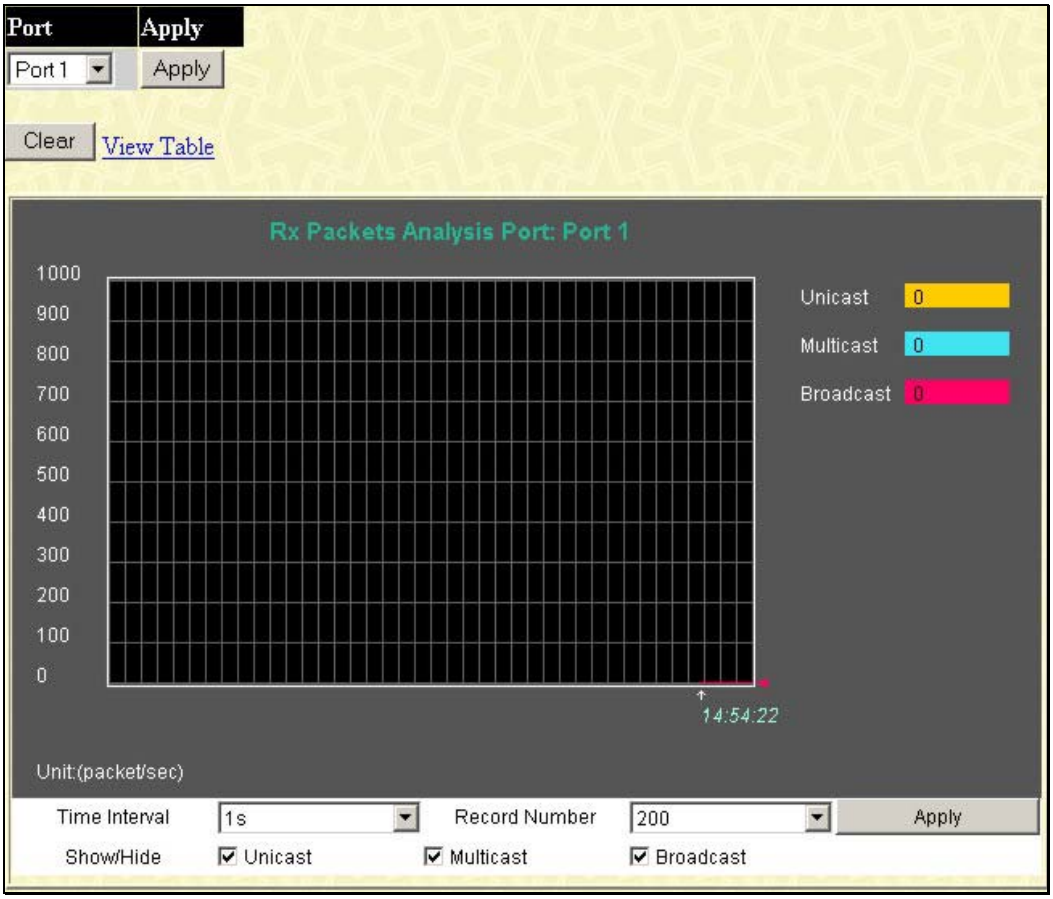


Figure 11- 5. Rx Packets Analysis window (line graph for Unicast, Multicast, and Broadcast Packets)

To view the **UMB Cast Table**, click the View Table link, which will show the following table:

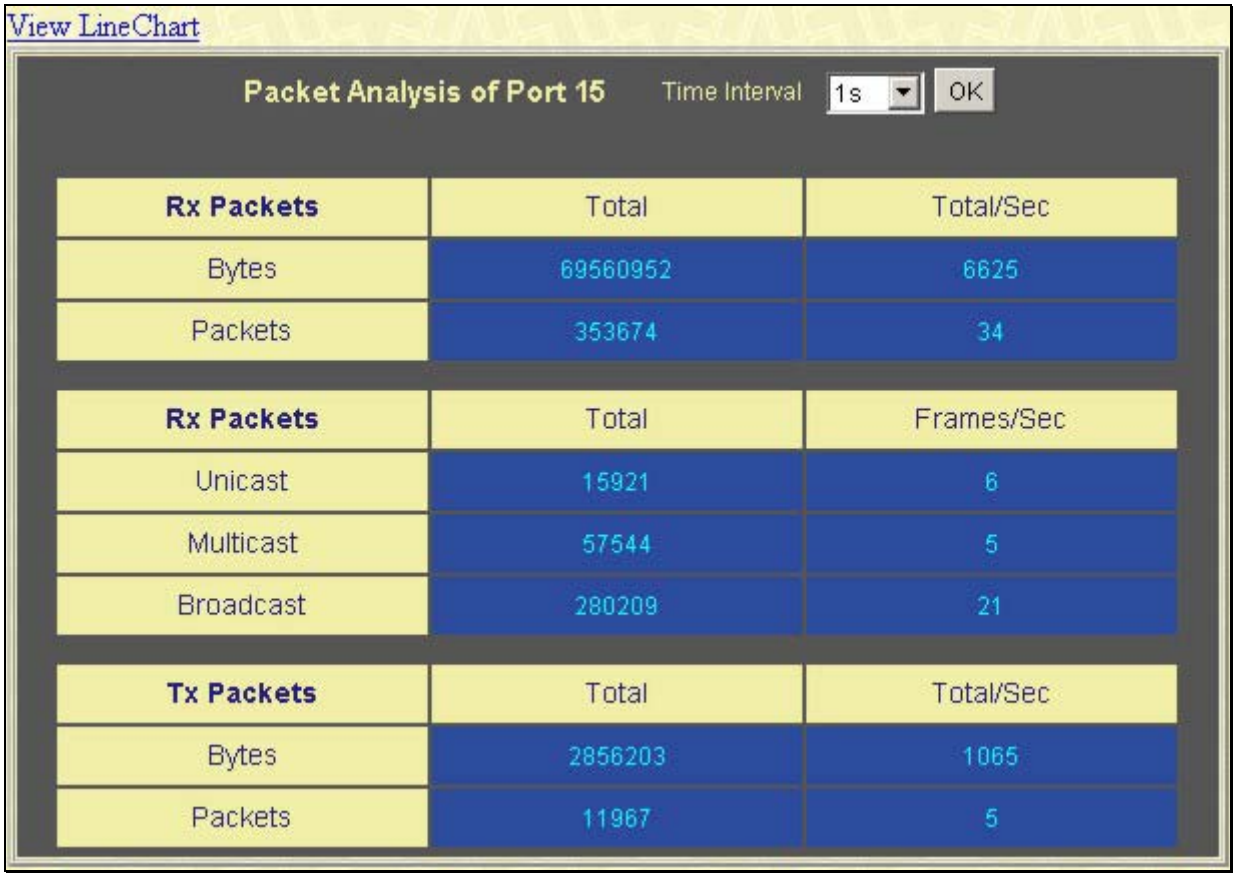


Figure 11- 6. Rx Packets Analysis window (table for Unicast, Multicast, and Broadcast Packets)

The following fields may be set or viewed:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	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 (TX)

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, use the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

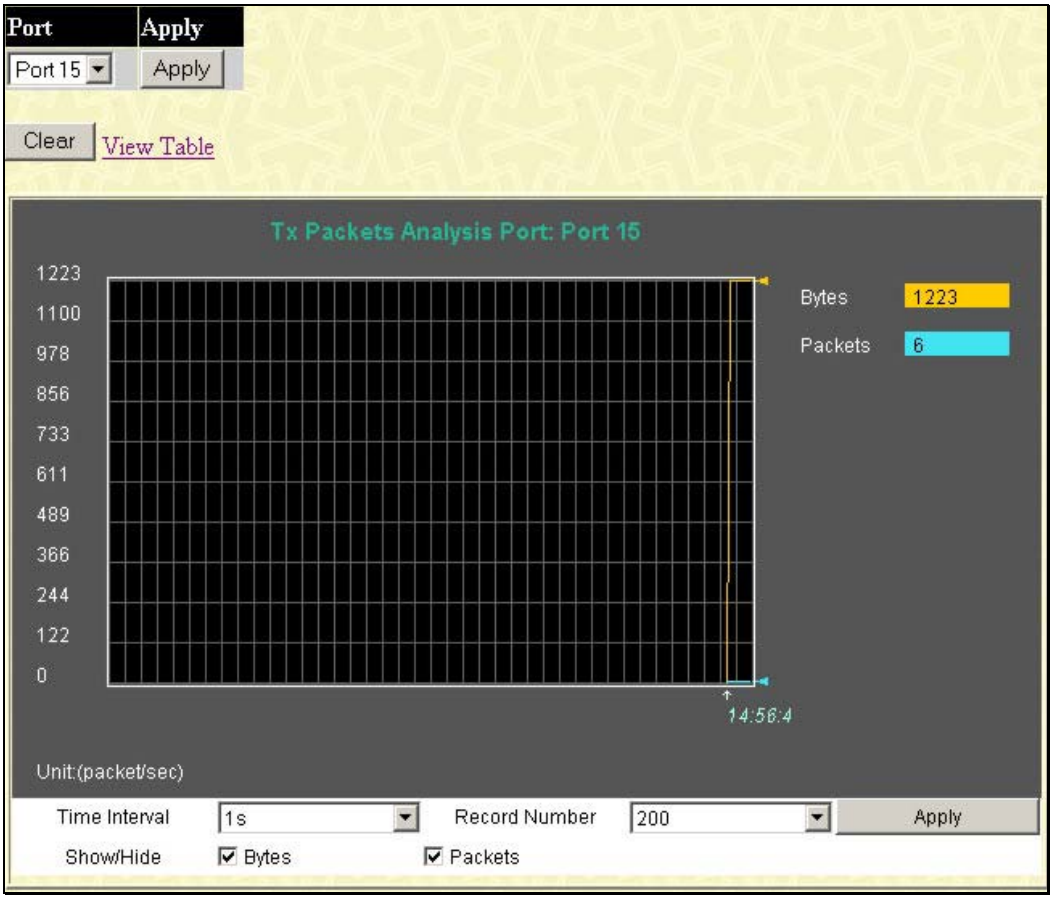


Figure 11- 7. Tx Packets Analysis window (line graph for Bytes and Packets)

To view the **Transmitted (TX) Table**, click the link View Table, which will show the following table:

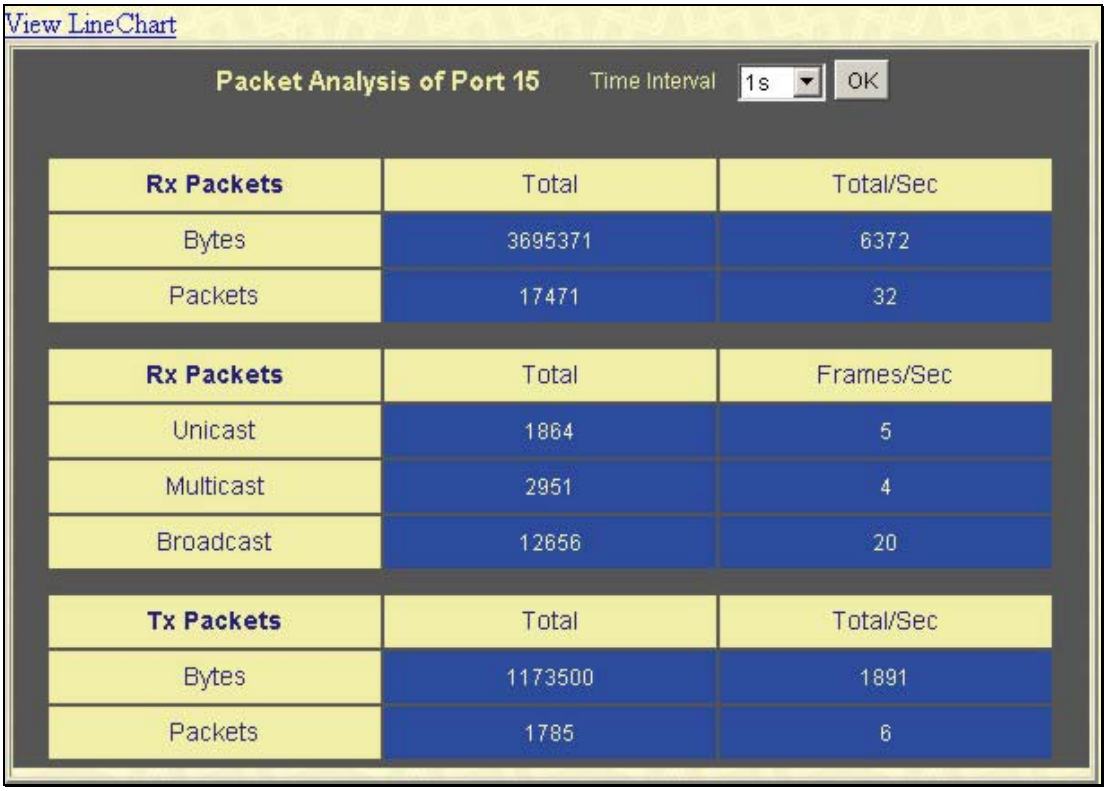


Figure 11- 8. Tx Packets Analysis window (table for Bytes and Packets)

The following fields may be set or viewed:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	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.

Packet Errors

The Web Manager allows port error statistics compiled by the Switch's management agent to be viewed as either a line graph or a table. Four windows are offered.

Received (RX)

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, select the port by using the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

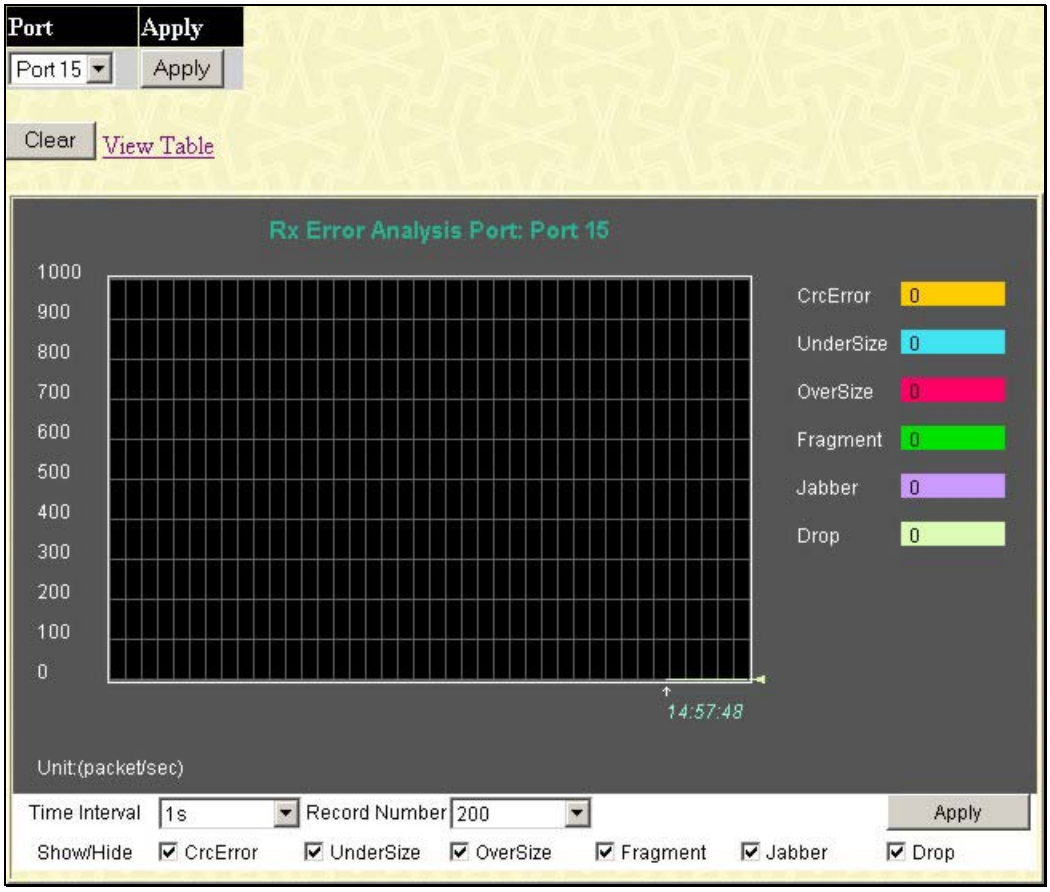


Figure 11- 9. Rx Error Analysis window (line graph)

To view the **Received Error Packets Table**, click the link **View Table**, which will show the following table:

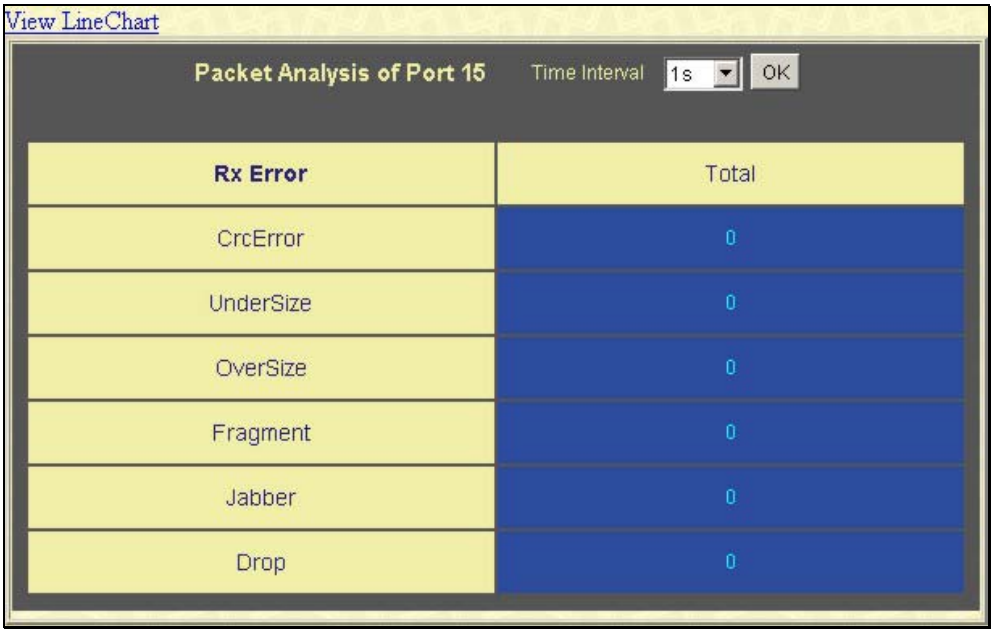


Figure 11- 10. Rx Error Analysis window (table)

