ES-1528

Ethernet Switch

User's Guide

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Edition 1

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the switch using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide
  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your hardware connections.
- Web Configurator Online Help
  Embedded web help for descriptions of individual screens and supplementary information.

It is recommended you use the web configurator to configure the switch.

- Supporting Disk
  Refer to the included CD for support documents.
- ZyXEL Web Site
  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your device.

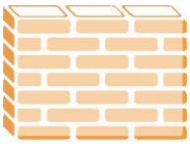
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The ES-1528 may be referred to as the "switch", the "device" or the "system" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The switch icon is not an exact representation of your device.

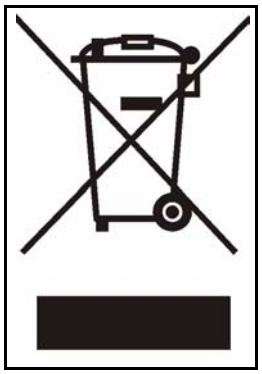
ES-1528 	Computer 	Notebook computer 
Server 	DSLAM 	Firewall 
Telephone 	Switch 	Router 

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device.
- Connect the power adaptor or cord to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the power outlet.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.

This product is recyclable. Dispose of it properly.



Contents Overview

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PART I
Introduction and Hardware Overview

1

Getting to Know Your Switch

This chapter introduces the main features and applications of the switch.

1.1 Introduction

The ES-1528 is an Ethernet switch with 24 10/100Mbps ports, two RJ-45 Gigabit ports for stacking and 2 mini-GBIC slots for fiber connections.

With its built-in web configurator, managing and configuring the switch is easy.

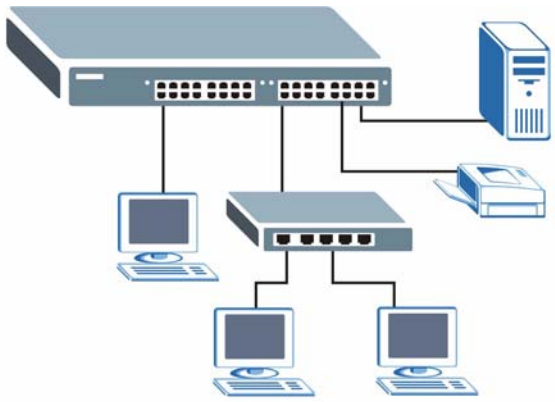
See Appendix A on page 147 for a full list of software features available on the switch.

1.1.1 Backbone Application

The switch is an ideal solution for small networks where rapid growth can be expected in the near future. The switch can be used standalone for a group of heavy traffic users. You can connect computers and servers directly to the switch's port or connect other switches to the switch.

In this example, all computers can share high-speed applications on the server. To expand the network, simply add more networking devices such as switches, routers, computers, print servers etc.

Figure 1 Backbone Application

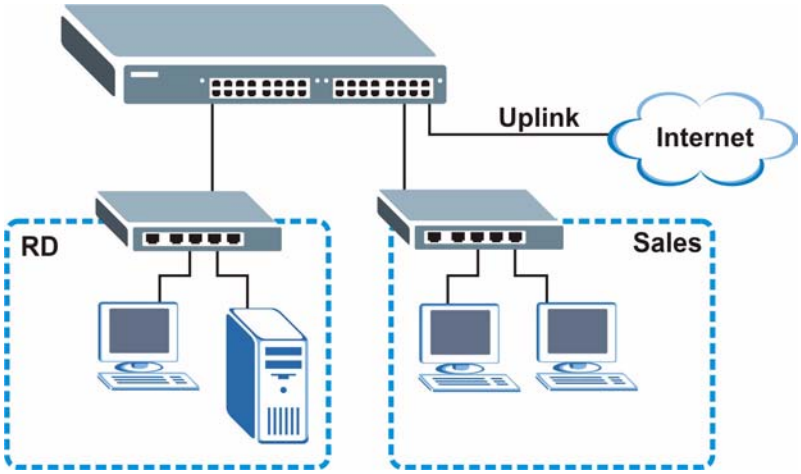


1.1.2 Bridging Example

In this example application the switch connects different company departments (**RD** and **Sales**) to the corporate backbone. It can alleviate bandwidth contention and eliminate server and network bottlenecks. All users that need high bandwidth can connect to high-speed department servers via the switch. You can provide a super-fast uplink connection by using a Gigabit Ethernet/mini-GBIC port on the switch.

Moreover, the switch eases supervision and maintenance by allowing network managers to centralize multiple servers at a single location.

Figure 2 Bridging Application

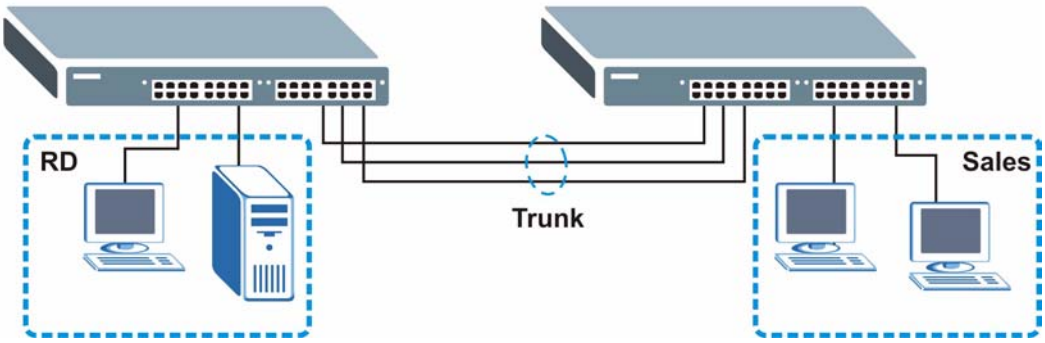


1.1.3 High Performance Switching Example

The switch is ideal for connecting two networks that need high bandwidth. In the following example, use trunking to connect these two networks.

Switching to higher-speed LANs such as ATM (Asynchronous Transmission Mode) is not feasible for most people due to the expense of replacing all existing Ethernet cables and adapter cards, restructuring your network and complex maintenance. The switch can provide the same bandwidth as ATM at much lower cost while still being able to use existing adapters and switches. Moreover, the current LAN structure can be retained as all ports can freely communicate with each other.

Figure 3 High Performance Switched Workgroup Application



1.1.4 IEEE 802.1Q VLAN Application Examples

A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Stations on a logical network belong to one group. A station can belong to more than one group. With VLAN, a station cannot directly talk to or hear from stations that are not in the same group(s) unless such traffic first goes through a router.

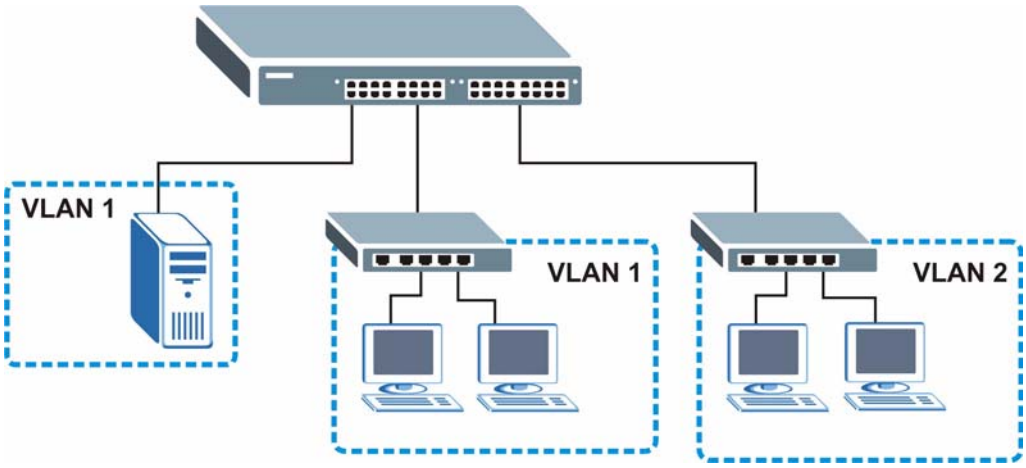
For more information on VLANs, refer to Chapter 8 on page 63.

1.1.4.1 Tag-based VLAN Example

Ports in the same VLAN group share the same frame broadcast domain thus increase network performance through reduced broadcast traffic. VLAN groups can be modified at any time by adding, moving or changing ports without any re-cabling.

Shared resources such as a server can be used by all ports in the same VLAN as the server. In the following figure only ports that need access to the server need to be part of VLAN 1. Ports can belong to other VLAN groups too.

Figure 4 Shared Server Using VLAN Example



2

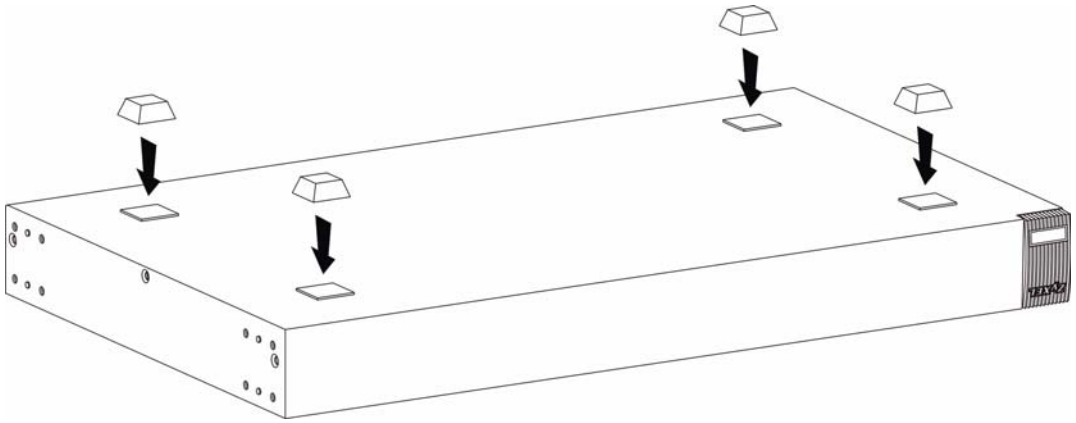
Hardware Installation and Connection

This chapter shows you how to install and connect the switch.

2.1 Freestanding Installation

1. Make sure the switch is clean and dry.
2. Set the switch on a smooth, level surface strong enough to support the weight of the switch and the connected cables. Make sure there is a power outlet nearby.
3. Make sure there is enough clearance around the switch to allow air circulation and the attachment of cables and the power cord.
4. Remove the adhesive backing from the rubber feet.
5. Attach the rubber feet to each corner on the bottom of the switch. These rubber feet help protect the switch from shock or vibration and ensure space between devices when stacking.

Figure 5 Attaching Rubber Feet



Do NOT block the ventilation holes. Leave space between devices when stacking.

For proper ventilation, allow at least 4 inches (10 cm) of clearance at the front and 3.4 inches (8 cm) at the back of the switch. This is especially important for enclosed rack installations.

2.2 Mounting the Switch on a Rack

This section lists the rack mounting requirements and precautions and describes the installation steps.

2.2.1 Rack-mounted Installation Requirements

- Two mounting brackets.
- Eight M3 flat head screws and a #2 Philips screwdriver.
- Four M5 flat head screws and a #2 Philips screwdriver.

Failure to use the proper screws may damage the unit.

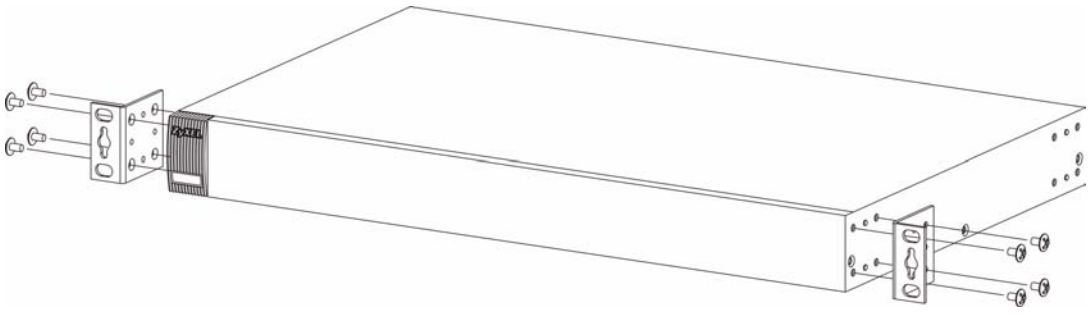
2.2.1.1 Precautions

- Make sure the rack will safely support the combined weight of all the equipment it contains.
- Make sure the position of the switch does not make the rack unstable or top-heavy. Take all necessary precautions to anchor the rack securely before installing the unit.

2.2.2 Attaching the Mounting Brackets to the Switch

1 Position a mounting bracket on one side of the switch, lining up the four screw holes on the bracket with the screw holes on the side of the switch.

Figure 6 Attaching the Mounting Brackets

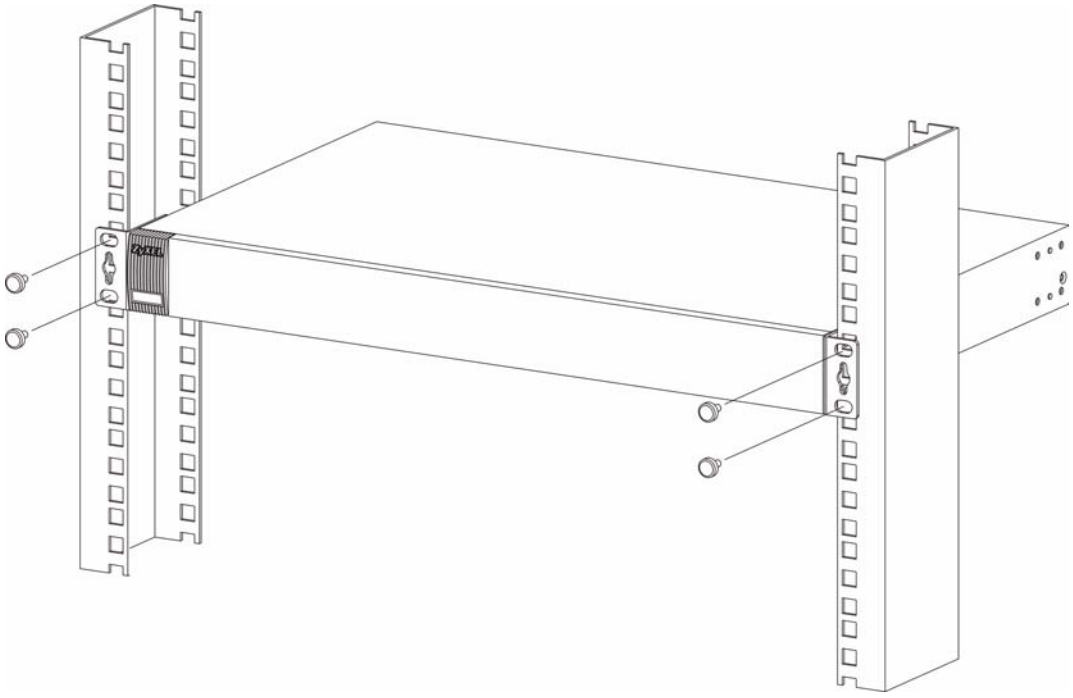


2 Using a #2 Philips screwdriver, install the M3 flat head screws through the mounting bracket holes into the switch.
3 Repeat steps 1 and 2 to install the second mounting bracket on the other side of the switch.
4 You may now mount the switch on a rack. Proceed to the next section.

2.2.3 Mounting the Switch on a Rack

1 Position a mounting bracket (that is already attached to the switch) on one side of the rack, lining up the two screw holes on the bracket with the screw holes on the side of the rack.

Figure 7 Mounting the Switch on a Rack



2 Using a #2 Philips screwdriver, install the M5 flat head screws through the mounting bracket holes into the rack.
3 Repeat steps 1 and 2 to attach the second mounting bracket on the other side of the rack.

3

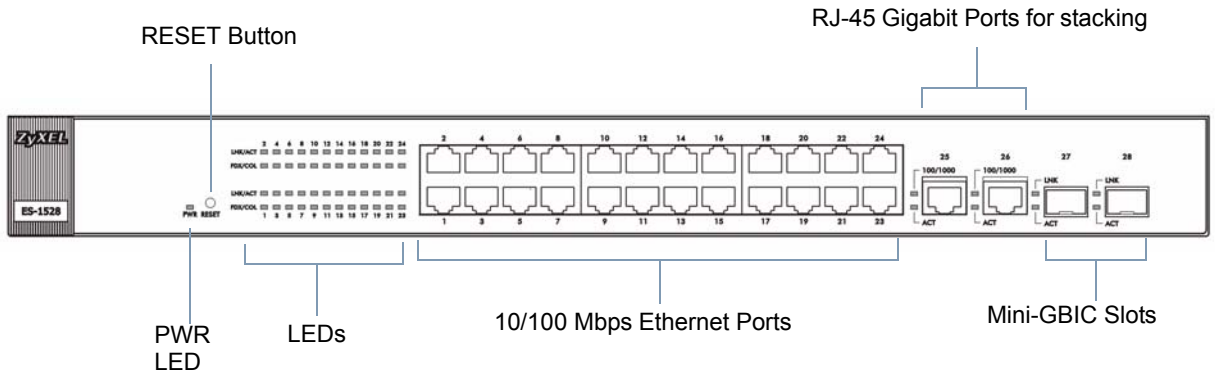
Hardware Overview

This chapter describes the front panel and rear panel of the switch and shows you how to make the hardware connections.

3.1 Panel Connections and the RESET Button

The figure below shows the front panel of the switch.

Figure 8 Front Panel



The following table describes the ports on the panels.

Table 1 Panel Connections

CONNECTOR	DESCRIPTION
24 10/100 Mbps RJ-45 Ethernet Ports	Connect these ports to a computer, a hub, an Ethernet switch or router.
Two 100/1000 Mbps RJ-45 Gigabit Ports	Connect these Gigabit Ethernet ports to high-bandwidth backbone network Ethernet switches or use them to daisy-chain other switches.
2 Mini-GBIC Slots	Use mini-GBIC transceivers in these slots for fiber-optic connections to backbone Ethernet switches.