The following fields can be set:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	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 (TX)

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, select the port by using the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

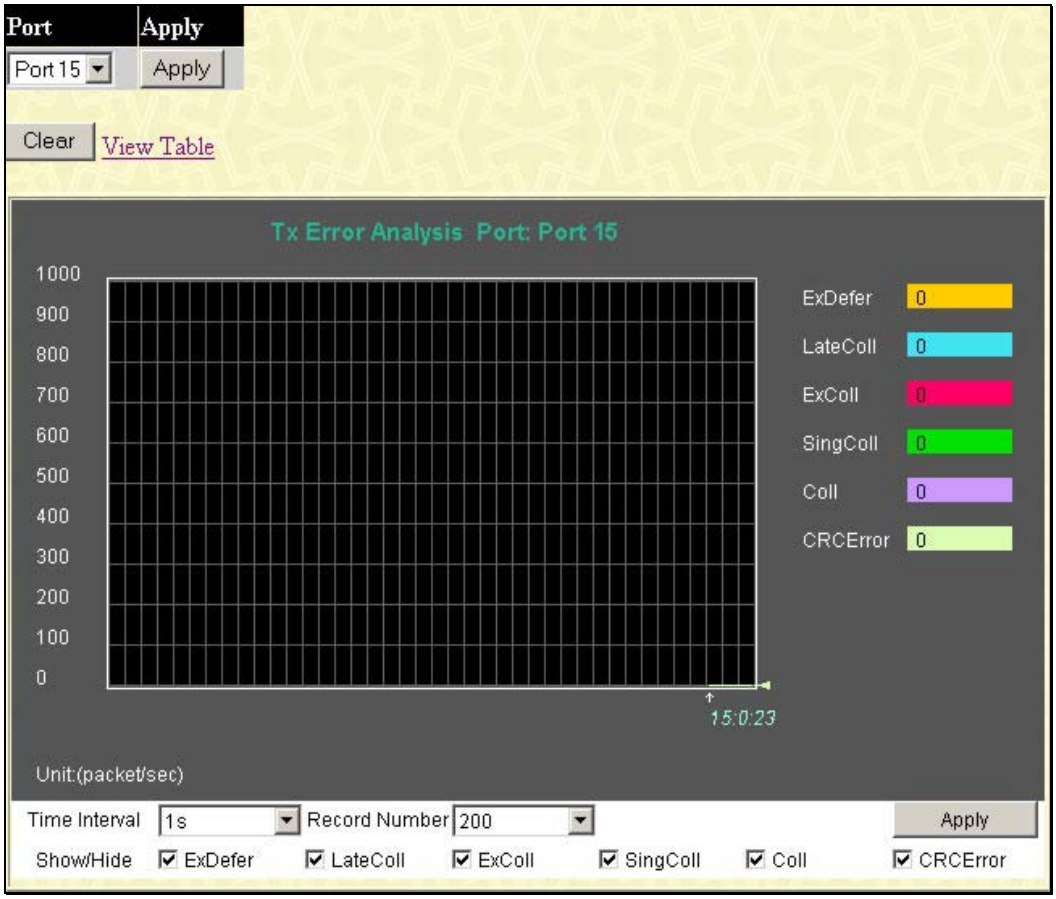


Figure 11- 11. Tx Error Analysis window (line graph)

To view the **Transmitted Error Packets Table**, click the link View Table, which will show the following table:

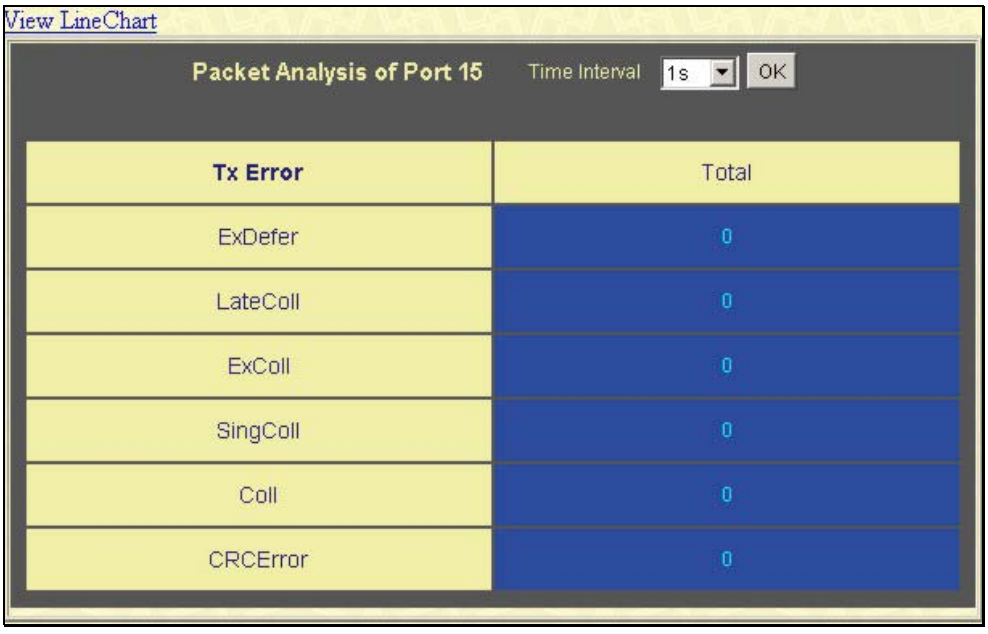


Figure 11- 12. Tx Error Analysis window (table)

The following fields may be set or viewed:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	Select number of times the Switch will be polled between *20* and *200*. The default value is *200*.

	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.

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, select the port by using the **Port** pull-down menu. The user may also use the real-time graphic of the Switch at the top of the web page by simply clicking on a port.

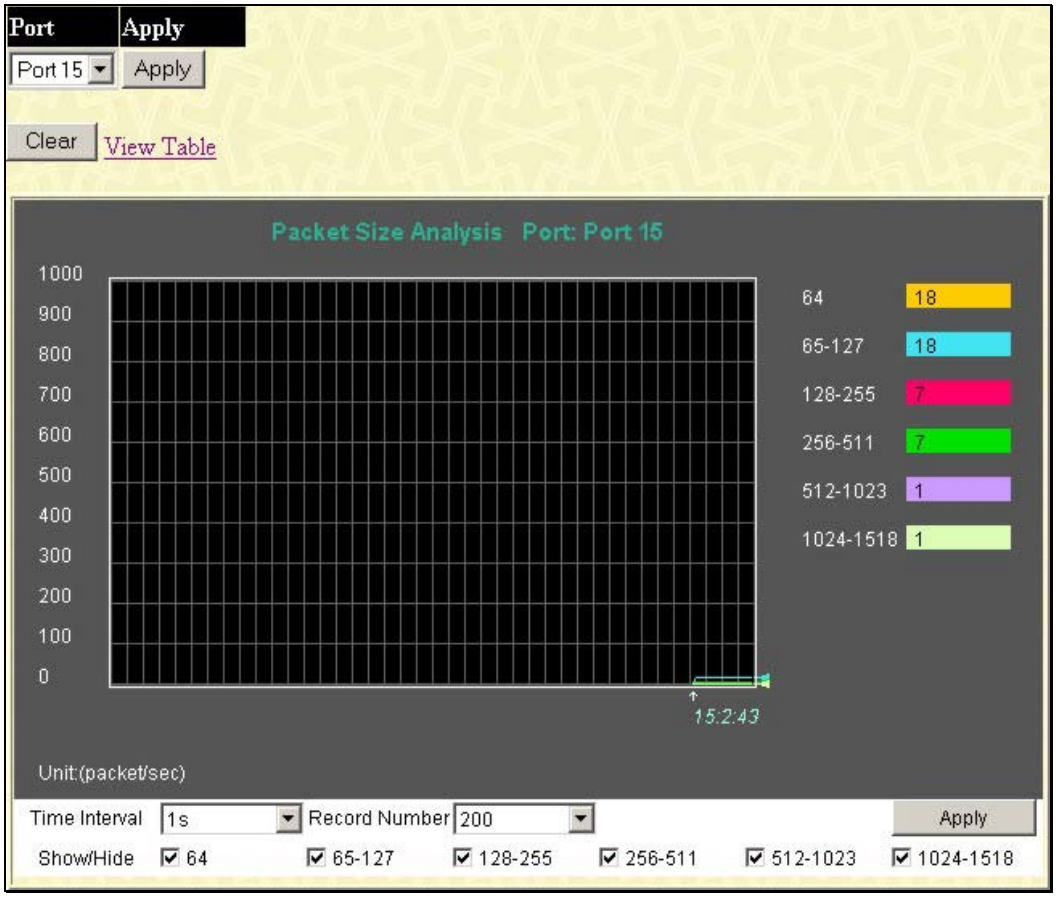


Figure 11- 13. Rx Size Analysis window (line graph)

To view the **Packet Size Analysis Table**, click the link View Table, which will show the following table:

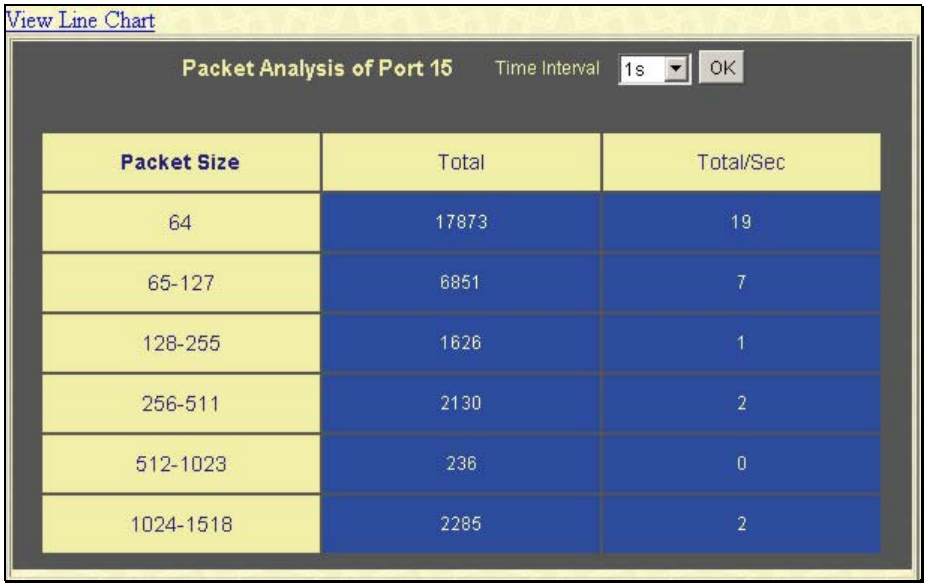


Figure 11- 14. Rx Size Analysis window (table)

The following fields can be set or viewed:

Parameter	Description
Time Interval	Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
Record Number	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.

To view the MAC Address forwarding table, from the **Monitoring** menu, click the **MAC Address** link:

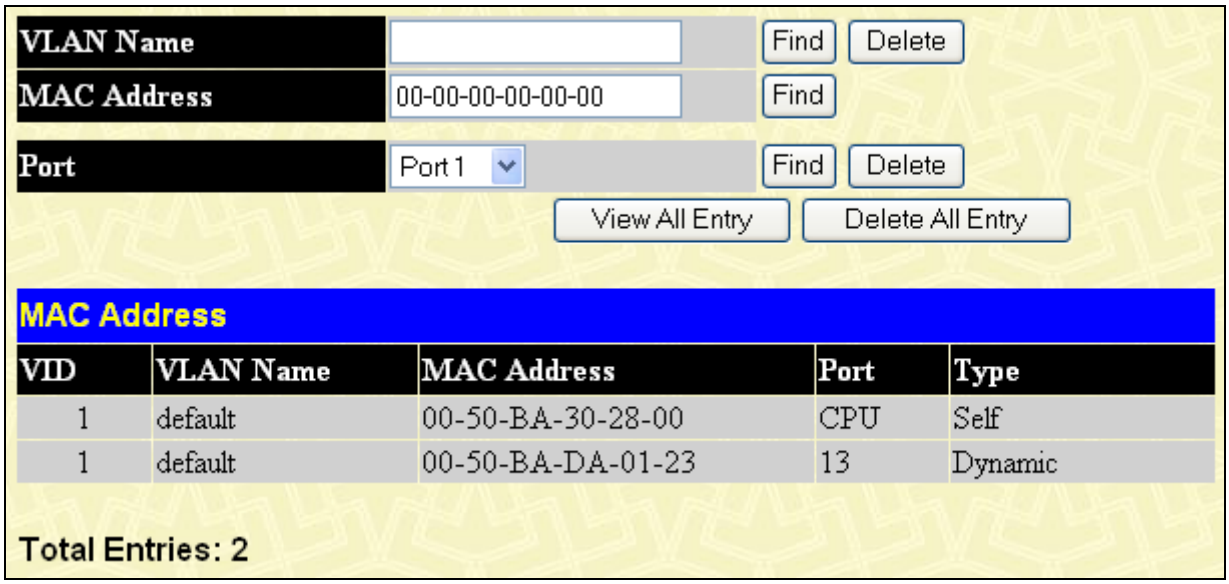


Figure 11- 15. MAC Address window

The following fields can be viewed or set:

Parameter	Description
VLAN Name	Enter a VLAN Name by which to browse the forwarding table.
MAC Address	Enter a MAC address by which to browse the forwarding table.
Port	Select the port by using the corresponding pull-down menu.
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.
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.
View All Entry	Clicking this button will allow the user to view all entries of the address table.

Switch Log

The Web manager allows the Switch's history log, as compiled by the Switch's management agent, to be viewed. To view the Switch history log, open the **Monitoring** folder and click the **Switch Log** link.

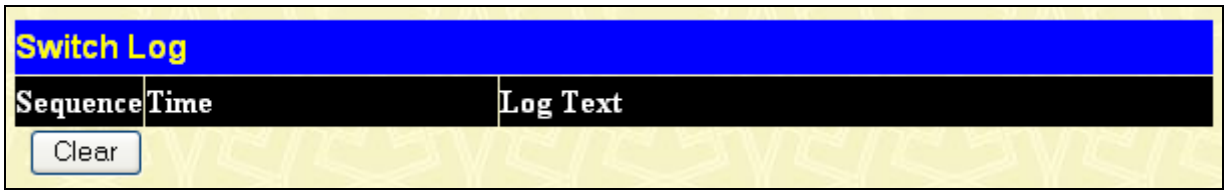


Figure 11- 16. Switch History Log window

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. Click **Next** to go to the next page of the **Switch History Log**. Clicking **Clear** will allow the user to clear the **Switch History Log**.

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 Group

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** window, click **IGMP Snooping Group** on the **Monitoring** menu:

Figure 11- 17. IGMP Snooping Group window

The user may search the **IGMP Snooping Group Table** by VID by entering it in the top left hand corner and clicking **Search**.

The following field can be viewed:

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 Switch, go to the **L2 Features** folder and select **IGMP Snooping**. Configuration and other information concerning IGMP snooping may be found in Section 7 of this manual under **IGMP Snooping**.

Browse 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**.

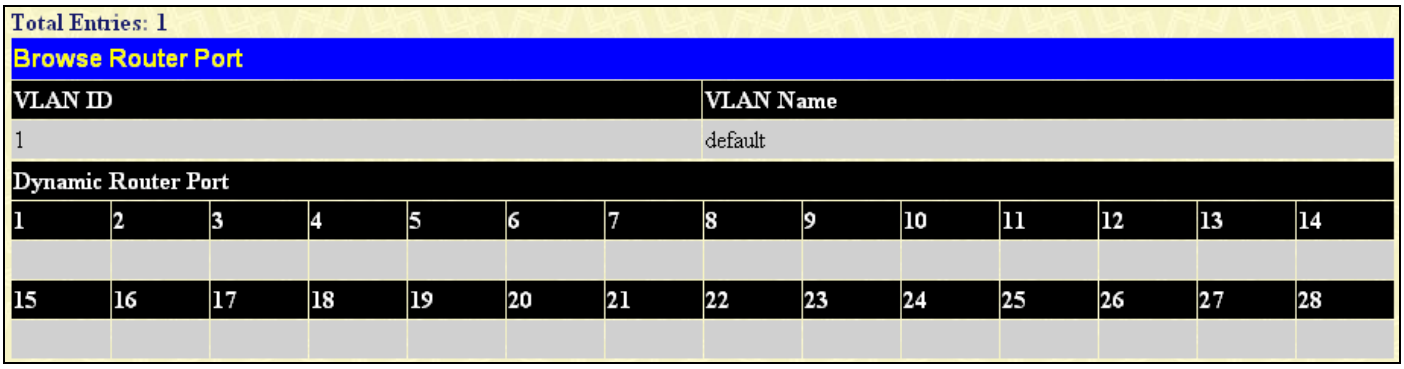


Figure 11- 18. Browse Router Port window

Static ARP Settings

The **Browse ARP Table** window may be found in the **Monitoring** menu. This window will show current ARP entries on the Switch. To clear the **ARP Table**, click **Clear All.**

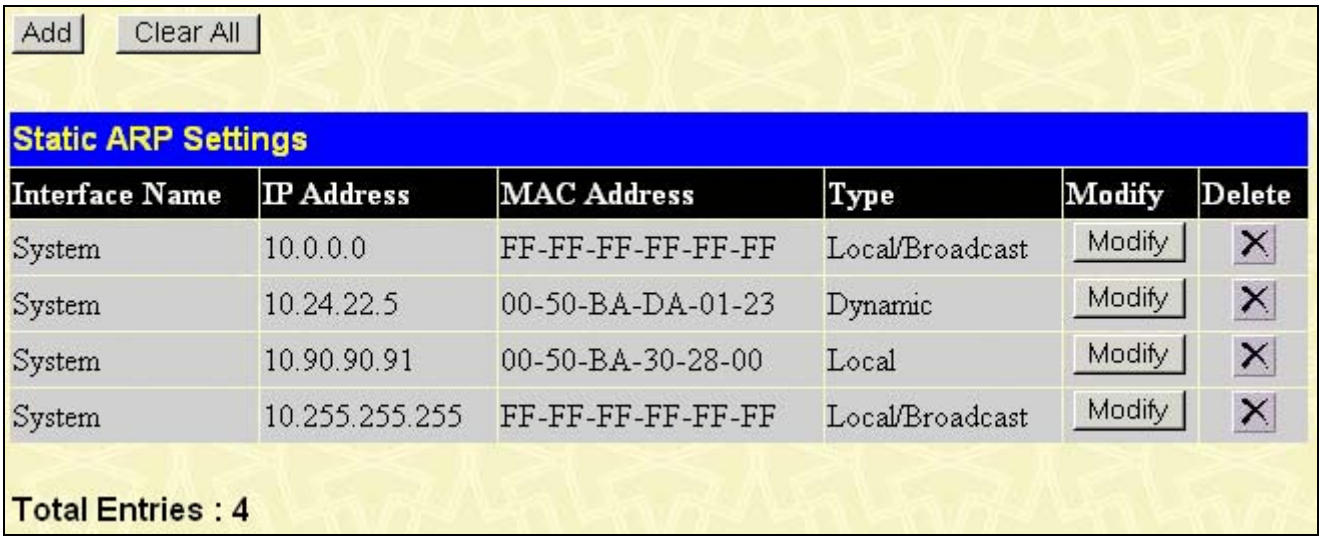


Figure 11- 19. Static ARP Settings window

To add an entry to the Static ARP Settings table, click the **Add** button.

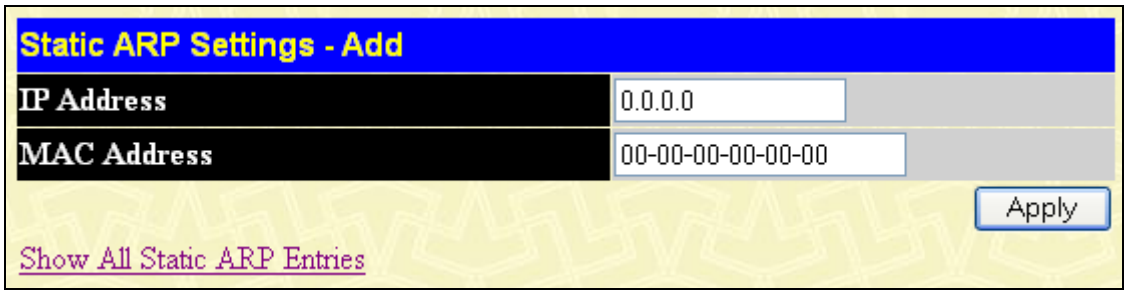


Figure 11- 20. Static ARP Settings – Add window

To modify an entry, select it on the ARP Settings table and click **Modify**.

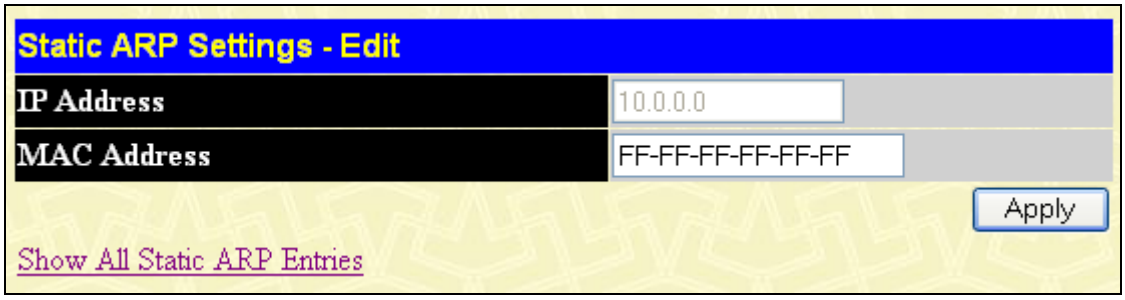


Figure 11- 21. Static ARP Settings – Edit window

Session Table

The Session Table allows the user to view detailed information on the current configuration session of the Switch. Information such as the Session **ID** of the user, initial **Login Time**, **Live Time**, configuration connection **From** the Switch, **Level** and **Name** of the user are displayed. Click **Reload** to refresh this window.

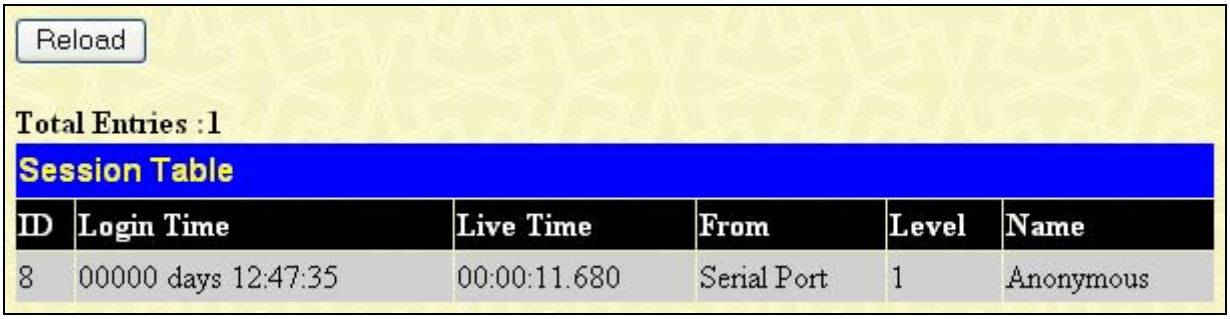


Figure 11- 22. Session Table window

Port Access Control

The following windows are used to monitor 802.1x statistics of the Switch, on a per port basis. To view the **Port Access Control** windows, open the **Monitoring** folder and click the **Port Access Control** folder. There are six windows to monitor.

NOTE: The **Authenticator State**, **Authenticator Statistics**, **Authenticator Session Statistics** and **Authenticator Diagnostics** windows in this section cannot be viewed on the Switch unless 802.1x is enabled by port or by MAC address. To enable 802.1x, go to the **Switch 802.1x** entry in the **DES-30xx Web Management Tool**.

RADIUS Authentication

This table contains information concerning the activity of the RADIUS authentication client on the client side of the RADIUS authentication protocol. It has one row for each RADIUS authentication server that the client shares a secret with. To view the **RADIUS Authentication**, click **Monitoring > Port Access Control > RADIUS Authentication**.

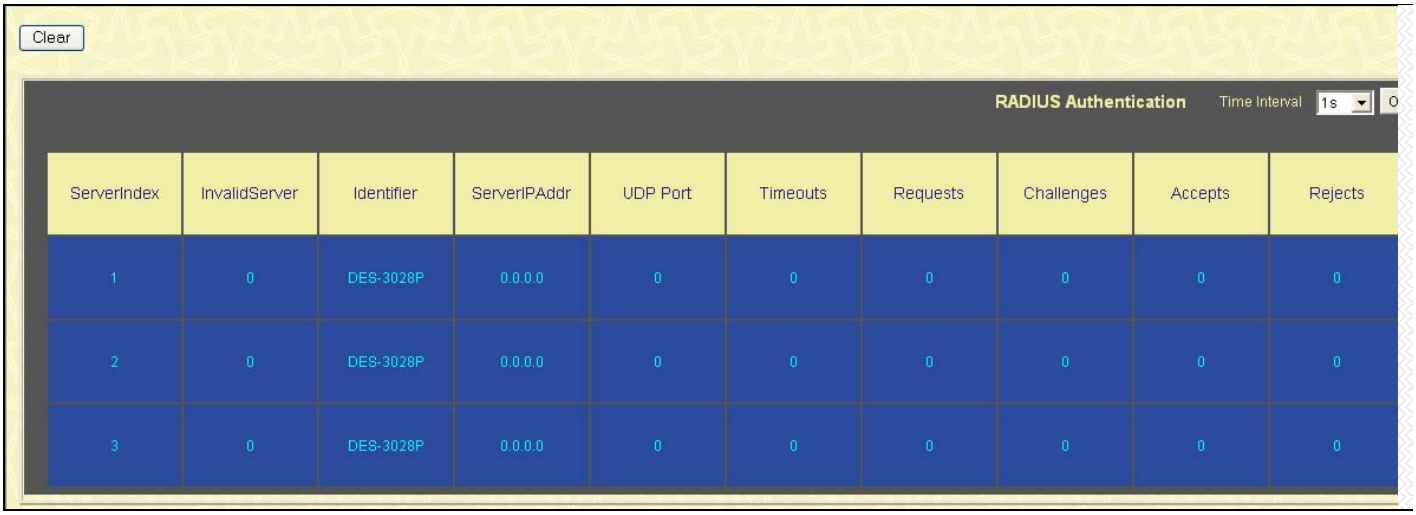


Figure 11- 23. RADIUS Authentication window

The user may also select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second. To clear the current statistics shown, click the **Clear** button in the top left hand corner.

The following fields can be viewed:

Parameter	Description
Server	The identification number assigned to each RADIUS Authentication server that the client shares a secret with.
UDP Port	The UDP port the client is using to send requests to this server.
Timeouts	The number of authentication timeouts to this server. After a timeout the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as a Request as well as a timeout.
Requests	The number of RADIUS Access-Request packets sent to this server. This does not include retransmissions.
Challenges	The number of RADIUS Access-Challenge packets (valid or invalid) received from this server.
Accepts	The number of RADIUS Access-Accept packets (valid or invalid) received from this server.
AccessRejects	The number of RADIUS Access-Reject packets (valid or invalid) received from this server.
RoundTripTime	The time interval (in hundredths of a second) between the most recent Access-Reply/Access-Challenge and the Access-Request that matched it from this RADIUS authentication server.
AccessRetrans	The number of RADIUS Access-Request packets retransmitted to this RADIUS authentication server.
PendingRequests	The number of RADIUS Access-Request packets destined for this server that have not yet timed out or received a response. This variable is incremented when an Access-Request is sent and decremented due to receipt of an Access-Accept, Access-Reject or Access-Challenge, a timeout or retransmission.
AccessResponses	The number of malformed RADIUS Access-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators or Signature attributes or known types are not included as malformed access responses.

BadAuthenticators	The number of RADIUS Access-Response packets containing invalid authenticators or Signature attributes received from this server.
UnknownTypes	The number of RADIUS packets of unknown type which were received from this server on the authentication port
PacketsDropped	The number of RADIUS packets of which were received from this server on the authentication port and dropped for some other reason.

RADIUS Accounting

This window shows managed objects used for managing RADIUS accounting clients, and the current statistics associated with them. It has one row for each RADIUS authentication server that the client shares a secret with. To view the **RADIUS Accounting**, click **Monitoring > Port Access Control > RADIUS Accounting**.

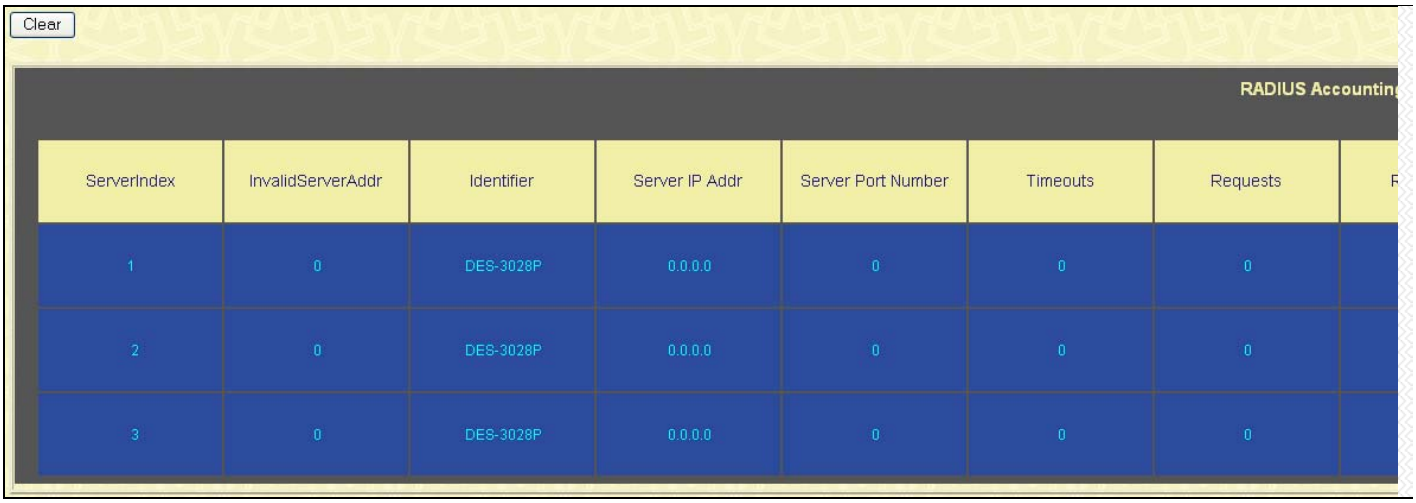


Figure 11- 24. RADIUS Accounting window

The user may also select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second. To clear the current statistics shown, click the *Clear* button in the top left hand corner.

The following fields can be viewed:

Parameter	Description
Server IP Addr	The IP address assigned to each RADIUS Accounting server that the client shares a secret with.
UDP Port	The UDP port the client is using to send requests to this server.
Timeouts	The number of accounting timeouts to this server. After a timeout the client may retry to the same server, send to a different server, or give up. A retry to the same server is counted as a retransmit as well as a timeout. A send to a different server is counted as an Accounting-Request as well as a timeout.
Requests	The number of RADIUS Accounting-Request packets sent. This does not include retransmissions.
Responses	The number of RADIUS packets received on the accounting port from this server.
RoundTripTime	The time interval between the most recent Accounting-Response and the Accounting-Request that matched it from this RADIUS accounting server.
AccessRetrans	The number of RADIUS Access-Request packets retransmitted to this RADIUS authentication server.
PendingRequests	The number of RADIUS Accounting-Request packets sent to this server that have not yet timed out or received a response. This variable is incremented when an Accounting-Request is sent and decremented due to receipt of an Accounting-Response, a timeout or a retransmission.
MalformedResponses	The number of malformed RADIUS Accounting-Response packets received from this server. Malformed packets include packets with an invalid length. Bad authenticators and unknown types are not included as malformed accounting responses.
BadAuthenticators	The number of RADIUS Accounting-Response packets, which contained invalid authenticators, received from this server.

UnknownTypes	The number of RADIUS packets of unknown type which were received from this server on the accounting port.
PacketsDropped	The number of RADIUS packets, which were received from this server on the accounting port and dropped for some other reason.

Auth Diagnostics

This table contains the diagnostic information regarding the operation of the Authenticator associated with each port. An entry appears in this table for each port that supports the Authenticator function. To view the **Authenticator Diagnostics**, click **Monitoring > Port Access Control > Auth Diagnostics**.