3.1.1 Ethernet Ports

The switch has 24 10/100Mbps auto-negotiating, auto-crossover Ethernet ports. In 10/100Mbps Fast Ethernet, the speed can be 10Mbps or 100Mbps and the duplex mode can be half duplex or full duplex.

There are two Gigabit Ethernet ports. The speed of the Gigabit Ethernet ports can be 10 Mbps, 100Mbps or 1000Mbps and the duplex mode can be half duplex (at 100 Mbps) or full duplex.

An auto-negotiating port can detect and adjust to the optimum Ethernet speed (100/1000Mpbs) and duplex mode (full duplex or half duplex) of the connected device.

An auto-crossover (auto-MDI/MDI-X) port automatically works with a straight-through or crossover Ethernet cable.

3.1.1.1 Default Ethernet Settings

The factory default negotiation settings for the Ethernet ports on the switch are:

- Speed: Auto
- Duplex: Auto
- Flow control: Off

3.1.2 Mini-GBIC Slots

There are two mini-GBIC (Gigabit Interface Converter) slots for mini-GBIC transceivers. A transceiver is a single unit that houses a transmitter and a receiver. The switch does not come with transceivers. You must use transceivers that comply with the SFP Transceiver MultiSource Agreement (MSA). See the SFF committee's INF-8074i specification Rev 1.0 for details.

You can change transceivers while the switch is operating. You can use different transceivers to connect to Ethernet switches with different types of fiber-optic connectors.

- Type: SFP connection interface
- Connection speed: 1 Gigabit per second (Gbps)

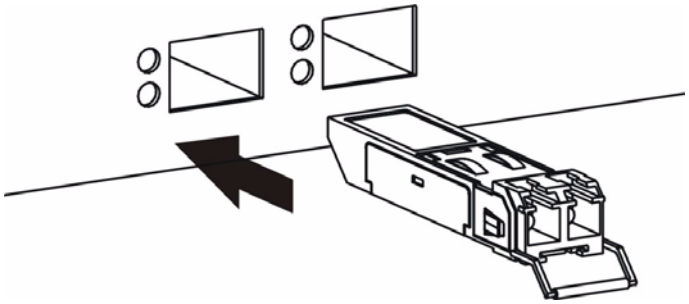
To avoid possible eye injury, do not look into an operating fiber-optic module's connectors.

3.1.2.1 Transceiver Installation

Use the following steps to install a mini GBIC transceiver (SFP module).

1. Insert the transceiver into the slot with the exposed section of PCB board facing down.

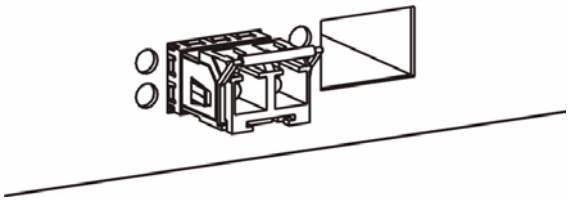
Figure 9 Transceiver Installation Example



2. Press the transceiver firmly until it clicks into place.

3 The switch automatically detects the installed transceiver. Check the LEDs to verify that it is functioning properly.

Figure 10 Installed Transceiver

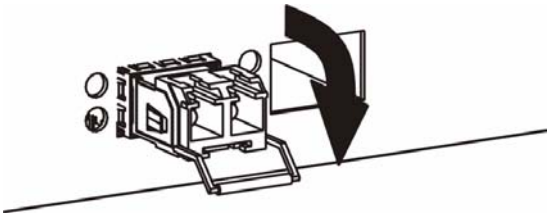


3.1.2.2 Transceiver Removal

Use the following steps to remove a mini GBIC transceiver (SFP module).

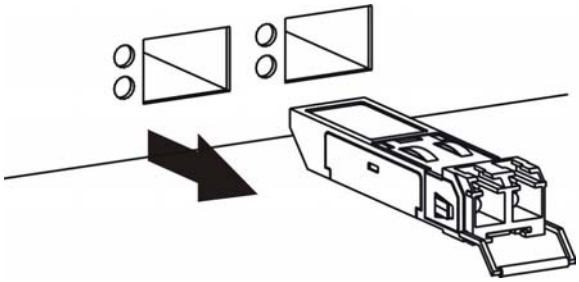
1 Open the transceiver's latch (latch styles vary).

Figure 11 Opening the Transceiver's Latch Example



2 Pull the transceiver out of the slot.

Figure 12 Transceiver Removal Example



3.2 The RESET Button

The switch allows you to reset the switch to its factory default configuration via the **RESET** button. Press the RESET button for one second and release. The switch automatically reboots and reloads its factory default configuration file.

When you use the RESET button all of your configuration settings will be lost. Use the default IP address (192.168.1.1) and user name (admin) and password (admin) to log back into the switch. It may take up to 2 minutes for the switch to restart when you reload the default configuration file.

3.3 Rear Panel

The following figures show the rear panels of the AC power input model switch. The rear panel contains a connector for the power receptacle.

Figure 13 Rear Panel - AC Model

3.3.1 Power Connector

Make sure you are using the correct power source as shown on the panel.

To connect the power to the switch, insert the female end of power cord to the power receptacle on the rear panel. Connect the other end of the supplied power cord to a 100~240V AC, 1.5A power outlet.

3.4 LEDs

The following table describes the LEDs.

Table 2 LEDs

LED	COLOR	STATUS	DESCRIPTION
PWR	Green	On	The system is turned on.
		Off	The system is off.
10/100 Mbps Ethernet Ports			
LNK/ACT	Amber	Blinking	The system is transmitting/receiving to/from a 10/100 Mbps Ethernet network.
		On	The link to a 10/100 Mbps Ethernet network is up.
		Off	The link to an Ethernet network is down.
FDX/COL	Amber	On	The Ethernet port is negotiating in full-duplex mode.
		Blinking	The switch is detecting collisions on the Ethernet port.
		Off	The Ethernet port is negotiating in half-duplex mode.
Gigabit Ethernet Ports			
100/1000	Green	On	The link to a 10/1000 Mbps Ethernet network is up.
	Amber	On	The link to a 100 Mbps Ethernet network is up.
		Off	The link to an Ethernet network is down.
ACT	Green	On	The link to an Ethernet network is up.
		Blinking	The Ethernet port is transmitting/receiving data.
		Off	The link to an Ethernet network is down.

Table 2 LEDs (continued)

LED	COLOR	STATUS	DESCRIPTION
GBIC Slots			
LNK	Green	On	The port has a successful connection.
		Off	No Ethernet device is connected to this port.
ACT	Green	Blinking	The port is receiving or transmitting data.

PART II
Basic & Advanced Settings

4

The Web Configurator

This section introduces the configuration and functions of the web configurator.

4.1 Introduction

The web configurator is an HTML-based management interface that allows easy switch setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

4.2 System Login

1. Start your web browser.
2. Type “http://” and the IP address of the switch (for example, the default is 192.168.1.1) in the Location or Address field. Press [ENTER].
3. The login screen appears. The default username is **admin** and associated default password is **admin**.

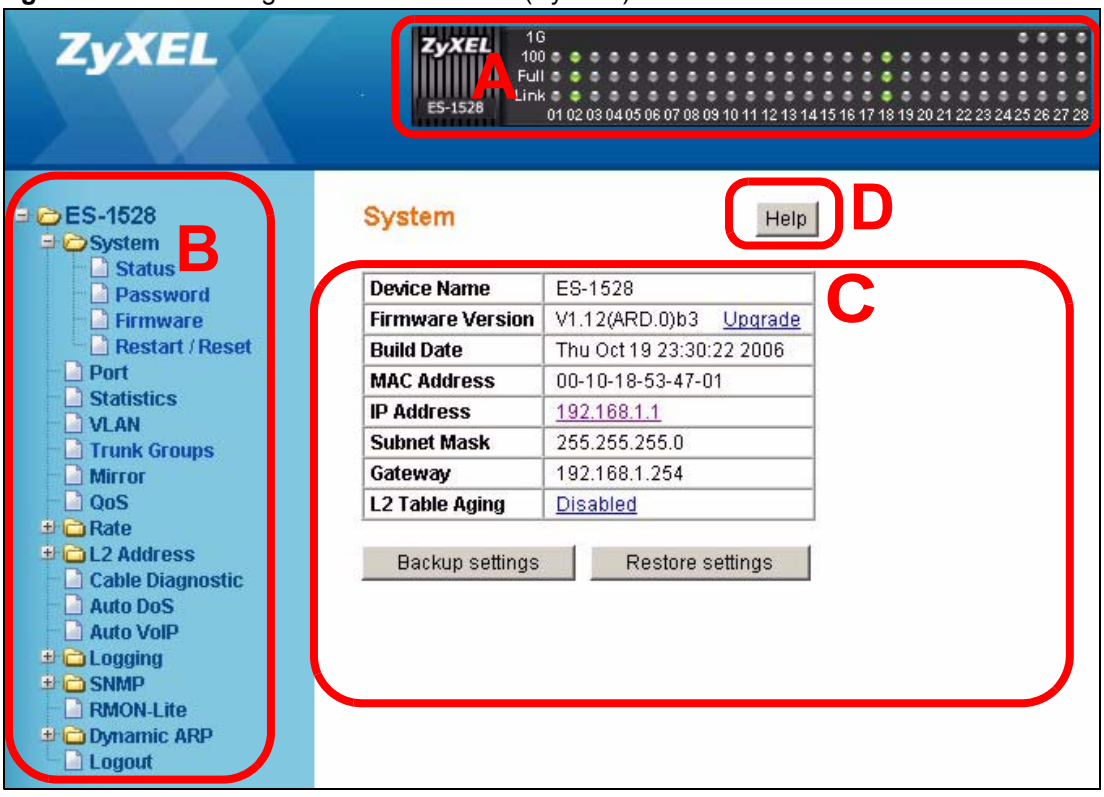
Figure 14 Web Configurator: Login

4 Click **LOGIN** to view the first web configurator screen.

4.3 The Status Screen

The **System** screen is the first screen that displays when you access the web configurator. The following figure shows the navigating components of the web configurator screen.

Figure 15 Web Configurator Home Screen (System)



A - The LED panel displays the port status.

B - The navigation panel has links to screens that let you configure the switch features.

C - The function frame allows you to view and edit individual feature settings.

D - Use the **Help** link to find out more information about the fields in the screen you are configuring.

4.3.1 The LED Panel

Use the LED panel to view the status of the individual ports. The LED panel in the web configurator updates automatically every 5 seconds.

Figure 16 LED Panel

The following table describes the labels in this screen.

Table 3 LED Panel

LABEL	DESCRIPTION
1G	This LED is green if the corresponding port has a 1 Gbps connection.
100	This LED is green if the corresponding port has a 100 Mbps connection.
Full	This LED is green if the corresponding port is transmitting in full duplex mode.
Link	This LED is green if the corresponding port has an Ethernet connection. It is orange if the port has been disabled.
1...28	This number indicates the port number on the switch.

4.3.2 The Navigation Panel

Navigate to individual feature configuration screens from the navigation panel.

The following table describes the links in the navigation panel.

Table 4 Navigation Panel Links

LINK	DESCRIPTION
System	Use these screens to view general system information such as firmware version, IP address and so on. You can also use this screen to backup and restore your configuration.
Status	Use this screen to view general system and hardware monitoring information.
Password	Use this screen to change the system login password
Firmware	Use this screen to perform firmware upgrades
Restart/ Reset	Use this screen to reboot the switch or to restore the default configuration of the switch.
Port	Use these screens to view the status and configure settings for individual ports on the switch.

Table 4 Navigation Panel Links (continued)

LINK	DESCRIPTION
Statistics	Use these screen to view system statistics such as the number of packets received on the switch, collisions and errors and to view statistics for individual ports on the switch.
VLAN	Use these screens to create new IEEE 802.1Q VLANs as well as view the status and edit existing IEEE 802.1Q VLANs on the switch.
Trunk Groups	Use these screens to create trunk groups and add/remove ports from existing trunk groups.
Mirror	Use this screen to copy traffic from one port or ports to another port in order that you can examine the traffic from the first port without interference.
QoS	Use these screens to configure queuing with associated queue weights for the switch.
Rate	Use these screens to specify bandwidth limits and storm control limits for the switch.
Port Rate	Use this screen to cap the maximum bandwidth allowed from specified source(s) to specified destination(s).
Storm Control	Use this screen to cap the rate of broadcast, multicast and unknown unicast packets the switch will allow on individual ports.
L2 Address	Use these screens to view and manage the MAC address table.
Management	Use this screen to add, delete or look up MAC addresses in the MAC address table.
Display	Use this screen to view the entries in the MAC address table.
Cable Diagnostic	Use this screen to perform cable testing on individual ports.
Auto DoS	Use these screens to activate security features against Denial of Service (DoS) attacks.
Auto VoIP	Use these screens to configure settings that automatically give higher priority to Voice over Internet Protocol (VoIP) traffic.
Logging	Use these screens to configure log settings and view system logs.
Settings	Use this screen to configure which events the switch should log.
RAM Logs	Use this screen to configure logs which are saved to volatile memory. These logs are cleared when the switch is rebooted.
Flash Logs	Use this screen to configure logs which are saved to non-volatile memory. You can view these logs even after a switch is rebooted.
SNMP	Use these screens to configure SNMP management settings.
Engine ID	Use this screen to configure SNMP engine ID.
Group	Use this screen to configure groups with different access rights for SNMP management.
User	Use this screen to create users and assign them to pre-defined SNMP groups.
Community	Use this screen to define security parameters for SNMP v1 and SNMP v2c.
Trap Station	Use this screen to configure settings that define when notifications are sent to an external management station.
RMON-Lite	Use this screen to configure Remote Network Monitoring Management Information Base (RMON MIB) settings.
Dynamic ARP	Use these screens to enable and configure ARP table settings.
Settings	Use this screen to configure ARP table settings.

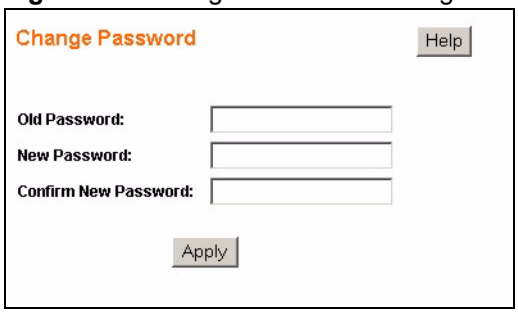
Table 4 Navigation Panel Links (continued)

LINK	DESCRIPTION
ARP Entries	Use this screen to enter and view MAC address to IP address mappings.
Logout	Click this to logout of the web configurator.

4.3.3 Change Your Password

After you log in for the first time, it is recommended you change the default administrator password. Click **System**, **Password** to display the next screen.

Figure 17 Change Administrator Login Password



4.4 Saving Your Configuration

When you are done modifying the settings in a screen, click **Apply** to save your changes back to the switch.

4.5 Switch Lockout

You could block yourself (and all others) from using the web configurator if you:

1. Remove all the ports from the default VLAN (default is VLAN 1) when no other VLANs exist.
2. Disable all ports.
3. Forget the password and/or IP address.
4. Enable Dynamic ARP without entering the proper MAC to IP address binding.

4.6 Resetting the Switch

If you lock yourself (and others) from the switch or forget the administrator password, you will need to reset the switch back to the factory defaults.

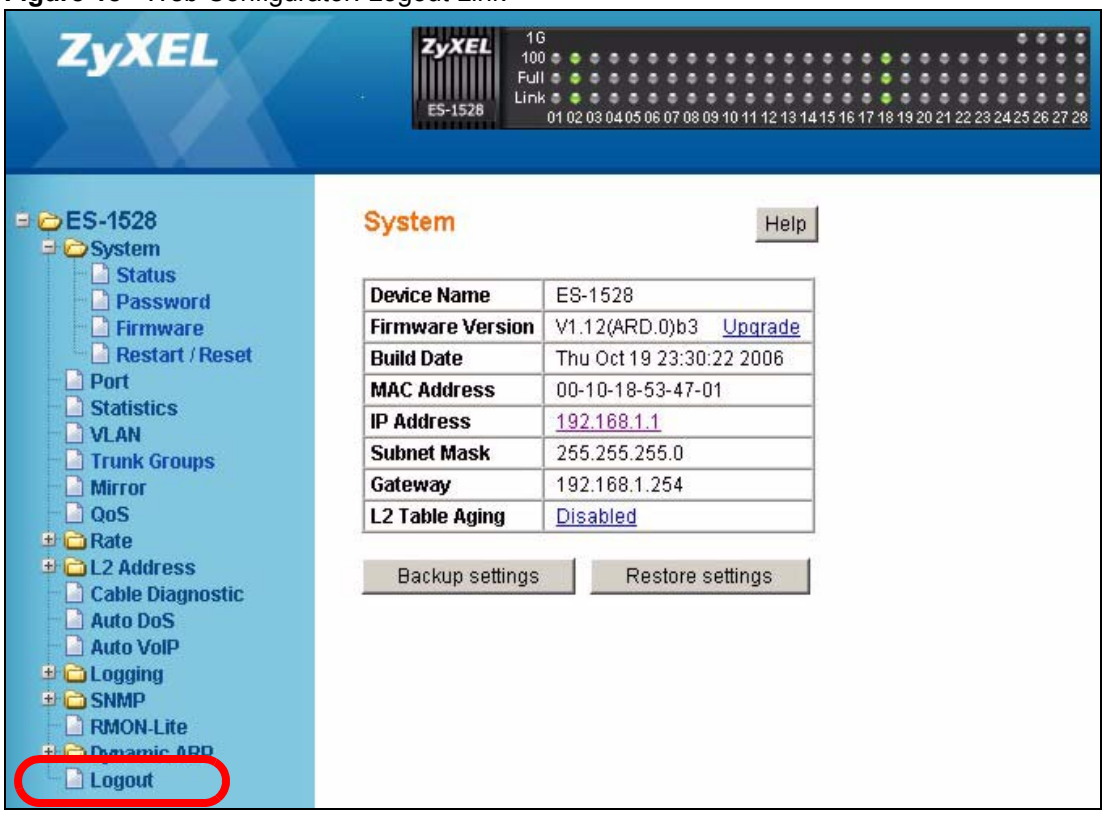
Use the **RESET** button on the front panel of the switch to reset the switch back to factory defaults. Press and hold the **RESET** button for one second. The switch will reload its factory defaults.