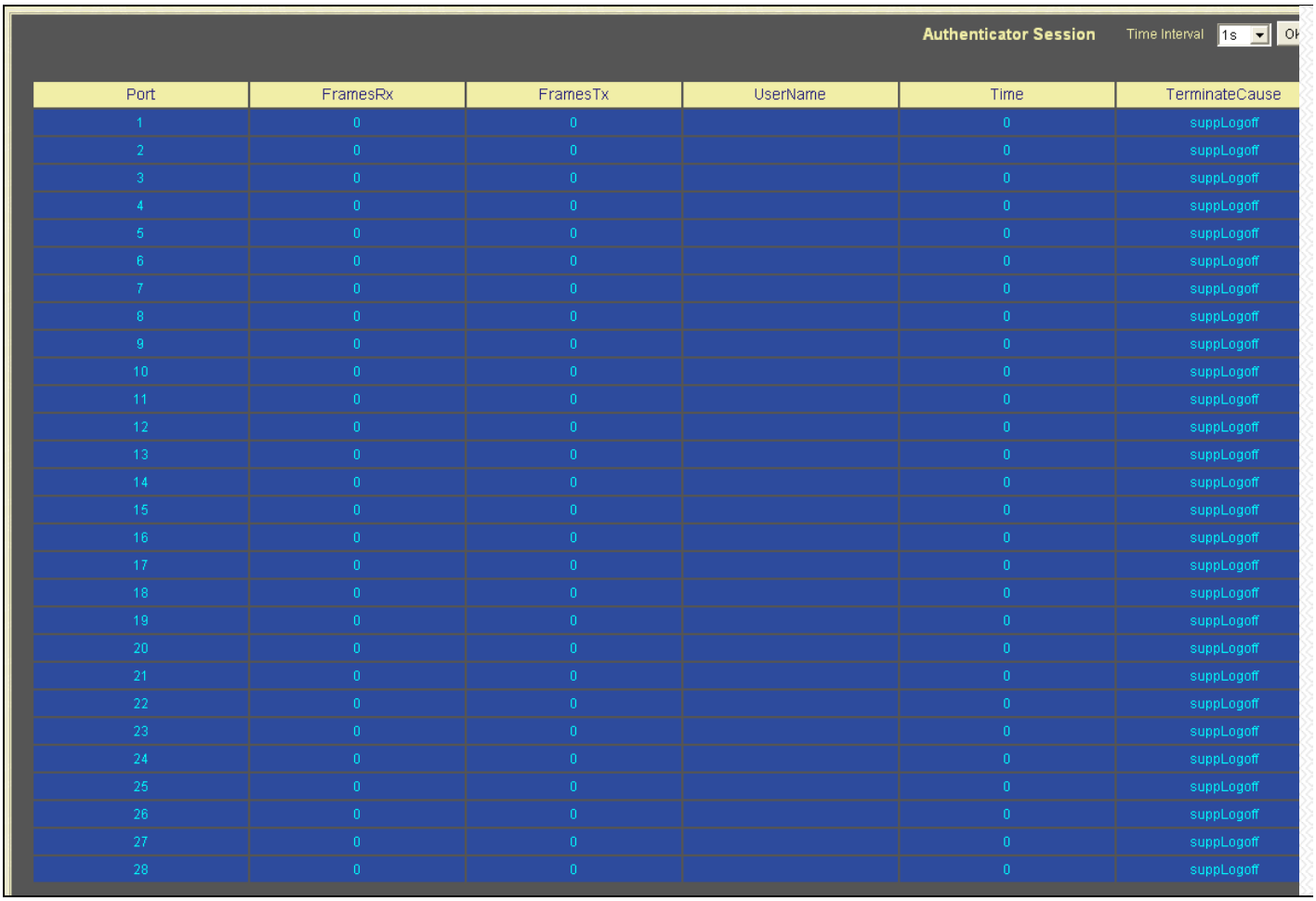


Figure 11- 25. Authenticator Diagnostics window

The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

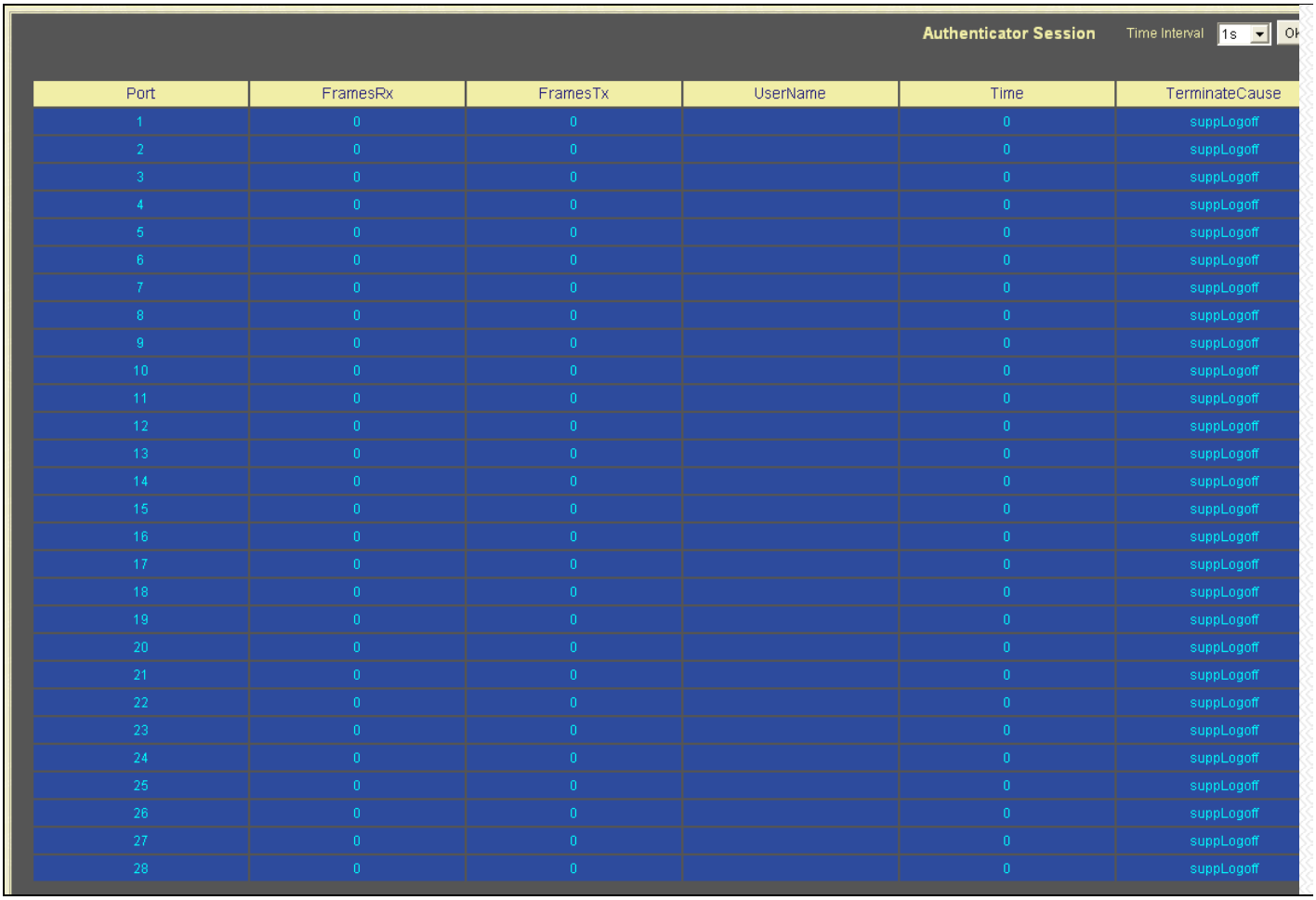
The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
EntersConnecting	Counts the number of times that the state machine transitions to the CONNECTING state from any other state.
EapLogOffsConnecting	Counts the number of times that the state machine transitions from CONNECTING to DISCONNECTED as a result of receiving an EAPOL-Logoff message.
EntersAuthenticating	Counts the number of times that the state machine transitions from CONNECTING to AUTHENTICATING, as a result of an EAP-Response/Identity message being received from the Supplicant.
SuccessAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to AUTHENTICATED, as a result of the Backend Authentication state machine indicating successful authentication of the Supplicant (authSuccess = TRUE).

TimeoutsAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of the Backend Authentication state machine indicating authentication timeout (authTimeout = TRUE).
FailAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to HELD, as a result of the Backend Authentication state machine indicating authentication failure (authFail = TRUE).
ReauthsAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of a reauthentication request (reAuthenticate = TRUE).
EapStartsAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Start message being received from the Supplicant.
EapLogOffAuthenticating	Counts the number of times that the state machine transitions from AUTHENTICATING to ABORTING, as a result of an EAPOL-Logoff message being received from the Supplicant.
ReauthsAuthenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of a reauthentication request (reAuthenticate = TRUE).
EapStartsAuthenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to CONNECTING, as a result of an EAPOL-Start message being received from the Supplicant.
EapLogOffAuthenticated	Counts the number of times that the state machine transitions from AUTHENTICATED to DISCONNECTED, as a result of an EAPOL-Logoff message being received from the Supplicant.
Responses	Counts the number of times that the state machine sends an initial Access-Request packet to the Authentication server (i.e., executes sendRespToServer on entry to the RESPONSE state). Indicates that the Authenticator attempted communication with the Authentication Server.
AccessChallenges	Counts the number of times that the state machine receives an initial Access-Challenge packet from the Authentication server (i.e., aReq becomes TRUE, causing exit from the RESPONSE state). Indicates that the Authentication Server has communication with the Authenticator.
OtherReqToSupp	Counts the number of times that the state machine sends an EAP-Request packet (other than an Identity, Notification, Failure, or Success message) to the Supplicant (i.e., executes txReq on entry to the REQUEST state). Indicates that the Authenticator chose an EAP-method.
ResponsesFromSupplicant	Counts the number of times that the state machine receives a response from the Supplicant to an initial EAP-Request, and the response is something other than EAP-NAK (i.e., rxResp becomes TRUE, causing the state machine to transition from REQUEST to RESPONSE, and the response is not an EAP-NAK). Indicates that the Supplicant can respond to the Authenticator's chosen EAP-method.
AuthSuccesses	Counts the number of times that the state machine receives an Accept message from the Authentication Server (i.e., aSuccess becomes TRUE, causing a transition from RESPONSE to SUCCESS). Indicates that the Supplicant has successfully authenticated to the Authentication Server.
AuthFails	Counts the number of times that the state machine receives a Reject message from the Authentication Server (i.e., aFail becomes TRUE, causing a transition from RESPONSE to FAIL). Indicates that the Supplicant has not authenticated to the Authentication Server.

Auth Session Statistics

This table contains the session statistics objects for the Authenticator PAE associated with each port. An entry appears in this table for each port that supports the Authenticator function. To view the **Authenticator Session Statistics**, click **Monitoring > Port Access Control > Auth Session Statistics**.



Port	FramesRx	FramesTx	UserName	Time	TerminateCause
1	0	0		0	suppLogoff
2	0	0		0	suppLogoff
3	0	0		0	suppLogoff
4	0	0		0	suppLogoff
5	0	0		0	suppLogoff
6	0	0		0	suppLogoff
7	0	0		0	suppLogoff
8	0	0		0	suppLogoff
9	0	0		0	suppLogoff
10	0	0		0	suppLogoff
11	0	0		0	suppLogoff
12	0	0		0	suppLogoff
13	0	0		0	suppLogoff
14	0	0		0	suppLogoff
15	0	0		0	suppLogoff
16	0	0		0	suppLogoff
17	0	0		0	suppLogoff
18	0	0		0	suppLogoff
19	0	0		0	suppLogoff
20	0	0		0	suppLogoff
21	0	0		0	suppLogoff
22	0	0		0	suppLogoff
23	0	0		0	suppLogoff
24	0	0		0	suppLogoff
25	0	0		0	suppLogoff
26	0	0		0	suppLogoff
27	0	0		0	suppLogoff
28	0	0		0	suppLogoff

Figure 11- 26. Authenticator Session Counter window

The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

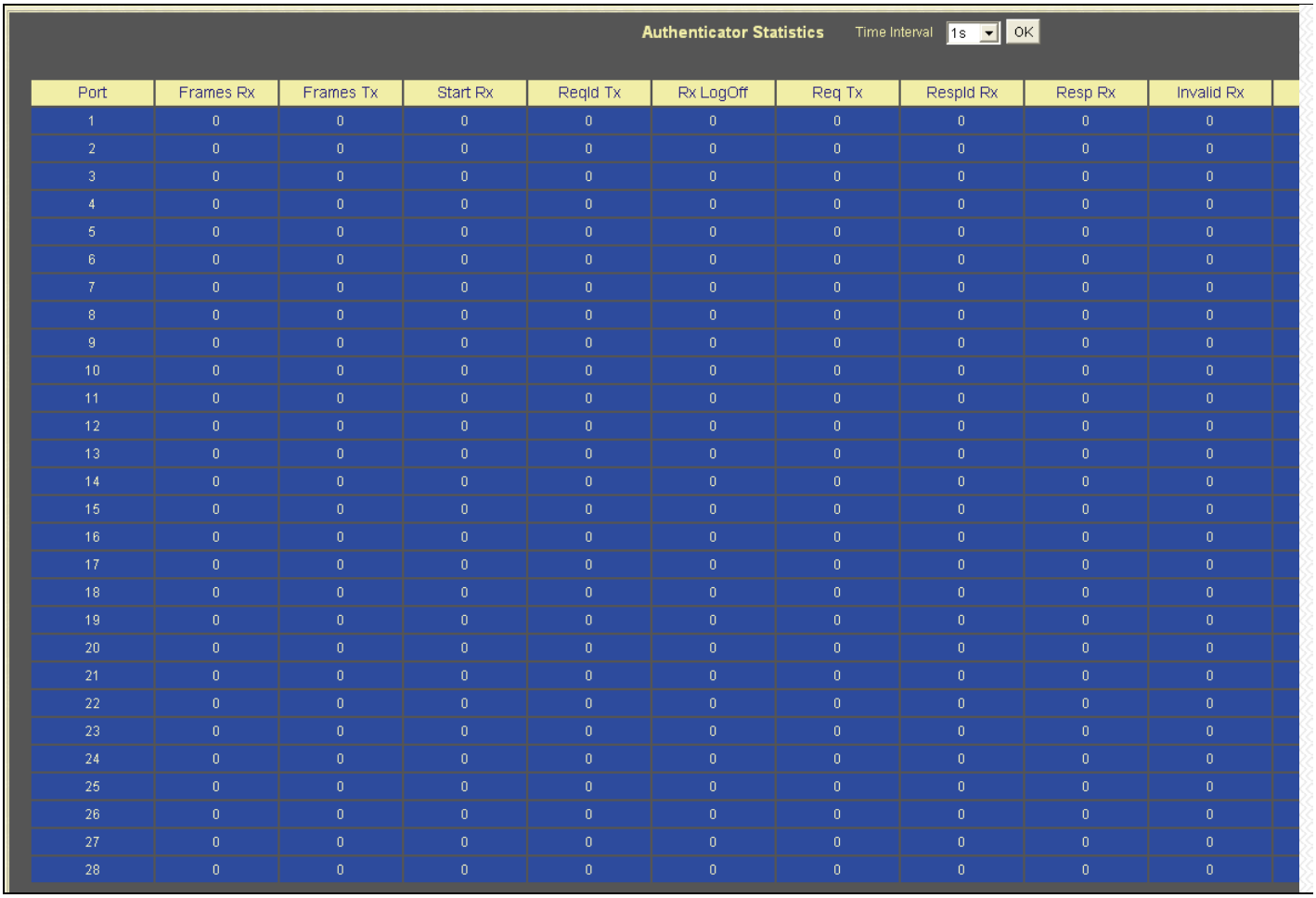
The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
Frames Rx	The number of user data frames received on this port during the session.
Frames Tx	The number of user data frames transmitted on this port during the session.
UserName	The User-Name representing the identity of the Supplicant PAE.
Time	The duration of the session in seconds.
Terminate Cause	The reason for the session termination. There are eight possible reasons for termination. 1) Supplicant Logoff 2) Port Failure 3) Supplicant Restart 4) Reauthentication Failure

	5) AuthControlledPortControl set to ForceUnauthorized 6) Port re-initialization 7) Port Administratively Disabled 8) Not Terminated Yet
Octets Rx	The number of octets received in user data frames on this port during the session.
Octets Tx	The number of octets transmitted in user data frames on this port during the session.
ID	A unique identifier for the session, in the form of a printable ASCII string of at least three characters.
Authentic Method	The authentication method used to establish the session. Valid Authentic Methods include: (1) Remote Authentic Server - The Authentication Server is external to the Authenticator's System. (2) Local Authentic Server - The Authentication Server is located within the Authenticator's System.

Auth Statistics

This table contains the statistics objects for the Authenticator PAE associated with each port. An entry appears in this table for each port that supports the Authenticator function. To view the Authenticator Statistics, click **Monitoring > Port Access Control > Auth Statistics.**



Port	Frames Rx	Frames Tx	Start Rx	ReqId Tx	Rx LogOff	Req Tx	RespId Rx	Resp Rx	Invalid Rx
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0

Figure 11- 27. Authenticator Statistics window

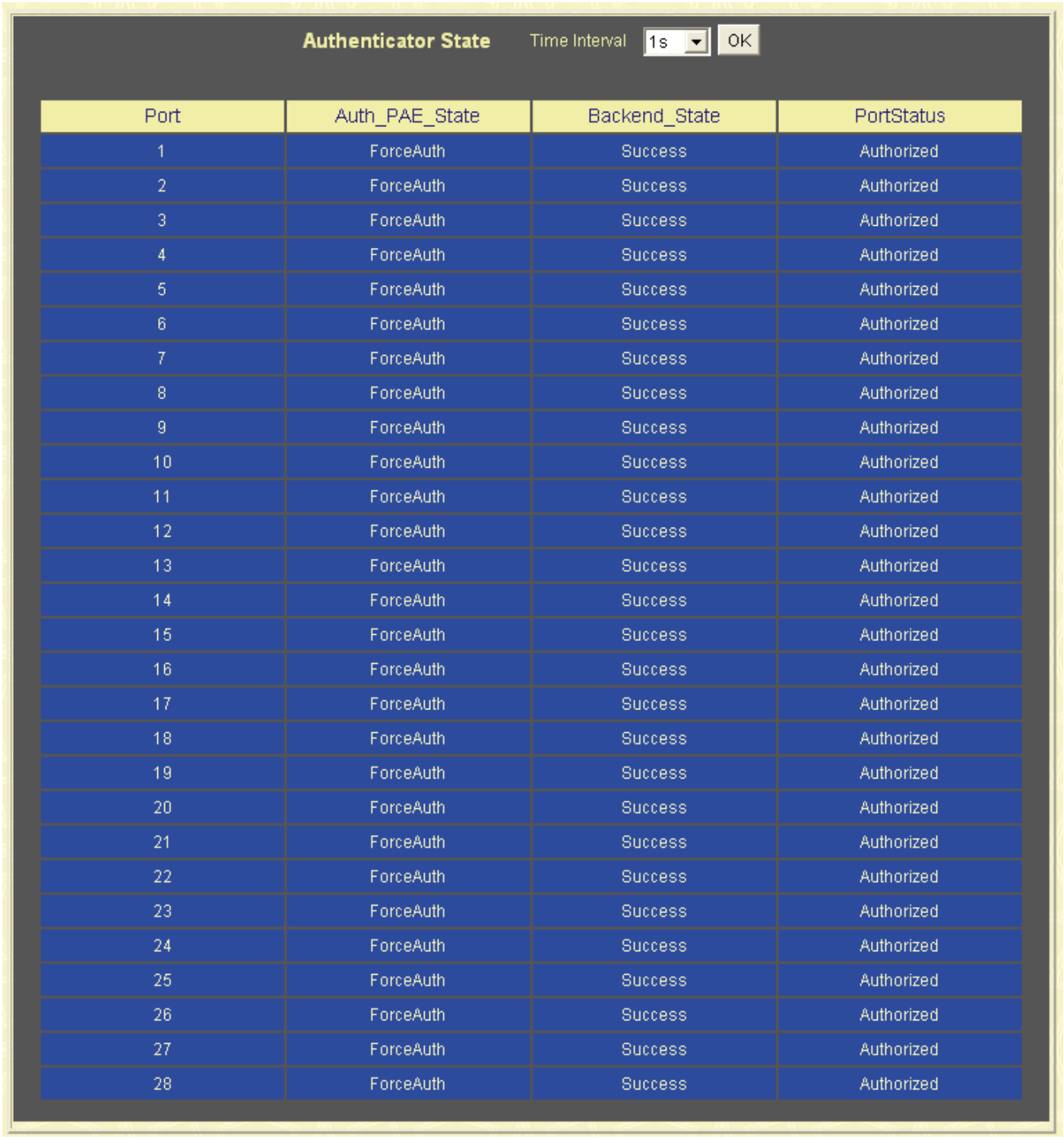
The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

The following fields can be viewed:

Parameter	Description
Port	The identification number assigned to the Port by the System in which the Port resides.
Frames Rx	The number of valid EAPOL frames that have been received by this Authenticator.
Frames Tx	The number of EAPOL frames that have been transmitted by this Authenticator.
Rx Start	The number of EAPOL Start frames that have been received by this Authenticator.
TxReqId	The number of EAP Req/Id frames that have been transmitted by this Authenticator.
RxLogOff	The number of EAPOL Logoff frames that have been received by this Authenticator.
Tx Req	The number of EAP Request frames (other than Rq/Id frames) that have been transmitted by this Authenticator.
Rx RespId	The number of EAP Resp/Id frames that have been received by this Authenticator.
Rx Resp	The number of valid EAP Response frames (other than Resp/Id frames) that have been received by this Authenticator.
Rx Invalid	The number of EAPOL frames that have been received by this Authenticator in which the frame type is not recognized.
Rx Error	The number of EAPOL frames that have been received by this Authenticator in which the Packet Body Length field is invalid.
Last Version	The protocol version number carried in the most recently received EAPOL frame.
Last Source	The source MAC address carried in the most recently received EAPOL frame.

Auth State

This table displays the Authenticator State for each port. To view the Authenticator State, click **Monitoring > Port Access Control > Auth State.**



Port	Auth_PAE_State	Backend_State	PortStatus
1	ForceAuth	Success	Authorized
2	ForceAuth	Success	Authorized
3	ForceAuth	Success	Authorized
4	ForceAuth	Success	Authorized
5	ForceAuth	Success	Authorized
6	ForceAuth	Success	Authorized
7	ForceAuth	Success	Authorized
8	ForceAuth	Success	Authorized
9	ForceAuth	Success	Authorized
10	ForceAuth	Success	Authorized
11	ForceAuth	Success	Authorized
12	ForceAuth	Success	Authorized
13	ForceAuth	Success	Authorized
14	ForceAuth	Success	Authorized
15	ForceAuth	Success	Authorized
16	ForceAuth	Success	Authorized
17	ForceAuth	Success	Authorized
18	ForceAuth	Success	Authorized
19	ForceAuth	Success	Authorized
20	ForceAuth	Success	Authorized
21	ForceAuth	Success	Authorized
22	ForceAuth	Success	Authorized
23	ForceAuth	Success	Authorized
24	ForceAuth	Success	Authorized
25	ForceAuth	Success	Authorized
26	ForceAuth	Success	Authorized
27	ForceAuth	Success	Authorized
28	ForceAuth	Success	Authorized

Figure 11- 28. Authenticator State window

The user may select the desired time interval to update the statistics, between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

Reset

The **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.

NOTE: Only 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

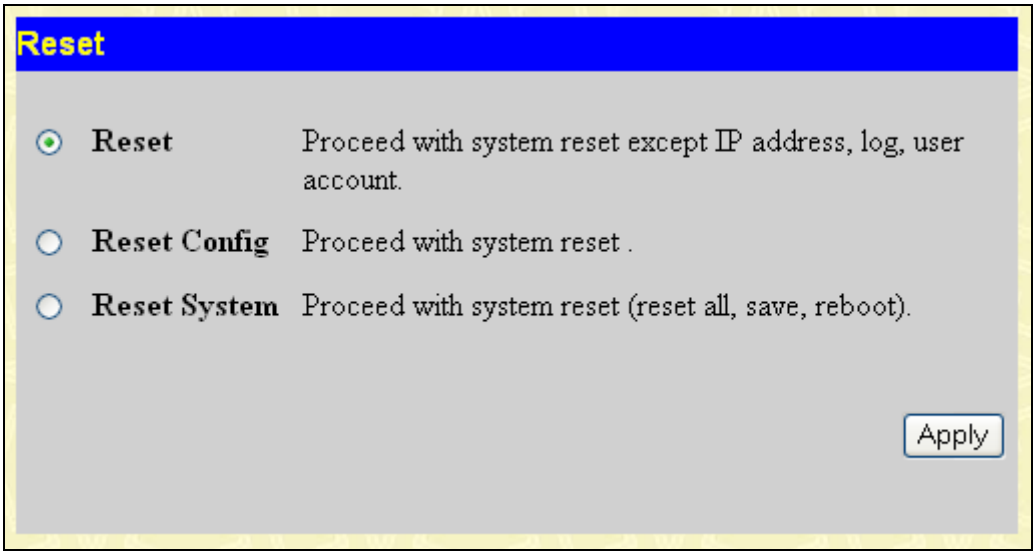


Figure 11- 29. Reset window

Reboot System

The following window is used to restart the Switch.

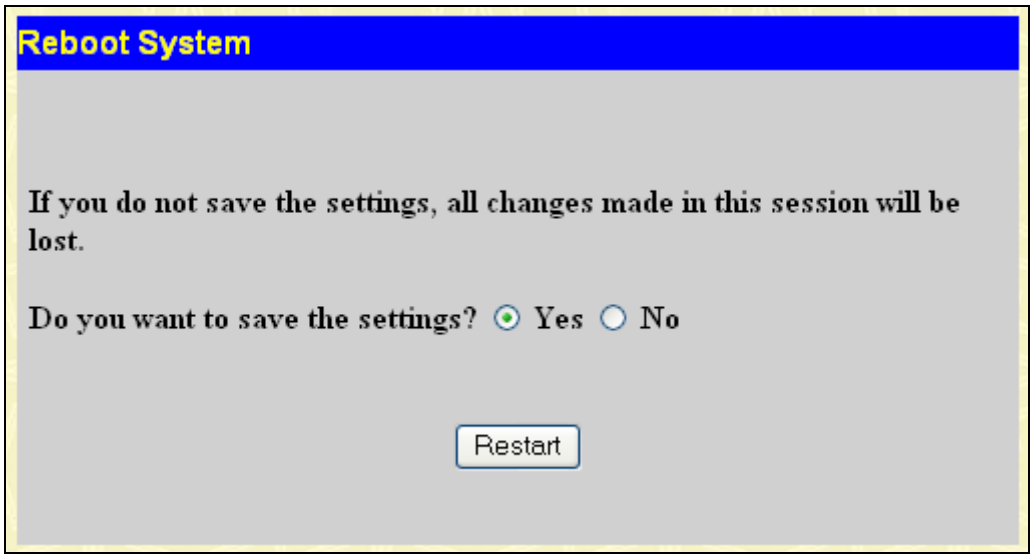


Figure 11- 30. Reboot System window

Clicking the **Yes** radio button will instruct the Switch to save the current configuration to non-volatile RAM before restarting the Switch.

Clicking the **No** radio button 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.

Save Changes

The Switch 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 on the **Save** button in the **Save Changes** page, as shown below.

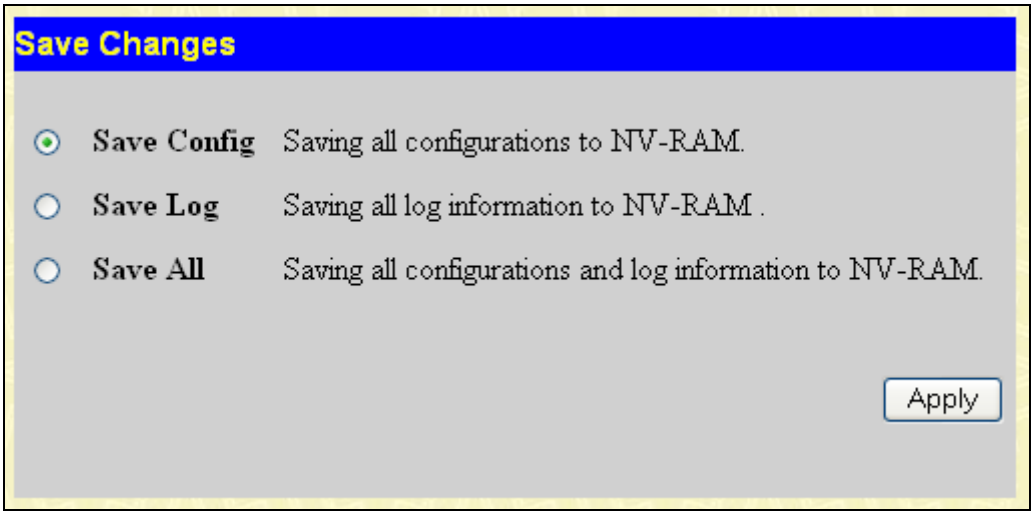


Figure 11- 31. Save Changes window

Logout

Click the **Logout** button on the **Logout** window to immediately exit the Switch.

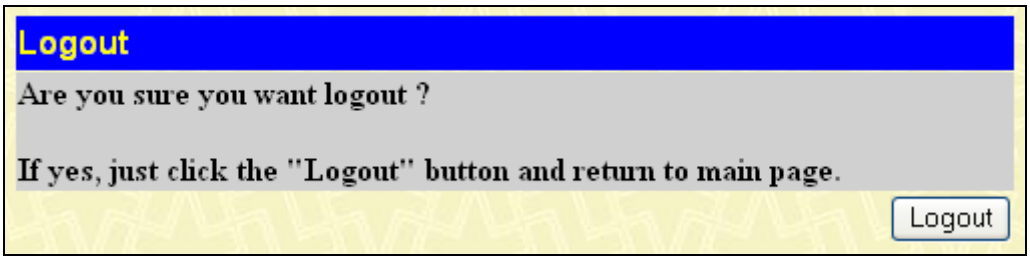


Figure 11- 32. Logout window

Appendix A

Technical Specifications

General	
Protocols	IEEE 802.3 10BASE-T Ethernet IEEE 802.3u 100BASE-TX Fast Ethernet IEEE 802.3ab 1000BASE-T Gigabit Ethernet IEEE 802.3z 1000BASE-T (SFP "Mini GBIC") IEEE 802.1D Spanning Tree IEEE 802.1D/S/W Spanning Tree IEEE 802.1Q VLAN IEEE 802.1p Priority Queues IEEE 802.1X Port Based Network Access Control IEEE 802.3ad Link Aggregation Control IEEE 802.3x Full-duplex Flow Control IEEE 802.3 NWay auto-negotiation IEEE802.3af standard (only for POE)
Fiber-Optic	SFP (Mini GBIC) Support: DEM-310GT (1000BASE-LX) DEM-311GT (1000BASE-SX) DEM-314GT (1000BASE-LH) DEM-315GT (1000BASE-ZX) DEM-210 (Single Mode 100BASE-FX) DEM-211 (Multi Mode 100BASE-FX) WDM Transceivers Supported: DEM-330T (TX-1550/RX-1310nm), up to 10km, Single-Mode DEM-330R (TX-1310/RX-1550nm), up to 10km, Single-Mode DEM-331T (TX-1550/RX-1310nm), up to 40km, Single-Mode DEM-331R (TX-1310/RX-1550nm), up to 40km, Single-Mode
Standards	CSMA/CD
Data Transfer Rates: **Ethernet** **Fast Ethernet** **Gigabit Ethernet**	Half-duplex Full-duplex 10 Mbps 20Mbps 100Mbps 200Mbps n/a 2000Mbps
Topology	Star
Network Cables	Cat.5 Enhanced for 1000BASE-T UTP Cat.5, Cat. 5 Enhanced for 100BASE-TX UTP Cat.3, 4, 5 for 10BASE-T EIA/TIA-568 100-ohm screened twisted-pair (STP)(100m)
Number of Ports	DES-3028/DES-3028P: 24 x 10/100Base-T Ports 2 x 1000Base-T/SFP Combo Ports 2 x 1000Base-T ports DES-3052/DES-3052P: 48 x 10/100Base-T Ports 2 x 1000Base-T/SFP Combo Ports 2 x 1000Base-T ports

Physical and Environmental	
Internal Power Supply	Input: 100~240V, AC/10A, 50~60Hz Output: DES-3028/DES-3052: 12V, 3.3A (Max) DES-3028P: 12V, 3.3A/50V, 3.7A (Max) DES-3052P: 12V,10.5A/50V,7.5A (Max)
Power Consumption	DES-3028 – 25W DES-3052 – 26W DES-3028P – 217W DES-3052P – 395W
DC Fans	DES-3028/DES-3052 – None DES-3028P – one 8.5cm fan and one 17cm fan DES-3052P – one 5cm fan, one 8.3cm fan, and one 17cm fan
Operating Temperature	0 - 40°C
Storage Temperature	-40 - 70°C
Humidity	5 - 95% non-condensing
Dimensions	DES-3028: 441(W) x 207(D) x 44(H) mm DES-3028P/3052/3052P: 441(W) x 309(D) x 44(H) mm
Weight	DES-3028 – 2.36kg (5.20lbs) DES-3028P – 4.5kg (9.9lbs) DES-3052 – 3.85kg (8.48lbs) DES-3052P – 5.70kg (12.56lbs)
EMI	CE Class A, FCC Class A, C-Tick, VCCI
Safety	CB Report, UL

Performance	
Transmission Method	Store-and-forward
Packet Buffer	512 KB per device
Packet Filtering/ Forwarding Rate	14,881 pps (10M port) 148.810 pps (100M port) 1,488,100 pps (1Gbps port)
MAC Address Learning	Automatic update. Supports 8K MAC address
Priority Queues	4 Priority Queues per port.
Forwarding Table Age Time	Max age: 10-1000000 seconds. Default = 300.

<table>
<tr><th colspan="2">PoE Features</th></tr>
<tr><td>PoE Capable Ports</td><td>DES-3028P:Random 12 ports
DES-3052P:Random 24 ports</td></tr>
<tr><td>Power feeding for PoE</td><td>DES-3028P:
Per port →15.4W (Default),
Output capacity for DES-3028P→185W
Power consumption→Max. 225W
DES-3052P:
Per port →15.4W (Default),
Output capacity for DES-3052P→370W
Power consumption→Max. 500W</td></tr>
<tr><td>PoE Specification</td><td>1. Supplies power to PD device up to 15.4W per port, meeting IEEE802.3af standards and more sufficiently is able to provide power to PD devices
2. Auto discovery feature, automatically recognize the connection of PD device and immediately sends power to it
3. Auto disable port if the port current is over 350mA while other ports remain active
4. Active circuit protection, automatically disables the port if there is a short while other ports remain active
5. PD should be able to receive the power following the classification below
<table>
<tr><th>Class</th><th>Usage</th><th>Max power used by PD</th></tr>
<tr><td>0</td><td>Default</td><td>0.44 to 12.95W</td></tr>
<tr><td>1</td><td>Optional</td><td>0.44 to 3.84W</td></tr>
<tr><td>2</td><td>Optional</td><td>3.84 to 6.49W</td></tr>
<tr><td>3</td><td>Optional</td><td>6.49 to 12.95W</td></tr>
<tr><td>4</td><td>Not allowed</td><td>Reserved</td></tr>
</table>
6. PSE should be provide the power following the classification below
<table>
<tr><th>Class</th><th>Usage</th><th>Max power used by PD</th></tr>
<tr><td>0</td><td>Default</td><td>15.4W</td></tr>
<tr><td>1</td><td>Optional</td><td>4.0W</td></tr>
<tr><td>2</td><td>Optional</td><td>7.0W</td></tr>
<tr><td>3</td><td>Optional</td><td>15.4W</td></tr>
<tr><td>4</td><td>Reserved</td><td>15.4W</td></tr>
</table>
7. DES-3028P/DES-3052P should follow the standard PSE pin-out standard of Alternative A which is sending out power over number 1,2,3,6 pins of 8 wires of CAT5 UTP cable
8. DES-3028P/DES-3052P works with all D-Link 802.3af capable devices
9. DES-3028P/DES-3052P works with all non-802.3af capable D-Link AP, IP Cam and IP phone via DWL-P50</td></tr>
</table>