The switch is now reinitialized with a default configuration file including the default administrator username (admin) and password (admin). The IP address of the switch also reverts to the default 192.168.1.1.

4.7 Logging Out of the Web Configurator

Click **Logout** in the navigation panel to exit the web configurator. You have to log in with your password again after you log out. This is recommended after you finish a management session for security reasons.

Figure 18 Web Configurator: Logout Link



4.8 Help

The web configurator's online help has descriptions of individual screens and some supplementary information.

Click the **Help** link from a web configurator screen to view an online help description of that screen.

5

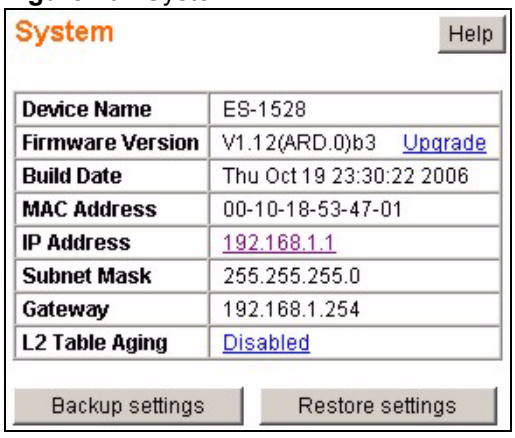
System

This chapter describes the system screens.

5.1 System Screen

The home screen of the web configurator displays general system information and allows you to perform system maintenance. Click **System** > **Status** in the navigation panel to view device specific information such as system name, firmware version and so on.

Figure 19 System



The following table describes the labels in this screen.

Table 5 System

LABEL	DESCRIPTION
Device Name	This read-only field displays the name of your switch.
Firmware Version	This field displays the version number of the switch 's current firmware. Click **Upgrade** to go to the firmware upgrade screen. See Section 5.3 on page 52.
Build Date	This field displays the date of the currently installed firmware.
MAC Address	This field displays the MAC address of the switch.
IP Address	This field indicates the IP address of the switch. **Note:** You can click the existing IP address to change it. See Section 5.1.1 on page 50.
Subnet Mask	This field indicates the subnet mask of the switch.
Gateway	This field indicates the IP address of the default gateway.

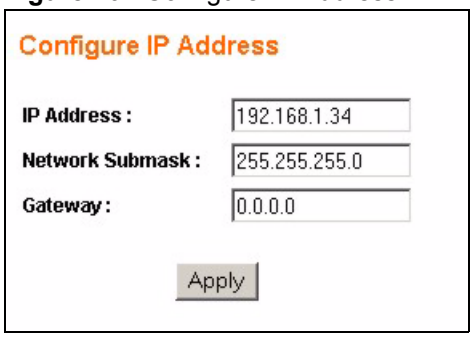
Table 5 System (continued)

LABEL	DESCRIPTION
L2 Table Aging	This field displays whether the L2 Table Aging is enabled or disabled. Click **Enabled**/**Disabled** to change the L2 Table Aging settings.
Backup settings	Click this link to create and save a backup configuration file. See Section 5.1.3 on page 51.
Restore settings	Click this link to upload an existing configuration file to the switch. See Section 5.1.4 on page 51.

5.1.1 Configure IP Address

Use the **Configure IP Address** screen to set up the IP address manually. The following screen appears when you click the existing IP address in the **System > Status** screen.

Figure 20 Configure IP Address



The following table describes the labels in this screen.

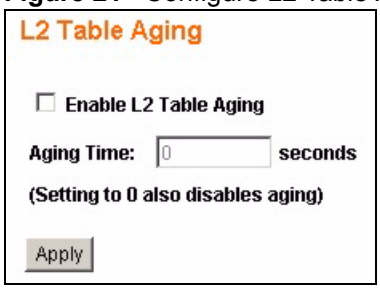
Table 6 Configure IP Address

LABEL	DESCRIPTION
IP Address	Enter the IP address of your switch in dotted decimal notation. For example, 192.168.1.1.
Network Submask	Enter the IP subnet mask of your switch in dotted decimal notation for example 255.255.255.0.
Gateway	Enter the IP address of the default outgoing gateway in dotted decimal notation, for example 192.168.1.5.

5.1.2 Level 2 (L2) Table Aging

L2 Table Aging defines the aging time of the Address Resolution Logic (ARL) table. This table learns and remembers MAC addresses of devices sending information through it. See Chapter 13 on page 83 for more background information. Click the link in the **L2 Table Aging field** to see the screen as shown next.

Figure 21 Configure L2 Table Aging



Select the **Enable L2 Table Aging** checkbox and enter the amount of time in seconds (up to 1048575) that the switch remembers MAC address entries. Select "0" to disable L2 table aging. Click **Apply** to save your configuration changes.

5.1.3 Backup Settings

Backing up your switch configurations allows you to create various "snap shots" of your device from which you may restore at a later date.

Back up your current switch configuration to a computer using the **Backup Settings** link.

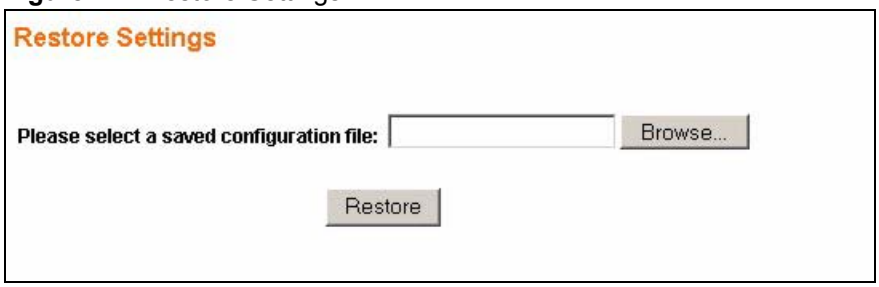
Follow the steps below to back up the current switch configuration.

1. Click **Backup**.
2. Click **Save** to display the **Save As** screen.
3. Choose a location to save the file on your computer from the **Save in** drop-down list box and type a descriptive name for it in the **File name** list box. Click **Save** to save the configuration file to your computer.

5.1.4 Restore Settings

Restore a previously saved configuration from your computer to the switch using the **Restore Settings** screen.

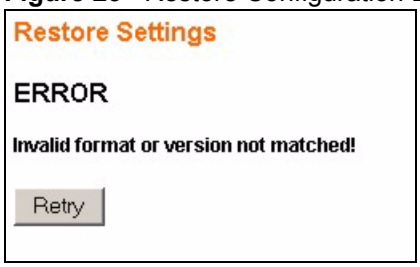
Figure 22 Restore Settings



Type the path and file name of the configuration file you wish to restore in the **Please select a saved configuration file** text box or click **Browse** to display the **Choose File** screen from which you can locate it. After you have specified the file, click **Restore**.

Make sure you are using the proper configuration when you are restoring your configuration. The file name extension should be ".cfg". If you attempt to restore a wrong configuration file the following error message appears.

Figure 23 Restore Configuration Error



You can click **Retry** to locate the proper configuration file.

5.2 System: Change Password

Use the Change Password screen to change the administrator username and password for the switch. Click **System > Password** to view the screen as shown.

Figure 24 System: Password

The following table describes the labels in this screen.

Table 7 Change Password

LABEL	DESCRIPTION
Old Password	Type the existing system password (**admin** is the default password when shipped).
New Password	Enter your new system password. Enter up to 15 alpha-numeric characters; spaces are allowed.
Confirm New Password	Retype your new system password for confirmation

5.3 Firmware Upgrade

Make sure you have downloaded (and unzipped) the correct model firmware and version to your computer before uploading to the device.

Be sure to upload the correct model firmware as uploading the wrong model firmware may damage your device.

From the **System** screen, click **Upgrade** in the Firmware Version field to display the screen as shown next.

Figure 25 Firmware Upgrade

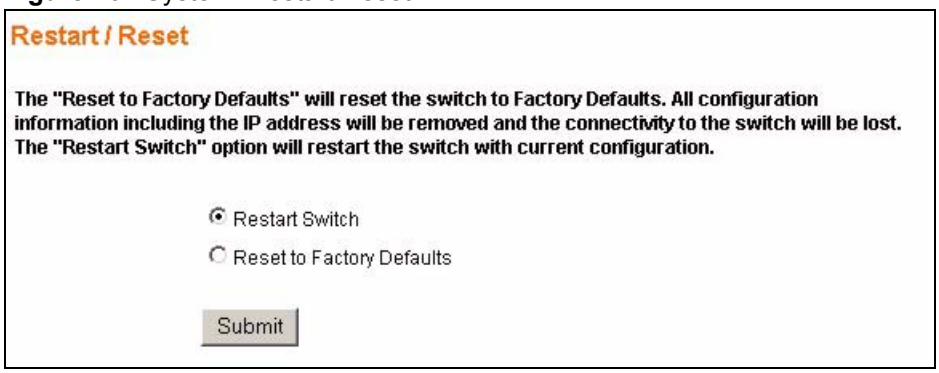
Type the path and file name of the firmware file you wish to upload to the switch in the **File Path** text box or click **Browse** to locate it. After you have specified the file, click **Upgrade**.