LED indicators

Location	LED Indicative	Color	Status	Description
Per Device	**Power**	Green	Solid Light	Power On
			Light off	Power Off
	Console	Green	Solid Light	Console on
			Blinking	POST is in progress/ POST is failure.
			Light off	Console off
"Mode Select Button"	**Link/Act/ Speed**	Green	Solid Light	Link/Act/Speed Mode
	PoE	Green	Solid Light	PoE Mode
LED Per 10/100 Mbps Port	**Link/Act/Speed**	Green/Amber	Solid Green	When there is a secure 100Mbps Fast Ethernet connection (or link) at any of the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity—Act) of data occurring at a Fast Ethernet connected port.
			Solid Amber	When there is a secure 10Mbps Ethernet connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at an Ethernet connected port.
			Light off	No link
	PoE	Green	Solid Green	Powered device is connected.
			Blinking	Port has detected a error condition
			Light off	Powered Device may receive power from an AC power source or no 802.3af PD is found.
LED Per GE Port	**Link/Act/Speed mode for 1000BASE-T ports**	Green/Amber	Solid Green	When there is a secure 1000Mbps connection (or link) at any of the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity--Act) of data occurring at a 1000Mbps connected port.
			Solid Amber	When there is a secure 10/100Mbps Fast Ethernet connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at a Fast Ethernet connected port.
			Light off	No link
	Link/Act/Speed mode for SFP ports	Green/Amber	Solid Green	When there is a secure 1000Mbps connection (or link) at the ports.
			Blinking Green	When there is reception or transmission (i.e. Activity--Act) of data occurring at a 1000Mbps connected port.
			Solid Amber	When there is a secure 100Mbps connection (or link) at any of the ports.
			Blinking Amber	When there is reception or transmission (i.e. Activity—Act) of data occurring at the ports.
			Light off	No link

Power

Feature	*Detailed Description*
Internal Power Supply	AC Input: 100 - 240 VAC, 50-60 Hz

Performance

Feature	*Detailed Description*
Wire speed on all FE/GE ports	Full-wire speed (full-duplex) operation on all FE/GE ports
Forwarding Mode	Store and Forward
Switching Capacity	12.8Gbps for DES-3028/DES-3028P 17.6Gbps for DES-3052/DES-3052P
64 Byte system packet forwarding rate	9.5 million packets per second for DES-3028/DES-3028P 13.1 million packets per second for DES-3052/DES-3052P
Priority Queues	4 Priority Queues per port
MAC Address Table	Supports 8K MAC address
Packet Buffer Memory	4M bits

Port Functions

Feature	*Detailed Description*
Console Port	DCE RS-232 DB-9 for out-of-band configuration of the software features
24 x 10/100BaseT ports 48 x 10/100BaseT ports (Power over LAN support)	Compliant to following standards, 1. IEEE 802.3 compliance 2. IEEE 802.3u compliance 3. Support Half/Full-Duplex operations 4. All ports support Auto MDI-X/MDI-II cross over 5. IEEE 802.3x Flow Control support for Full-Duplex mode, Back Pressure when Half-Duplex mode, and Head-of-line blocking prevention. 6. Compliant IEEE802.3af standard(only for PoE)
Combo ports in the front panel	2 combo 1000BASE-T/SFP ports 1000BASE-T ports compliant to following standards: 2. IEEE 802.3 compliance 3. IEEE 802.3u compliance 4. IEEE 802.3ab compliance 5. Support Full-Duplex operations 6. IEEE 802.3x Flow Control support for Full-Duplex mode, back pressure when Half-Duplex mode, and Head-of-line blocking prevention

	SFP Transceivers Supported: 1. DEM-310GT (1000BASE-LX) 2. DEM-311GT (1000BASE-SX) 3. DEM-314GT (1000BASE-LH) 4. DEM-315GT (1000BASE-ZX) 5. DEM-210 (Single Mode 100BASE-FX) 6. DEM-211 (Multi Mode 100BASE-FX) -WDM Transceiver Supported: 1.DEM-330T (TX-1550/RX-1310nm),up to 10km,Single-Mode 2.DEM-330R (TX-1310/RX-1550nm), up to 10km,Single-Mode 3.DEM-331T (TX-1550/RX-1310nm), up to 40km, Single-Mode 4.DEM-331R (TX-1310/RX-1550nm), up to 40km, Single-Mode Compliant to following standards: 1. IEEE 802.3z compliance 2. IEEE 802.3u compliance
2 1000BASE-T ports in the front panel	1000BASE-T ports compliant to following standards: 1. IEEE 802.3 compliance 2. IEEE 802.3u compliance 3. IEEE 802.3ab compliance 4. Support Full-Duplex operations 5. IEEE 802.3x Flow Control support for Full-Duplex mode, back pressure when Half-Duplex mode, and Head-of-line blocking prevention

Pin Assignment for Data/Power Pairs: (alternative A MDI-X)

PIN#	Signal	Descriptions
1	Receive+ & Power-	0V
2	Receive- & Power-	0V
3	Transmit+ & Power+	+48V
4		
5		
6	Transmit- & Power+	+48V
7		
8		

Appendix B

System Log Entries

The following table lists all possible entries and their corresponding meanings that will appear in the System Log of this Switch.

Category	Event Description	Log Content	Severity
system	System started up	Uint <unitID>, System started up	Critical
	Configuration saved to flash	Uint <unitID>, Configuration saved to flash by console(Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	System log saved to flash	Unit <unitID>, System log saved to flash by console(Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Configuration and log saved to flash	Unit <unitID>, Configuration and log saved to flash by console(Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
up/down-load	Firmware upgraded successfully	Unit <unitID>, Firmware upgraded by console successfully (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Firmware upgrade was unsuccessful	Unit <unitID>, Firmware upgrade by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Configuration successfully downloaded	Configuration successfully downloaded by console(Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Configuration download was unsuccessful	Configuration download by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Configuration successfully uploaded	Configuration successfully uploaded by console (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Configuration upload was unsuccessful	Configuration upload by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Log message successfully uploaded	Log message successfully uploaded by console (Username: <username>, IP: <ipaddr>, MAC:	Informational

Category	Event Description	Log Content	Severity
		<macaddr>)	
	Log message upload was unsuccessful	Log message upload by console was unsuccessful! (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
Interface	Port link up	Port <unitID:portNum> link up, <link state>	Informational
	Port link down	Port <unitID:portNum> link down	Informational
Console	Successful login through Console	Unit <unitID>, Successful login through Console (Username: <username>)	Informational
	Login failed through Console	Unit <unitID>, Login failed through Console (Username: <username>)	Warning
	Logout through Console	Unit <unitID>, Logout through Console (Username: <username>)	Informational
	Console session timed out	Unit <unitID>, Console session timed out (Username: <username>)	Informational
Web	Successful login through Web	Successful login through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Login failed through Web	Login failed through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Logout through Web	Logout through Web (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Successful login through Web(SSL)	Successful login through Web(SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Login failed through Web(SSL)	Login failed through Web(SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Logout through Web(SSL)	Logout through Web(SSL) (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Web(SSL) session timed out	Web(SSL) session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
Telnet	Successful login through Telnet	Successful login through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational

Category	Event Description	Log Content	Severity
		<ipaddr>, MAC: <macaddr>)	
	Login failed through Telnet	Login failed through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Logout through Telnet	Logout through Telnet (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Telnet session timed out	Telnet session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
SNMP	SNMP request received with invalid community string	SNMP request received from <ipAddress> with invalid community string!	Informational
STP	Topology changed	Topology changed	Informational
	New Root selected	New Root selected	Informational
	BPDU Loop Back on port	BPDU Loop Back on Port <unitID:portNum>	Warning
	Spanning Tree Protocol is enabled	Spanning Tree Protocol is enabled	Informational
	Spanning Tree Protocol is disabled	Spanning Tree Protocol is disabled	Informational
SSH	Successful login through SSH	Successful login through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	Login failed through SSH	Login failed through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Warning
	Logout through SSH	Logout through SSH (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	SSH session timed out	SSH session timed out (Username: <username>, IP: <ipaddr>, MAC: <macaddr>)	Informational
	SSH server is enabled	SSH server is enabled	Informational
	SSH server is disabled	SSH server is disabled	Informational
AAA	Authentication Policy is enabled	Authentication Policy is enabled (Module: AAA)	Informational
	Authentication Policy is disabled	Authentication Policy is disabled (Module: AAA)	Informational

Category	Event Description	Log Content	Severity
	Successful login through Console authenticated by AAA local method	Successful login through Console authenticated by AAA local method (Username: <username>)	Informational
	Login failed through Console authenticated by AAA local method	Login failed through Console authenticated by AAA local method (Username: <username>)	Warning
	Successful login through Web authenticated by AAA local method	Successful login through Web from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Web authenticated by AAA local method	Login failed failed through Web from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through Web(SSL) authenticated by AAA local method	Successful login through Web(SSL) from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Web(SSL) authenticated by AAA local method	Login failed through Web(SSL) from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through Telnet authenticated by AAA local method	Successful login through Telnet from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Telnet authenticated by AAA local method	Login failed through Telnet from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through SSH authenticated by AAA local method	Successful login through SSH from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through SSH authenticated by AAA local method	Login failed through SSH from <userIP> authenticated by AAA local method (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through Console authenticated by AAA none method	Successful login through Console authenticated by AAA none method (Username: <username>)	Informational

Category	Event Description	Log Content	Severity
	Successful login through Web authenticated by AAA none method	Successful login through Web from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful login through Web(SSL) authenticated by AAA none method	Successful login through Web(SSL) from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful login through Telnet authenticated by AAA none method	Successful login through Telnet from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful login through SSH authenticated by AAA none method	Successful login through SSH from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful login through Console authenticated by AAA server	Successful login through Console authenticated by AAA server <serverIP> (Username: <username>)	Informational
	Login failed through Console authenticated by AAA server	Login failed through Console authenticated by AAA server <serverIP> (Username: <username>)	Warning
	Successful login through Web authenticated by AAA server	Successful login through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Web authenticated by AAA server	Login failed through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through Web(SSL) authenticated by AAA server	Successful login through Web(SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Web(SSL) authenticated by AAA server	Login failed through Web(SSL) from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Login failed through Web(SSL) due to AAA server timeout or improper configuration	Login failed through Web(SSL) from <userIP> due to AAA server timeout or improper configuration (Username: <username>, MAC: <macaddr>)	Warning

Category	Event Description	Log Content	Severity
		<macaddr>)	
	Successful login through Telnet authenticated by AAA server	Successful login through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through Telnet authenticated by AAA server	Login failed through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Successful login through SSH authenticated by AAA server	Successful login through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Login failed through SSH authenticated by AAA server	Login failed through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Successful Enable Admin through Console authenticated by AAA local_enable method	Successful Enable Admin through Console authenticated by AAA local_enable method (Username: <username>)	Informational
	Enable Admin failed through Console authenticated by AAA local_enable method	Enable Admin failed through Console authenticated by AAA local_enable method (Username: <username>)	Warning
	Successful Enable Admin through Web authenticated by AAA local_enable method	Successful Enable Admin through Web from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Informational
	Enable Admin failed through Web authenticated by AAA local_enable method	Enable Admin failed through Web from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Warning
	Successful Enable Admin through Telnet authenticated by AAA local_enable method	Successful Enable Admin through Telnet from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Informational
	Enable Admin failed through Telnet authenticated by AAA local_enable method	Enable Admin failed through Telnet from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Warning

Category	Event Description	Log Content	Severity
	Successful Enable Admin through SSH authenticated by AAA local_enable method	Successful Enable Admin through SSH from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Informational
	Enable Admin failed through SSH authenticated by AAA local_enable method	Enable Admin failed through SSH from <userIP> authenticated by AAA local_enable method (Username: <username>, MAC: <macaddr>)	Warning
	Successful Enable Admin through Console authenticated by AAA none method	Successful Enable Admin through Console authenticated by AAA none method (Username: <username>)	Informational
	Successful Enable Admin through Web authenticated by AAA none method	Successful Enable Admin through Web from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful Enable Admin through Telnet authenticated by AAA none method	Successful Enable Admin through Telnet from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful Enable Admin through SSH authenticated by AAA none method	Successful Enable Admin through SSH from <userIP> authenticated by AAA none method (Username: <username>, MAC: <macaddr>)	Informational
	Successful Enable Admin through Console authenticated by AAA server	Successful Enable Admin through Console authenticated by AAA server <serverIP> (Username: <username>)	Informational
	Enable Admin failed through Console authenticated by AAA server	Enable Admin failed through Console authenticated by AAA server <serverIP> (Username: <username>)	Warning
	Successful Enable Admin through Web authenticated by AAA server	Successful Enable Admin through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Enable Admin failed through Web authenticated by AAA server	Enable Admin failed through Web from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Successful Enable Admin through Telnet authenticated by AAA server	Successful Enable Admin through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC:	Informational

Category	Event Description	Log Content	Severity
	server	(Username: <username>, MAC: <macaddr>)	
	Enable Admin failed through Telnet authenticated by AAA server	Enable Admin failed through Telnet from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
	Successful Enable Admin through SSH authenticated by AAA server	Successful Enable Admin through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Informational
	Enable Admin failed through SSH authenticated by AAA server	Enable Admin failed through SSH from <userIP> authenticated by AAA server <serverIP> (Username: <username>, MAC: <macaddr>)	Warning
Port security	Port security has exceeded its maximum learning size and will not learn any new addresses	Port security violation (Port:<unitID:portNum>, MAC: <macaddr>)	Warning
IP and Password Changed	IP Address change activity	Unit <unitID>,Management IP address was changed by (Username: <username>,IP:<ipaddr>,MAC:<macaddr>)	Informational
	Password change activity	Unit <unitID>,Password was changed by (Username: <username>,IP:<ipaddr>,MAC:<macaddr>)	Informational
Safeguard Engine	Safeguard Engine is in normal mode	Safeguard Engine enters NORMAL mode	Informational
	Safeguard Engine is in filtering packet mode	Safeguard Engine enters EXHAUSTED mode	Warning
Packet Storm	Broadcast strom occurrence	Port <unitID:portNum> Broadcast storm is occurring	Warning
	Broadcast storm cleared	Port <unitID:portNum> Broadcast storm has cleared	Informational
	Multicast storm occurrence	Port <unitID:portNum> Multicast storm is occurring	Warning
	Multicast storm cleared	Port <unitID:portNum> Multicast storm has cleared	Informational
	Port shut down due to a packet storm	Port <unitID:portNum> is currently shut down due to a packet storm	Warning

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

Appendix D

Glossary

1000BASE-SX: A short laser wavelength on multimode fiber optic cable for a maximum length of 2000 meters

1000BASE-LX: 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.

aging: 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/CMSA/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 appearance.

FCC Warning

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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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.

Warnung!

Dies ist ein Produkt der Klasse A. Im Wohnbereich kann dieses Produkt Funkstoerungen verursachen. In diesem Fall kann vom Benutzer verlangt werden, angemessene Massnahmen zu ergreifen.

Precaución!

Este es un producto de Clase A. En un entorno doméstico, puede causar interferencias de radio, en cuyo case, puede requerirse al usuario para que adopte las medidas adecuadas.

Attention!

Ceci est un produit de classe A. Dans un environnement domestique, ce produit pourrait causer des interférences radio, auquel cas l`utilisateur devrait prendre les mesures adéquates.

Attenzione!

Il presente prodotto appartiene alla classe A. Se utilizzato in ambiente domestico il prodotto può causare interferenze radio, nel cui caso è possibile che l`utente debba assumere provvedimenti adeguati.

BSMI Warning

警告使用者
這是甲類的資訊產品,在居住的環境中使用時,可能會造成射頻干擾,
在這種情況下使用者會被要求採取某些適當的對策

Warranties/Registration

LIMITED WARRANTY

D-Link provides this limited warranty for its product only to the person or entity who originally purchased the product from D-Link or its authorized reseller or distributor. D-Link would fulfill the warranty obligation according to the local warranty policy in which you purchased our products.

Limited Hardware Warranty: D-Link warrants that the hardware portion of the D-Link products described below ("Hardware") will be free from material defects in workmanship and materials from the date of original retail purchase of the Hardware, for the period set forth below applicable to the product type ("Warranty Period") if the Hardware is used and serviced in accordance with applicable documentation; provided that a completed Registration Card is returned to an Authorized D-Link Service Office within ninety (90) days after the date of original retail purchase of the Hardware. If a completed Registration Card is not received by an authorized D-Link Service Office within such ninety (90) period, then the Warranty Period shall be ninety (90) days from the date of purchase.

Product Type	***Warranty Period***
Product (including Power Supplies and Fans)	One (1) Year
Spare parts and pare kits	Ninety (90) days

D-Link's sole obligation shall be to repair or replace the defective Hardware at no charge to the original owner. 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 of an identical make, model or part; D-Link may in its discretion may 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. The Warranty Period shall extend for an additional ninety (90) days after any repaired or replaced Hardware is delivered. 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 delivery of the Software for a period of ninety (90) days ("Warranty Period"), if 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. 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. The Warranty Period shall extend for an additional ninety (90) days after any replacement Software is delivered. 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.

What You Must Do For Warranty Service:

Registration Card. The Registration Card provided at the back of this manual must be completed and returned to an Authorized D-Link Service Office for each D-Link product within ninety (90) days after the product is purchased and/or licensed. The addresses/telephone/fax list of the nearest Authorized D-Link Service Office is provided in the back of this manual. FAILURE TO PROPERLY COMPLETE AND TIMELY RETURN THE REGISTRATION CARD MAY AFFECT THE WARRANTY FOR THIS PRODUCT.

Submitting A Claim. Any claim under this limited warranty must be submitted in writing before the end of the Warranty Period to an Authorized D-Link Service Office. The claim must include 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. The packaged product shall be insured and shipped to Authorized D-Link Service Office with all shipping costs prepaid. 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 that 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; and

Any hardware, software, firmware or other products or services provided by anyone other than D-Link.

Disclaimer of Other Warranties: EXCEPT FOR THE LIMITED WARRANTY SPECIFIED HEREIN, THE PRODUCT IS PROVIDED "AS-IS" WITHOUT ANY WARRANTY OF ANY KIND 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, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, 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.

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

Copyright Statement

FCC Warning

This equipment has been tested and found to comply with the limits for a Class B 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 communications. 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.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum 20cm between the radiator and your body.