After the firmware upgrade process is complete, see the **System > Status** screen to verify your current firmware version number.

5.3.1 System: Restart/Reset

Click **System > Restart/Reset** to perform a system restart (keep current configuration) or a system reset (restore the switch's default configuration settings). Follow the instructions in the screen below to reset or restart the switch.

Figure 26 System: Restart/Reset



6

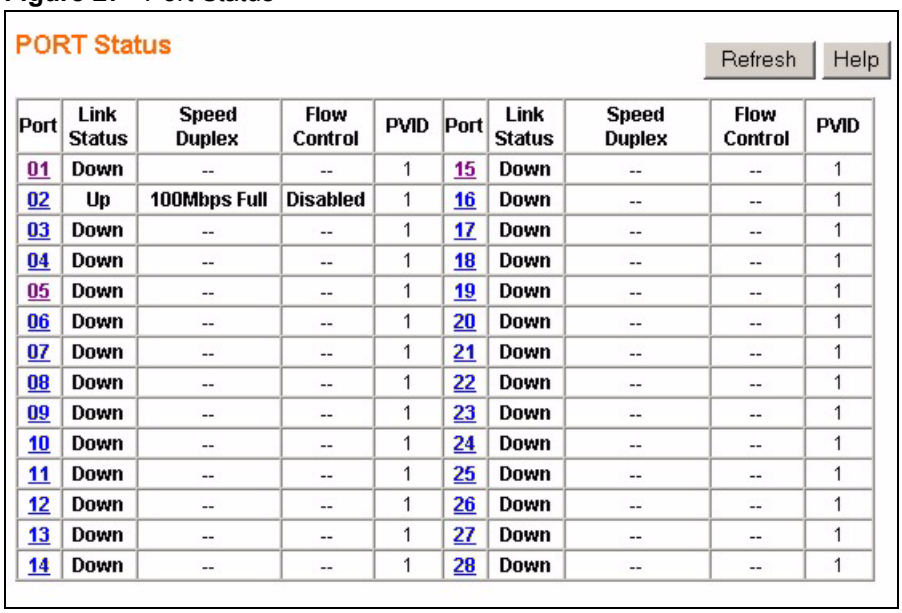
Port Settings

This chapter describes how to view and configure the port settings on the switch.

6.1 Port Status

Use this screen to view switch port settings. Click **System > Port** in the navigation panel to display the **Port Status** screen.

Figure 27 Port Status



Port	Link Status	Speed Duplex	Flow Control	PVID	Port	Link Status	Speed Duplex	Flow Control	PVID
01	Down	--	--	1	15	Down	--	--	1
02	Up	100Mbps Full	Disabled	1	16	Down	--	--	1
03	Down	--	--	1	17	Down	--	--	1
04	Down	--	--	1	18	Down	--	--	1
05	Down	--	--	1	19	Down	--	--	1
06	Down	--	--	1	20	Down	--	--	1
07	Down	--	--	1	21	Down	--	--	1
08	Down	--	--	1	22	Down	--	--	1
09	Down	--	--	1	23	Down	--	--	1
10	Down	--	--	1	24	Down	--	--	1
11	Down	--	--	1	25	Down	--	--	1
12	Down	--	--	1	26	Down	--	--	1
13	Down	--	--	1	27	Down	--	--	1
14	Down	--	--	1	28	Down	--	--	1

The following table describes the labels in this screen.

Table 8 Port Status

LABEL	DESCRIPTION
Refresh	Click this to update the **PORT Status** screen.
Port	This identifies the Ethernet port. Click a port number to display the **Port Configuration** screen (refer to Section 6.2 on page 56.)
Link Status	This field displays the link status of the port. **Up**, if the port is enabled and active or **Down**, if the port is disabled or not connected to any device.
Speed Duplex	This field displays the speed either **10Mbps**, **100Mbps** or **1000Mbps** and the duplex mode **Full** or **Half**.

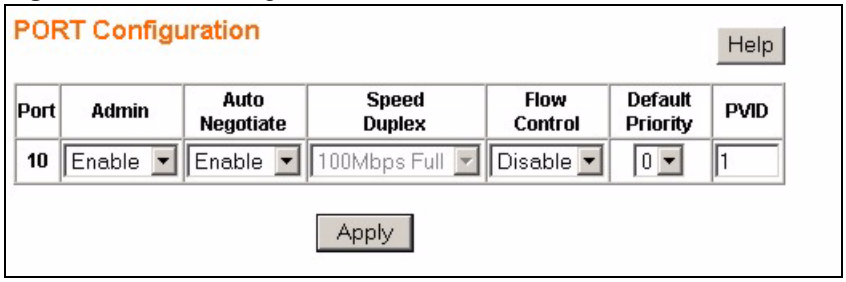
Table 8 Port Status (continued)

LABEL	DESCRIPTION
Flow Control	Enables access to buffering resources for the port thus ensuring lossless operation across network switches. This field displays either **Enabled** or **Disabled**.
PVID	The PVID field specifies what tag the incoming untagged frames receive on that port so that the frames are forwarded to the VLAN group that the tag defines.

6.2 Port Configuration

Use this screen to configure individual port settings.Click a port number in the **Port Status** screen to access this screen.

Figure 28 Port Configuration



The following table describes the labels in this screen.

Table 9 Port Configuration

LABEL	DESCRIPTION
Port	This is the port index number.
Admin	Select **Enable** to activate the port or **Disable** to deactivate the port.
Auto Negotiate	Select **Enable** and the port will negotiate the speed, duplex mode and flow control settings with the peer port. If the peer port does not support auto-negotiation or turns off this feature, the switch determines the connection speed by detecting the signal on the cable and using half duplex mode. Select **Disable** to configure the port settings manually. When the switch's auto-negotiation is turned off, a port uses the pre-configured speed and duplex mode when making a connection, thus requiring you to make sure that the settings of the peer port are the same in order to connect.
Speed Duplex	Select the speed and the duplex mode of the Ethernet connection on this port. Choices are **10Mbps Half**, **10Mbps Full**, **100Mbps Half**, **100Mbps Full** and **1000Mbps Full** (for Gigabit ports only).
Flow Control	A concentration of traffic on a port decreases port bandwidth and overflows buffer memory causing packet discards and frame losses. **Flow Control** is used to regulate transmission of signals to match the bandwidth of the receiving port. The switch uses IEEE802.3x flow control in full duplex mode and backpressure flow control in half duplex mode. IEEE802.3x flow control is used in full duplex mode to send a pause signal to the sending port, causing it to temporarily stop sending signals when the receiving port memory buffers fill. Back Pressure flow control is typically used in half duplex mode to send a "collision" signal to the sending port (mimicking a state of packet collision) causing the sending port to temporarily stop sending signals and resend later. Select **Enable** to turn this feature on or select **Disable** to turn it off.
Default Priority	This priority value is added to incoming frames without a priority queue tag.

Table 9 Port Configuration (continued)

LABEL	DESCRIPTION
PVID	Enter a number identifying an existing VLAN. The switch tags the incoming untagged frames on that port so that the frames are forwarded to the VLAN group that the tag defines.
Apply	Click **Apply** to save your changes to the switch.

7

System and Port Statistics

This chapter describes the overview and individual port statistics screens.

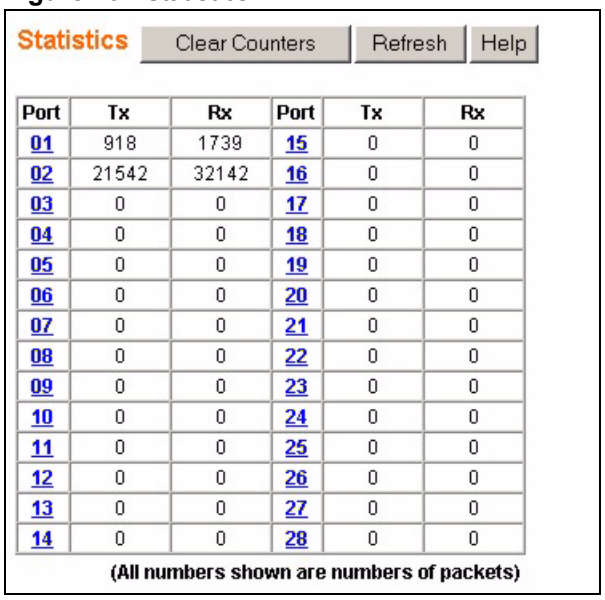
7.1 Overview

The statistics screen of the web configurator displays a port statistical summary with links to each port showing statistical details.

7.2 Statistics Summary

Click **Statistics** in the navigation panel to view the screen as shown. Use this screen to view the traffic counters for the switch.