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:

- Only to the person or entity that originally purchased the product from D-Link or its authorized reseller or distributor, and
- Only for 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, or addresses with an APO or FPO.

Limited Warranty: D-Link warrants that the hardware portion of the D-Link product described below ("Hardware") will be free from material defects in workmanship and materials under normal use from the date of original retail purchase of the product, for the period set forth below ("Warranty Period"), except as otherwise stated herein.

Limited Lifetime Warranty for the product is defined as follows:

- Hardware: For as long as the original customer/end user owns the product, or five (5) 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

The customer's sole and exclusive remedy and the entire liability of D-Link and its suppliers under this Limited Warranty will be, at D-Link's option, to repair or replace the defective Hardware during the Warranty Period at no charge to the original owner or to refund the actual purchase price paid. Any 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, at its option, 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 or ninety (90) days, whichever is longer, and is subject to the same limitations and exclusions. If a material defect is incapable of correction, or if D-Link determines that it is not practical to repair or replace the defective Hardware, the actual 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 ("Software 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 Software Warranty Period, the magnetic media on which D-Link delivers the Software will be free of physical defects. The customer's sole and exclusive remedy and the entire liability of D-Link and its suppliers under this Limited Warranty will be, at D-Link's option, 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 the portion of the actual purchase price paid that is attributable to the Software. 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. Replacement Software will be warranted for the remainder of the original Warranty Period and is subject to the same limitations and exclusions. 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 portions 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, along with proof of purchase of the product (such as a copy of the dated purchase invoice for the product) if the product is not registered.
- The customer must obtain a Case ID Number from D-Link Technical Support at 1-877-453-5465, who will attempt to assist the customer in resolving any suspected defects with the product. If the product is considered defective, the customer must obtain a Return Material Authorization ("RMA") number by completing the RMA form and entering the assigned Case ID Number at https://rma.dlink.com/.
- 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. Herrmann, 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. Return shipping charges shall be prepaid by D-Link if you use an address in the United States, otherwise we will ship the product to you freight collect. Expedited shipping is available upon request and provided shipping charges are prepaid by the customer.

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: The Limited Warranty provided herein by D-Link does not cover: Products that, 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; and 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. While necessary maintenance or repairs on your Product can be performed by any company, we recommend that you use only an Authorized D-Link Service Office. Improper or incorrectly performed maintenance or repair voids this Limited 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 you 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 owners.

CE Mark Warning: This is a Class A product. In a residential 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 commercial 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. Operation of this equipment in a residential environment is likely to cause harmful interference to radio or television reception. 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 information applicable to products purchased outside the United States, please contact the corresponding local D-Link office.

Product Registration

Register your D-Link product online at http://support.dlink.com/register/

Product registration is entirely voluntary and failure to complete or return this form will not diminish your warranty rights.

D-Link Europe Limited Lifetime Warranty

Dear Customer,

please read below to understand the details of the warranty coverage you have.

Warranty terms for D-LINK products:

All D-Link products* are supplied with a 5 year warranty as standard. To enable the Limited Lifetime Warranty on this product you must register the product, within the first three months of purchase** on the following website: **http://www.dlink.biz/productregistration/**

D-Link will then provide you with a Limited Lifetime Warranty reference number for this product. Please retain your original dated proof of purchase with a note of the serial number, and Limited Lifetime Warranty reference number together with this warranty statement and place each document in a safe location. When you make a warranty claim on a defective product, you may be asked to provide this information.

Nothing in this Limited Lifetime Warranty affects your statutory rights as a consumer. The following are special terms applicable to your Limited Lifetime hardware warranty.

Warranty beneficiary

The warranty beneficiary is the original end user. The original end user is defined as the person that purchases the product as the first owner.

Duration of Limited Lifetime Warranty

As long as the original end-user continues to own or use the product with the following conditions:

- fan and power supplies are limited to a five (5) year warranty only
- in the event of discontinuance of product manufacture, D-Link warranty support is limited to five (5) years from the announcement of discontinuance. If a product is no longer available for replacement, D-Link will issue a product comparable or better to the one originally purchased.

Replacement, Repair or Refund Procedure for Hardware

D-Link or its service center will use commercially reasonable efforts to ship a replacement part within ten (10) working days after receipt of the RMA request. Actual delivery times may vary depending on customer location. D-Link reserves the right to refund the purchase price as its exclusive warranty remedy.

To Receive a Return Materials Authorization (RMA) Number, please visit: http://service.dlink.biz and for Italy and Spain, please use: http://rma.dlink.es or http://rma.dlink.it.

D-Link Limited Lifetime Warranty

Hardware: D-Link warrants the D-Link hardware named above against defects in materials and workmanship for the period specified above. If D-Link receives notice of such defects during the warranty period, D-Link will, at its option, either repair or replace products proving to be defective. Replacement products may be either new or like-new.

***Software*.** D-Link warrants that D-Link software will not fail to execute its programming instructions, for the period specified above, due to defects in material and workmanship when properly installed and used. If D-Link receives notice of such defects during the warranty period, D-Link will replace software media that does not execute its programming instructions due to such defects.

Warranty exclusions

This warranty does not apply if the software, product or any other equipment upon which the software is authorized to be used (a) has been altered, except by D-Link or its authorized representative, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by D-Link (improper use or improper maintenance), (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident; (d) is licensed, for beta, evaluation, testing or demonstration purposes for which D-Link does not charge a purchase price or license fee or (e) defects are caused by force majeure (lightning, floods, war, etc.), soiling, by extraordinary environmental influences or by other circumstances of which D-Link is not responsible.

Disclaimer of warranty

Please note, some countries do not allow the disclaimer of implied terms in contracts with consumers and the disclaimer below may not apply to you.

To the extend allowed by local law, the above warranties are exclusive and no other warranty, condition or other term, whether written or oral, is expressed or implied. D-Link specifically disclaims any implied warranties, conditions and terms of merchantability, satisfactory quality, and fitness for a particular purpose.

To the extent allowed by local law, the remedies in this warranty statement are customer's sole and exclusive remedies. Except as indicated above, in no event will D-Link or its suppliers be liable for loss of data or for indirect, special, incidental, consequential (including lost profit or data), or other damage, whether based in a contract, tort, or otherwise.

To the extent local law mandatorily requires a definition of "Lifetime Warranty" different from that provided here, then the local law definition will supersede and take precedence.

Valid law

The warranty is subject to the valid laws in the country of purchase and is to be interpreted in the warranty terms with the said laws. You may have additional legal rights that are not restricted by this warranty. Nothing in this Limited Lifetime Warranty affects your statutory rights as a consumer.

* DES-6500 series is excluded from the Limited Lifetime Warranty offering and will be supplied with a standard 5 year warranty.

** Failure to register this product within the first three months of purchase [by the first user only] will invalidate the Limited Lifetime Warranty.

Tech Support

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers within Australia:

D-Link Technical Support over the Telephone:

1300-766-868

Monday to Friday 8:00am to 8:00pm EST

Saturday 9:00am to 1:00pm EST

D-Link Technical Support over the Internet:

http://www.dlink.com.au

email:support@dlink.com.au

Tech Support for customers within New Zealand:

D-Link Technical Support over the Telephone:

0800-900-900

Monday to Friday 8:30am to 8:30pm

Saturday 9:00am to 5:00pm

D-Link Technical Support over the Internet:

http://www.dlink.co.nz

email:support@dlink.co.nz

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers within South Eastern Asia and Korea:

D-Link South Eastern Asia and Korea Technical Support over the Telephone:

+65-6895-5355

Monday to Friday 9:00am to 12:30pm, 2:00pm-6:00pm Singapore Time

D-Link Technical Support over the Internet:

email:support@dlink.com.sg

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers within India

D-Link Technical Support over the Telephone:

+91-22-26526741

+91-22-26526696 –ext 161 to 167

Monday to Friday 9:30AM to 7:00PM

D-Link Technical Support over the Internet:

http://ww.dlink.co.in

http://www.dlink.co.in/dlink/drivers/support.asp

ftp://support.dlink.co.in

email: techsupport@dlink.co.in

D-Link®

Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

D-Link provides free technical support for customers
for the duration of the warranty period on this product.

Customers can contact D-Link technical support through our web site or by phone.

Tech Support for customers within the Russia

D-Link Technical Support over the Telephone:

(495) 744-00-99

Monday to Friday 10:00am to 6:30pm

D-Link Technical Support over the Internet

http://www.dlink.ru

email: support@dlink.ru

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers within the U.A.E & North Africa:

D-Link Technical Support over the Telephone:

(971) 4-391-6480 (U.A.E)

Sunday to Wednesday 9:00am to 6:00pm GMT+4

Thursday 9:00am to 1:00pm GMT+4

D-Link Middle East & North Africa

D-Link Technical Support over the Internet:

http://support.dlink-me.com

email:support@dlink-me.com

Tech Support for customers within Israel:

D-Link Technical Support over the Telephone:

(972) 9-9715701

Sunday to Thursday 9:00am to 5:00pm

D-Link Technical Support over the Internet:

http://www.dlink.co.il/support/

e-mail: support@dlink.co.il

Tech Support for customers within Turkey:

D-Link Technical Support over the Telephone:

0090 312 473 40 55

Monday to Friday 9:00am to 6:00pm

D-Link Technical Support over the Internet:

http://www.dlink.com.tr

e-mail: turkiye@dlink-me.com

Tech Support for customers within Egypt:

D-Link Technical Support over the Telephone:

+202-2919035, +202-2919047

Sunday to Thursday 9:00am to 5:00pm

D-Link Technical Support over the Internet:

http://support.dlink-me.com

e-mail: amostafa@dlink-me.com

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

Tech Support for customers within South Africa and Sub Sahara Region:

D-Link South Africa and Sub Sahara Technical Support over the Telephone:

+27-12-665-2165

08600 DLINK (For South Africa only)

Monday to Friday 8:30am to 9:00pm South Africa Time

D-Link Technical Support over the Internet:

http://www.d-link.co.za

email:support@d-link.co.za

D-Link®
Building Networks for People

Technical Support

You can find updates and user documentation on the D-Link website

Tech Support for Latin America customers:

D-Link Technical Support over the followings Telephones:

Argentina: 0800-666 1442	Monday to Friday 09:00am to 22:00pm
Chile: 800-214 422	Monday to Friday 08:00am to 21:00pm
Colombia: 01800-700 1588	Monday to Friday 07:00am to 20:00pm
Ecuador: 1800-777 711	Monday to Friday 07:00am to 20:00pm
El Salvador: 800-6137	Monday to Friday 06:00am to 19:00pm
Guatemala:1800-300 0017	Monday to Friday 06:00am to 19:00pm
Panama: 0800-560 0193	Monday to Friday 07:00am to 20:00pm
Peru: 0800-52049	Monday to Friday 07:00am to 20:00pm
Venezuela: 0800-100 3470	Monday to Friday 08:00am to 21:00pm

D-Link Technical Support over the Internet:

www.dlinkla.com

www.dlinklatinamerica.com

email:support@dlink.cl

Tech Support for customers within Brazil:

D-Link Technical Support over the Telephone:

0800-7014104

Monday to Friday 8:30am to 18:30pm

D-Link Technical Support over the Internet:

www.dlinkbrasil.com.br

email:suporte@dlinkbrasil.com.br

D-Link®

Building Networks for People

Техническая поддержка

Обновления программного обеспечения и документация доступны на Интернет-сайте D-Link.

D-Link предоставляет бесплатную поддержку для клиентов в течение гарантийного срока.

Клиенты могут обратиться в группу технической поддержки D-Link по телефону или через Интернет.

Техническая поддержка D-Link:

(495) 744-00-99

Техническая поддержка через Интернет

http://www.dlink.ru

email: support@dlink.ru

D-Link®
Building Networks for People

Asistencia Técnica

D-Link Latin América pone a disposición de sus clientes, especificaciones, documentación y software mas reciente a través de nuestro Sitio Web

www.dlinkla.com

El servicio de soporte técnico tiene presencia en numerosos países de la Región Latino América, y presta asistencia gratuita a todos los clientes de D-Link, en forma telefónica e internet, a través de la casilla

soporte@dlinkla.com

Soporte Técnico Help Desk Argentina:

Teléfono: 0800-6661442 Lunes a Viernes 09:00 am a 22:00 pm

Soporte Técnico Help Desk Chile:

Teléfono: 800 8 35465 Lunes a Viernes 08:00 am a 21:00 pm

Soporte Técnico Help Desk Colombia:

Teléfono: 01800-7001588 Lunes a Viernes 07:00 am a 20:00 pm

Soporte Técnico Help Desk Ecuador:

Teléfono: 1800-777 711 Lunes a Viernes 07:00 am a 20:00 pm

Soporte Técnico Help Desk El Salvador:

Teléfono: 800-6137 Lunes a Viernes 06:00 am a 19:00 pm

Soporte Técnico Help Desk Guatemala:

Teléfono: 1800-300 0017 Lunes a Viernes 06:00 am a 19:00 pm

Soporte Técnico Help Desk Panamá:

Teléfono: 0800-560 0193 Lunes a Viernes 07:00 am a 20:00 pm

Soporte Técnico Help Desk Perú:

Teléfono: 0800-52049 Lunes a Viernes 07:00 am a 20:00 pm

Soporte Técnico Help Desk Venezuela:

Teléfono: 0800-1003470 Lunes a Viernes 08:00 am a 21:00 pm

D-Link®
Building Networks for People

Suporte Técnico

Você pode encontrar atualizações de software e documentação de usuário no site da D-Link Brasil www.dlinkbrasil.com.br.

A D-Link fornece suporte técnico gratuito para clientes no Brasil durante o período de vigência da garantia deste produto.

Suporte Técnico para clientes no Brasil:

Telefone

São Paulo (11) 2185-9301

Segunda à sexta

Das 8h30 às 18h30

Demais Regiões do Brasil 0800 70 24 104

E-mail:

email:suporte@dlinkbrasil.com.br

D-Link®
Building Networks for People

D-Link 友訊科技 台灣分公司
技術支援資訊

如果您還有任何本使用手冊無法協助您解決的產品相關問題，台灣地區用戶可以透過我們的網站、電子郵件或電話等方式與D-Link台灣地區技術支援工程師聯絡。

D-Link 免付費技術諮詢專線
0800-002-615
服務時間：週一至週五，早上8:30 到 晚上7:00
(不含周六、日及國定假日)

網　　站：http://www.dlink.com.tw
電子郵件 ：dssqa_service@dlink.com.tw

如果您是台灣地區以外的用戶，請參考D-Link網站 全球各地分公司的聯絡資訊以取得相關支援服務。

產品保固期限、台灣區維修據點查詢，請參考以下網頁說明：
http://www.dlink.com.tw

產品維修：
使用者可直接送至全省聯強直營維修站或請洽您的原購買經銷商。

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

D-Link provides free technical support for customers within the United States and within Canada for the duration of the warranty period on this product.

U.S. and Canadian customers can contact D-Link technical support through our website, or by phone.

Tech Support for customers within the United States:

D-Link Technical Support over the Telephone:

(888) 843-6100

Hours of Operation: 8:00AM to 6:00PM PST

D-Link Technical Support over the Internet:

http://support.dlink.com

email:support@dlink.com

Tech Support for customers within Canada:

D-Link Technical Support over the Telephone:

(800) 361-5265

Monday to Friday 7:30am to 12:00am EST

D-Link Technical Support over the Internet:

http://support.dlink.ca

email:support@dlink.ca

D-Link®

Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link websites.

If you require product support, we encourage you to browse our FAQ section on the Web Site before contacting the Support line. We have many FAQ's which we hope will provide you a speedy resolution for your problem.

For Customers within

The United Kingdom & Ireland:

D-Link UK & Ireland Technical Support over the Internet:

http://www.dlink.co.uk

ftp://ftp.dlink.co.uk

D-Link UK & Ireland Technical Support over the Telephone:

08456 12 0003 (United Kingdom)

+1890 886 899 (Ireland)

Lines Open

8.00am-10.00pm Mon-Fri

10.00am-7.00pm Sat & Sun

For Customers within Canada:

D-Link Canada Technical Support over the Telephone:

1-800-361-5265 (Canada)

Mon. to Fri. 7:30AM to 9:00PM EST

D-Link Canada Technical Support over the Internet:

http://support.dlink.ca

email: support@dlink.ca

D-Link®
Building Networks for People

Technische Unterstützung

Aktualisierte Versionen von Software und Benutzerhandbuch finden Sie auf der Website von D-Link.

D-Link bietet kostenfreie technische Unterstützung für Kunden innerhalb Deutschlands, Österreichs, der Schweiz und Osteuropas.

Unsere Kunden können technische Unterstützung über unsere Website, per E-Mail oder telefonisch anfordern.

Web: http://www.dlink.de

E-Mail: support@dlink.de

Telefon: +49 (1805)2787

0,12 € /Min aus dem Festnetz der Deutschen Telekom.

Telefonische technische Unterstützung erhalten Sie Montags bis Freitags von 09.00 bis 17.30 Uhr.

Unterstützung erhalten Sie auch bei der Premiumhotline für D-Link Produkte unter der Rufnummer 09001-475767

Montag bis Freitag von 6-22 Uhr und am Wochenende von 11-18 Uhr.

1,75€/Min aus dem Festnetz der Deutschen Telekom.

Wenn Sie Kunde von D-Link außerhalb Deutschlands, Österreichs, der Schweiz und Osteuropas sind, wenden Sie sich bitte an die zuständige Niederlassung aus der Liste im Benutzerhandbuch.

D-Link®

Building Networks for People

Assistance technique

Vous trouverez la documentation et les logiciels les plus récents sur le site web **D-Link.**

Vous pouvez contacter le service technique de
D-Link par notre site internet ou par téléphone.