Figure 29 Statistics



The following table describes the labels in this screen.

Table 10 Statistics

LABEL	DESCRIPTION
Clear Counters	Click this to reset all counters to zero.
Refresh	Click this to retrieve the current information from the switch and update this screen.

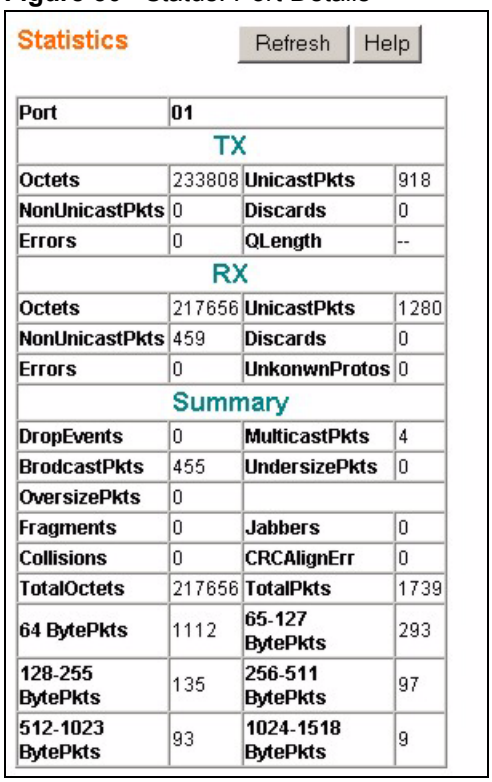
Table 10 Statistics (continued)

LABEL	DESCRIPTION
Port	This identifies the Ethernet port. Click a port number to display the **Port Details** screen (refer to Figure 30 on page 60).
Tx	This field shows the number of transmitted frames on this port.
Rx	This field shows the number of received frames on this port.

7.3 Port Statistics

Click a number in the **Port** column in the **Statistics** screen to display individual port statistics. Use this screen to check status and detailed performance data about an individual port on the switch.

Figure 30 Status: Port Details



The following table describes the labels in this screen.

Table 11 Status: Port Details

LABEL	DESCRIPTION
Refresh	Click this to retrieve the current information from the switch and update this screen.
Port	This field displays the port number you are viewing.
TX The following fields display detailed information about packets transmitted.	
Octets	This field shows the number of octets transmitted.
UnicastPkts	This field shows the number unicast packets transmitted.

Table 11 Status: Port Details (continued)

LABEL	DESCRIPTION
NonUnicastPkts	This field shows the number of nonunicast packets transmitted.
Discards	This field shows the number discarded (dropped) packets.
Errors	This field shows the number of packets for which transmission failed because of excessive collision.
QLength	This field shows the number of packets currently buffered.
RX The following fields display detailed information about packets received.	
Octets	This field shows the number of octets received.
UnicastPkts	This field shows the number unicast packets received.
NonUnicastPkts	This field shows the number of nonunicast packets received.
Discards	This field shows the number discarded (dropped) packets.
Errors	This field shows the number of undersize, oversize, fragmented or FCS error packets received.
UnknownProtos	This field shows the number of packets received with unknown protocols.
Summary The following fields display a summary of types of errors and size of packets transmitted/received.	
Drop Events	This is a count of dropped packets due to GBP or backpressure (buffer overflow).
MulticastPkts	This is a count of transmitted/received multicast packets.
BroadcastPkts	This is a count of transmitted/received broadcast packets.
UndersizePkts	This is a count of transmitted/received packets with length less than the minimum packet size.
OversizePkts	This is a count of transmitted/received packets with length more than the maximum packet size.
Fragments	This is a count of transmitted/received packets that were too short (shorter than 64 octets) with invalid FCS or alignment errors.
Jabbers	This is a count of transmitted/received packets that which exceeded maximum size to receive frame length.
Collision	This is a count of transmitted collision packets.
CRCAlignErr	This is a count of transmitted/received packets that were too short (shorter than 64 octets) with invalid FCS or alignment errors.
TotalOctets	This is a count of all transmitted/received packets that which exceeded maximum size to receive frame length.
TotalPkts	This is a count of transmitted/received packets (including bad packets, all unicast, broadcast, multicast and MAC control packets).
64 BytePkts	This field shows the number of packets (including bad packets) received that were 64 octets in length.
65-127 BytePkts	This field shows the number of packets (including bad packets) received that were between 65 and 127 octets in length.
128-255 BytePkts	This field shows the number of packets (including bad packets) received that were between 128 and 255 octets in length.
256-511 BytePkts	This field shows the number of packets (including bad packets) received that were between 256 and 511 octets in length.

Table 11 Status: Port Details (continued)

LABEL	DESCRIPTION
512-1023 BytePkts	This field shows the number of packets (including bad packets) received that were between 512 and 1023 octets in length.
1024-1518 BytePkts	This field shows the number of packets (including bad packets) received that were between 1024 and 1522 octets in length.

8

VLAN

This chapter shows you how to configure IEEE 802.1Q tagged VLANs.

8.1 Introduction to IEEE 802.1Q Tagged VLANs

A tagged VLAN uses an explicit tag (VLAN ID) in the MAC header to identify the VLAN membership of a frame across bridges - they are not confined to the switch on which they were created. The VLANs can be created statically by hand or dynamically through GVRP. The VLAN ID associates a frame with a specific VLAN and provides the information that switches need to process the frame across the network. A tagged frame is four bytes longer than an untagged frame and contains two bytes of TPID (Tag Protocol Identifier, residing within the type/length field of the Ethernet frame) and two bytes of TCI (Tag Control Information, starts after the source address field of the Ethernet frame).

The CFI (Canonical Format Indicator) is a single-bit flag, always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port. The remaining twelve bits define the VLAN ID, giving a possible maximum number of 4,096 VLANs. Note that user priority and VLAN ID are independent of each other. A frame with VID (VLAN Identifier) of null (0) is called a priority frame, meaning that only the priority level is significant and the default VID of the ingress port is given as the VID of the frame. Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved, so the maximum possible VLAN configurations are 4,094.

TPID 2 Bytes	User Priority 3 Bits	CFI 1 Bit	VLAN ID 12 bits

8.1.1 Forwarding Tagged and Untagged Frames

Each port on the switch is capable of passing tagged or untagged frames. To forward a frame from an 802.1Q VLAN-aware switch to an 802.1Q VLAN-unaware switch, the switch first decides where to forward the frame and then strips off the VLAN tag. To forward a frame from an 802.1Q VLAN-unaware switch to an 802.1Q VLAN-aware switch, the switch first decides where to forward the frame, and then inserts a VLAN tag reflecting the ingress port's default VID. The default PVID is VLAN 1 for all ports, but this can be changed.

A broadcast frame (or a multicast frame for a multicast group that is known by the system) is duplicated only on ports that are members of the VID (except the ingress port itself), thus confining the broadcast to a specific domain.

8.2 Static VLAN

Use a IEEE 802.1Q VLAN to decide whether an incoming frame on a port should be

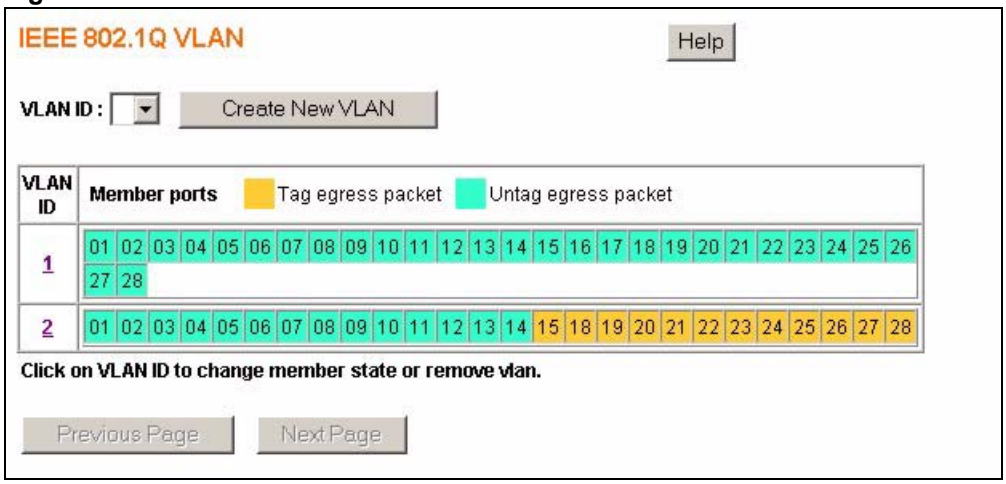
- sent to a VLAN group as normal depending on its VLAN tag.
- sent to a group whether it has a VLAN tag or not.

You can also tag all outgoing frames (that were previously untagged) from a port with the specified VID.

8.2.1 IEEE 802.1Q VLAN Screen

See Section 8.1 on page 63 for more information on VLANs. Click **VLAN** in the navigation panel to display the **IEEE 802.1Q VLAN** screen as shown next.

Figure 31 VLAN: VLAN Status



The following table describes the labels in this screen.