Support technique destiné aux clients établis en France:

Assistance technique D-Link par téléphone :

0820 0803 03

N° INDIGO - 0,12€ TTC/min*

*Prix en France Métropolitaine au 3 mars 2005

Du lundi au samedi – de 9h00 à 19h00

Assistance technique D-Link sur internet :

http://www.dlink.fr

e-mail : support@dlink.fr

Support technique destiné aux clients établis au Canada :

Assistance technique D-Link par téléphone :

(800) 361-5265

Lun.-Ven. 7h30 à 21h00 HNE.

Assistance technique D-Link sur internet :

http ://support.dlink.ca

e-mail : support@dlink.ca

D-Link®
Building Networks for People

Asistencia Técnica

Puede encontrar las últimas versiones de software así como documentación técnica en el sitio web de **D-Link**.

D-Link ofrece asistencia técnica gratuita para clientes residentes en España durante el periodo de garantía del producto.

Asistencia Técnica de D-Link por teléfono:

+34 902 30 45 45

Lunes a Viernes de 9:00 a 14:00 y de 15:00 a 18:00

Asistencia Técnica de D-Link a través de Internet:

http://www.dlink.es/support/

e-mail: soporte@dlink.es

D-Link®
Building Networks for People

Supporto tecnico

Gli ultimi aggiornamenti e la documentazione sono disponibili sul sito D-Link.

Supporto tecnico per i clienti residenti in Italia

D-Link Mediterraneo S.r.L.

Via N. Bonnet 6/B 20154 Milano

Supporto Tecnico dal lunedì al venerdì dalle ore 9.00 alle ore 19.00 con orario continuato

Telefono: 02-39607160

URL : http://www.dlink.it/supporto.html

Email: tech@dlink.it

D-Link®
Building Networks for People

Technical Support

You can find software updates and user documentation on the D-Link website.

D-Link provides free technical support for customers within Benelux for the duration of the warranty period on this product.

Benelux customers can contact D-Link technical support through our website, or by phone.

Tech Support for customers within the Netherlands:

D-Link Technical Support over the Telephone:

0900 501 2007

Monday to Friday 9:00 am to 10:00 pm

D-Link Technical Support over the Internet:

www.dlink.nl

Tech Support for customers within Belgium:

D-Link Technical Support over the Telephone:

070 66 06 40

Monday to Friday 9:00 am to 10:00 pm

D-Link Technical Support over the Internet:

www.dlink.be

Tech Support for customers within Luxemburg:

D-Link Technical Support over the Telephone:

+32 70 66 06 40

Monday to Friday 9:00 am to 10:00 pm

D-Link Technical Support over the Internet:

www.dlink.be

D-Link®
Building Networks for People

Pomoc techniczna

Najnowsze wersje oprogramowania i dokumentacji użytkownika można znaleźć w serwisie internetowym firmy D-Link.

D-Link zapewnia bezpłatną pomoc techniczną klientom w Polsce w okresie gwarancyjnym produktu.

Klienci z Polski mogą się kontaktować z działem pomocy technicznej firmy D-Link za pośrednictwem Internetu lub telefonicznie.

Telefoniczna pomoc techniczna firmy D-Link:

(+48 12) 25-44-000

Pomoc techniczna firmy D-Link świadczona przez Internet:

URL: http://www.dlink.pl

e-mail: dlink@fixit.pl

D-Link®
Building Networks for People

Technická podpora

Aktualizované verze software a uživatelských příruček najdete na webové stránce firmy D-Link.

D-Link poskytuje svým zákazníkům bezplatnou technickou podporu

Zákazníci mohou kontaktovat oddělení technické podpory přes webové stránky, mailem nebo telefonicky

Web: http://www.dlink.cz/suppport/

E-mail: support@dlink.cz

Telefon: 224 247 503

Telefonická podpora je v provozu:

PO- PÁ od 09.00 do 17.00

D-Link®
Building Networks for People

Technikai Támogatás

Meghajtó programokat és frissítéseket a **D-Link** Magyarország weblapjáról tölthet le.
Telefonon technikai segítséget munkanapokon hétfőtől-csütörtökig 9.00 – 16.00 óráig és pénteken 9.00 – 14.00 óráig kérhet
a **(1) 461-3001** telefonszámon vagy a **support@dlink.hu** emailcímen.

Magyarországi technikai támogatás :

D-Link Magyarország

1074 Budapest, Alsóerdősor u. 6. – R70 Irodaház 1 em.

Tel. : 06 1 461-3001

Fax : 06 1 461-3004

email : support@dlink.hu

URL : http://www.dlink.hu

D-Link®
Building Networks for People

Teknisk Support

Du kan finne programvare oppdateringer og bruker dokumentasjon på D-Links web sider.

D-Link tilbyr sine kunder gratis teknisk support under produktets garantitid.

Kunder kan kontakte D-Links teknisk support via våre hjemmesider, eller på tlf.

Teknisk Support:

D-Link Teknisk telefon Support:

800 10 610

(Hverdager 08:00-20:00)

D-Link Teknisk Support over Internett:

http://www.dlink.no

D-Link®
Building Networks for People

Teknisk Support

Du finder software opdateringer og bruger-dokumentation på D-Link's hjemmeside.

D-Link tilbyder gratis teknisk support til kunder i Danmark i hele produktets garantiperiode.

Danske kunder kan kontakte D-Link's tekniske support via vores hjemmeside eller telefonisk.

D-Link teknisk support over telefonen:

Tlf. 7026 9040

Hverdager: kl. 08:00 – 20:00

D-Link teknisk support på Internettet:

http://www.dlink.dk

D-Link®

Building Networks for People

Teknistä tukea asiakkaille Suomessa:

D-Link tarjoaa teknistä tukea asiakkailleen.

Tuotteen takuun voimassaoloajan.

Tekninen tuki palvelee seuraavasti:

Arkisin klo. 9 - 21
numerosta
0800-114 677

Internetin kautta
Ajurit ja lisätietoja tuotteista.
http://www.dlink.fi

Sähköpostin kautta
voit myös tehdä kyselyitä.

D-Link®
Building Networks for People

Teknisk Support

På vår hemsida kan du hitta mer information om mjukvaru uppdateringar och annan användarinformation.

D-Link tillhandahåller teknisk support till kunder i Sverige under hela garantitiden för denna produkt.

Teknisk Support för kunder i Sverige:

D-Link Teknisk Support via telefon:

0770-33 00 35

Vardagar 08.00-20.00

D-Link Teknisk Support via Internet:

http://www.dlink.se

D-Link®
Building Networks for People

Suporte Técnico

Você pode encontrar atualizações de software e documentação de utilizador no site de D-Link Portugal http://www.dlink.pt.

A D-Link fornece suporte técnico gratuito para clientes no Portugal durante o período de vigência de garantia deste produto.

Suporte Técnico para clientes no Portugal:

Assistência Técnica:

Email: soporte@dlink.es

http://www.dlink.pt/support/

ftp://ftp.dlink.es

D-Link®
Building Networks for People

Τεχνική Υποστήριξη

Μπορείτε να βρείτε software updates και πληροφορίες για τη χρήση των προϊόντων στις ιστοσελίδες της D-Link

Η D-Link προσφέρει στους πελάτες της δωρεάν υποστήριξη

στον Ελλαδικό χώρο

Μπορείτε να επικοινωνείτε με το τμήμα τεχνικής υποστήριξης μέσω της ιστοσελίδας ή μέσω τηλεφώνου

Για πελάτες εντός του Ελλαδικού χώρου:

Τηλεφωνική υποστήριξη D-Link :

Τηλ: 210 86 11 114
Φαξ: 210 86 53 172

(Δευτέρα-Παρασκευή 09:00-17:00)

e-mail: support@dlink.gr

Τεχνική υποστήριξη D-Link μέσω Internet:

http://www.dlink.gr

ftp://ftp.dlink.it

D-Link®
Building Networks for People

技术支持

办公地址：北京市朝阳区建国路 71 号惠通时代广场 C1 座
202 室 邮编: 100025

技术支持中心电话：8008868192/(028)85176977

技术支持中心传真：(028)85176948

维修中心地址：北京市朝阳区建国路 71 号惠通时代广场 C1 座
202 室 邮编: 100025

维修中心电话：(010) 58635800

维修中心传真：(010) 58635799

网址：http://www.dlink.com.cn

办公时间：周一到周五，早09:00到晚18:00

D-Link®
Building Networks for People

International Offices

U.S.A

17595 Mt. Herrmann Street
Fountain Valley, CA 92708
TEL: 1-800-326-1688
URL: www.dlink.com

Canada

2180 Winston Park Drive
Oakville, Ontario, L6H 5W1
Canada
TEL: 1-905-8295033
FAX: 1-905-8295223
URL: www.dlink.ca

Europe (U. K.)

4th Floor, Merit House
Edgware Road, Colindale
London NW9 5AB
U.K.
TEL: +44-20-8955-9000
FAX: +44-20-8955-9001
URL: www.dlink.co.uk

Germany

Schwalbacher Strasse 74
D-65760 Eschborn
Germany
TEL: 49-6196-77990
FAX: 49-6196-7799300
URL: www.dlink.de

France

No.2 all'ee de la Fresnerie
78330 Fontenay le Fleury
France
TEL: 33-1-30238688
FAX: 33-1-30238689
URL: www.dlink.fr

Netherlands

Weena 290
3012 NJ, Rotterdam
Netherlands
Tel: +31-10-282-1445
Fax: +31-10-282-1331
URL: www.dlink.nl

Belgium

Rue des Colonies 11
B-1000 Brussels
Belgium
Tel: +32(0)2 517 7111
Fax: +32(0)2 517 6500
URL: www.dlink.be

Italy

Via Nino Bonnet n. 6/b
20154 – Milano
Italy
TEL: 39-02-2900-0676
FAX: 39-02-2900-1723
URL: www.dlink.it

Sweden

P.O. Box 15036, S-167 15 Bromma
Sweden
TEL: 46-(0)8564-61900
FAX: 46-(0)8564-61901
URL: www.dlink.se

Denmark

Naverland 2, DK-2600
Glostrup, Copenhagen
Denmark
TEL: 45-43-969040
FAX: 45-43-424347
URL: www.dlink.dk

Norway

Karihaugveien 89
N-1086 Oslo
Norway
TEL: +47 99 300 100
FAX: +47 22 30 95 80
URL: www.dlink.no

Finland

Latokartanontie 7A
FIN-00700 HELSINKI
Finland
TEL: +358-10 309 8840
FAX: +358-10 309 8841
URL: www.dlink.fi

Spain

Avenida Diagonal, 593-95, 9th floor
08014 Barcelona
Spain
TEL: 34 93 4090770
FAX: 34 93 4910795
URL: www.dlink.es

Portugal

Rua Fernando Pahla
50 Edificio Simol
1900 Lisbon Portugal
TEL: +351 21 8688493
URL: www.dlink.es

Czech Republic

Vaclavske namesti 36, Praha 1
Czech Republic
TEL :+420 (603) 276 589
URL: www.dlink.cz

Switzerland

Glatt Tower, 2.OG CH-8301
Glattzentrum Postfach 2.OG
Switzerland
TEL : +41 (0) 1 832 11 00
FAX: +41 (0) 1 832 11 01
URL: www.dlink.ch

Greece

101, Panagoulis Str. 163-43
Helioupolis Athens, Greece
TEL : +30 210 9914 512
FAX: +30 210 9916902
URL: www.dlink.gr

Luxemburg

Rue des Colonies 11,
B-1000 Brussels,
Belgium
TEL: +32 (0)2 517 7111
FAX: +32 (0)2 517 6500
URL: www.dlink.be

Poland

Budynek Aurum ul. Walic-w 11
PL-00-851
Warszawa
Poland
TEL : +48 (0) 22 583 92 75
FAX: +48 (0) 22 583 92 76
URL: www.dlink.pl

Hungary

R-k-czi-t 70-72
HU-1074
Budapest
Hungary
TEL : +36 (0) 1 461 30 00
FAX: +36 (0) 1 461 30 09
URL: www.dlink.hu

Singapore

1 International Business Park
#03-12 The Synergy
Singapore 609917
TEL: 65-6774-6233
FAX: 65-6774-6322
URL: www.dlink-intl.com

Australia

1 Giffnock Avenue
North Ryde, NSW 2113
Australia
TEL: 61-2-8899-1800
FAX: 61-2-8899-1868
URL: www.dlink.com.au

India

D-Link House, Kurla Bandra Complex Road
Off CST Road, Santacruz (East)
Mumbai - 400098
India
TEL: 91-022-26526696/56902210
FAX: 91-022-26528914
URL: www.dlink.co.in

Middle East (Dubai)

P.O.Box: 500376
Office: 103, Building:3
Dubai Internet City
Dubai, United Arab Emirates
Tel: +971-4-3916480
Fax: +971-4-3908881
URL: www.dlink-me.com

Turkey

Cetin Emec Bulvari, 74.sokak, ABC Plaza No:9/3
Ovecler/Ankara- TURKEY
TEL: 0090 312 473 40 55
FAX: 0090 312 473 40 58
URL: www.dlink.com.tr

Egypt

47,El Merghany street,Heliopolis
Cairo-Egypt
TEL: +202-2919035, +202-2919047
FAX: +202-2919051
URL: www.dlink-me.com

Israel

11 Hamanofim Street
Ackerstein Towers, Regus Business Center
P.O.B 2148, Hertzelia-Pituach 46120
Israel
TEL: +972-9-9715700
FAX: +972-9-9715601
URL: www.dlink.co.il

LatinAmerica

Isidora Goyeechea 2934
Ofcina 702
Las Condes
Santiago – Chile
TEL: 56-2-232-3185
FAX: 56-2-232-0923
URL: www.dlink.cl

Brazil

Av das Nacoes Unidas
11857 – 14- andar - cj 141/142
Brooklin Novo
Sao Paulo - SP - Brazil
CEP 04578-000 (Zip Code)
TEL: (55 11) 21859300
FAX: (55 11) 21859322
URL: www.dlinkbrasil.com.br

South Africa

Einstein Park II
Block B
102-106 Witch-Hazel Avenue
Highveld Technopark
Centurion
Gauteng
Republic of South Africa
TEL: 27-12-665-2165
FAX: 27-12-665-2186
URL: www.d-link.co.za

Russia

Grafsky per., 14, floor 6
Moscow
129626 Russia
TEL: 7-495-744-0099
FAX: 7-495-744-0099 #350
URL: www.dlink.ru

China

No.202,C1 Building, Huitong Office Park,
No. 71, Jianguo Road, Chaoyang District, Beijing
100025, China.
TEL +86-10-58635800
FAX: +86-10-58635799
URL: www.dlink.com.cn

Taiwan

No. 289 , Sinhu 3rd Rd., Neihu District ,
Taipei City 114 ,Taiwan
TEL: 886-2-6600-0123
FAX: 886-2-6600-1188
URL: www.dlinktw.com.tw

Registration Card

(All Countries and Regions excluding USA)

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 ☐Windows NT ☐Windows ME ☐Windows 2000 ☐Windows XP

☐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

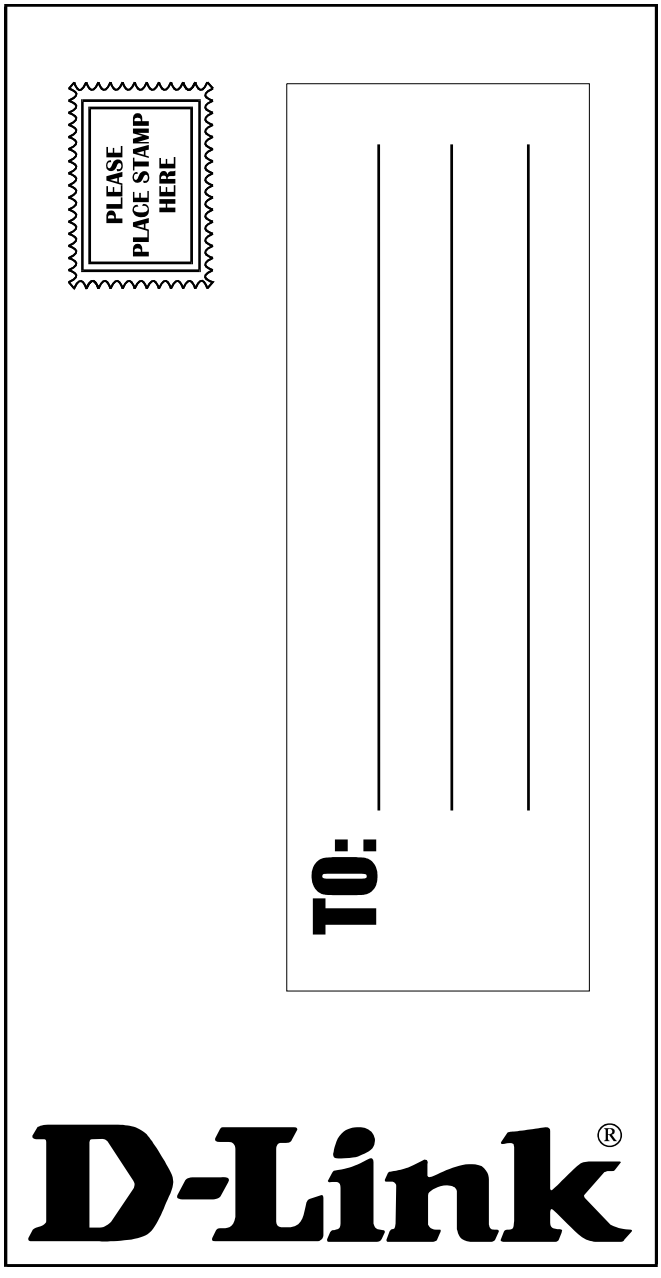
☐Retail/Chainstore/Wholesale ☐Government ☐Transportation/Utilities/Communication ☐VAR

☐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®