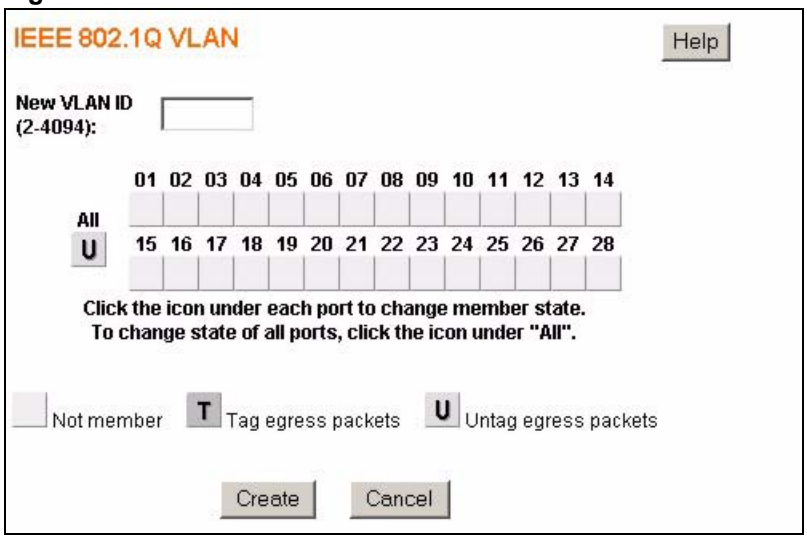
Table 12 VLAN: VLAN Status

LABEL	DESCRIPTION
VLAN ID	Select which VLAN you want to configure or click **Create New VLAN** to go to the new VLAN configuration screen.
VLAN Status Table	This table shows you the existing VLANs and their configurations.
VLAN ID	Click on the VLAN ID to go to the VLAN edit screen.
Member Ports	All the ports participating in the VLAN are listed here. The ports show up in two different colors: • (Orange) When the packet leaves this member port, the VLAN tag is added. • (Turquoise) When the packet leaves this member port, the VLAN tag is removed.
Previous Page	Click this button to view VLANs with lower identification numbers. This field is only active if you there are more VLANs than can be displayed on one screen.
Next Page	Click this button to view VLANs with higher identification numbers. This field is only active if there are more VLANs than can be displayed on one screen.

8.2.2 Create IEEE 802.1Q VLAN Screen

See Section 8.1 on page 63 for more information on VLANs. Click **VLAN** in the navigation panel to display the **IEEE 802.1Q VLAN** screen as shown next.

Figure 32 VLAN: Create VLAN



The following table describes the labels in this screen.

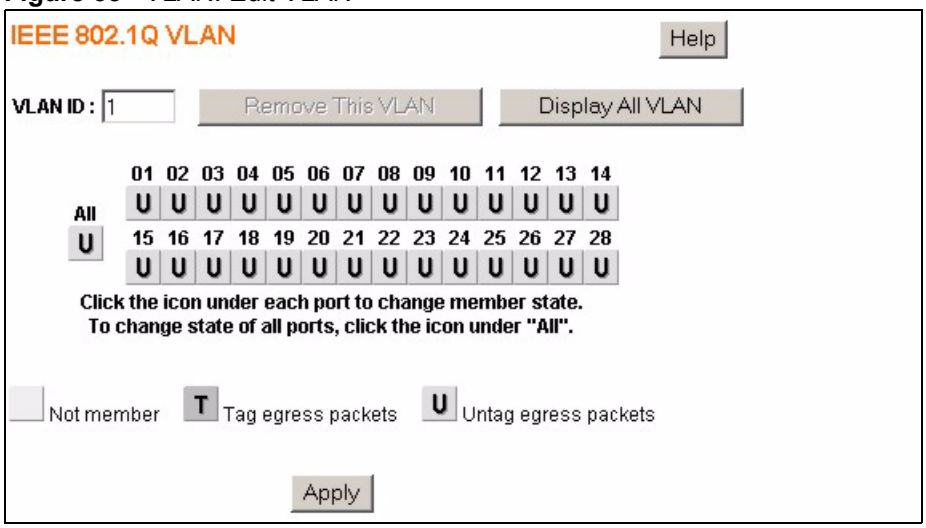
Table 13 VLAN: Create VLAN

LABEL	DESCRIPTION
New VLAN ID	Enter the VLAN ID of the VLAN you want to create.
ALL	This button allows you to configure all the ports at once. Click this button to change the state of all the ports at once. The possible states are: empty - This indicates that the port is not part of the VLAN. **T** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is added. **U** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is removed.
1...28	These buttons allow you to specify whether the individual ports are members of this VLAN. Click the buttons below the numbers to change the state of the ports. The possible states are: empty - This indicates that the port is not part of the VLAN. **T** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is added. **U** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is removed.
Create	Click **Create** to add this VLAN to the switch.
Cancel	Click **Cancel** to return to the VLAN status screen without making any changes.

8.2.3 Edit IEEE 802.1Q VLAN Screen

See Section 8.1 on page 63 for more information on VLANs. Click **VLAN** in the navigation panel to display the **IEEE 802.1Q VLAN** screen as shown next.

Figure 33 VLAN: Edit VLAN



The following table describes the labels in this screen.

Table 14 VLAN: Edit VLAN

LABEL	DESCRIPTION
VLAN ID	Select which VLAN you want to configure. Click **Remove This VLAN** to remove this VLAN from the switch.
Display All VLAN	Click this button to go back to the VLAN status screen.
ALL	This button allows you to configure all the ports at once. Click this button to change the state of all the ports at once. The possible states are: empty - This indicates that the port is not part of the VLAN. **T** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is added. **U** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is removed.
1...28	These buttons allow you to specify whether the individual ports are members of this VLAN. Click the buttons below the numbers to change the state of the port. The possible states are: empty - This indicates that the port is not part of the VLAN. **T** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is added. **U** - This indicates that this port is a member of the VLAN. When the packet leaves the member port, the VLAN tag is removed.
Apply	Click **Apply** to create the VLAN or update the VLAN's configuration.

9

Trunking

This chapter shows you how to logically aggregate physical links to form one logical, higher-bandwidth link.

9.1 Trunking Overview

Trunking is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.

However, the more ports you aggregate then the fewer available ports you have. A trunk group is one logical link containing multiple ports.

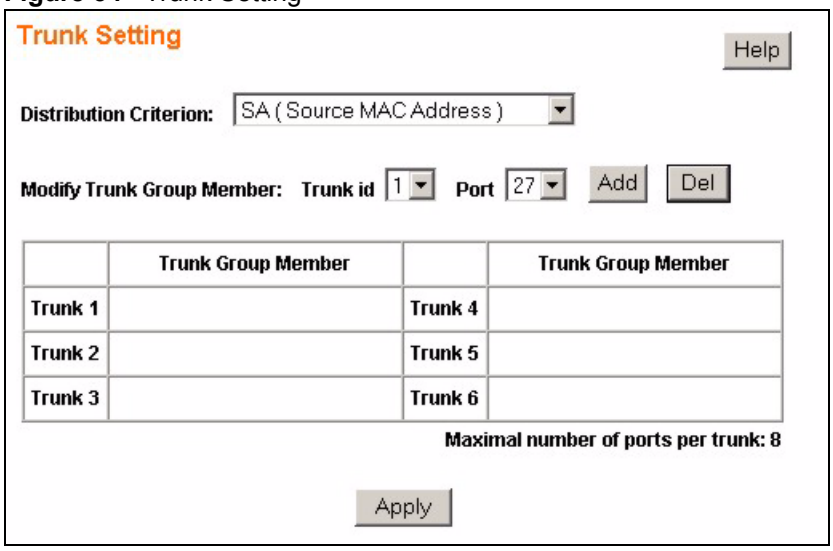
9.1.1 Distribution Criterion

The switch uses a traffic distribution algorithm to balance traffic between trunk members. The switch allows you to specify what criteria it should use to calculate the most efficient distribution of traffic. The choices are Source MAC Address (SA), Destination MAC Address (DA) or both (SA + DA). The best choice of distribution criteria depends on your specific network environment.

9.2 Trunk Setting Screen

Use this screen to aggregate groups of physical ports into one higher capacity link. Click **Trunk Groups** in the navigation panel to display the **Trunk Setting** screen.

Figure 34 Trunk Setting



The following table describes the labels in this screen.

Table 15 Trunking: Configuration

LABEL	DESCRIPTION
Distribution Criterion	Trunking uses a distribution algorithm to balance traffic between trunk members. Select the traffic distribution algorithm between trunk member ports. Your choices are: • **SA (Source MAC Address)** • **DA (Destination MAC Address)** • **SA + DA**
Modify Trunk Group Member	Configure the following settings to create and modify trunk groups.
Trunk id	Select the trunk you want to modify or select a trunk id which is not yet configured to create a new trunk group.
Port	Select the port you want to add or delete.
Add	Click this to add the port to the trunk group you selected in the **Trunk id** field.
Del	Click this to delete the port from the trunk group you selected in the **Trunk id** field.
Trunk 1 ... Trunk 6	This summary table lists all the trunks. **Trunk Group Member** column indicates which ports are members of the trunk group.
Apply	Click **Apply** to save your changes to the switch.

10 Mirroring

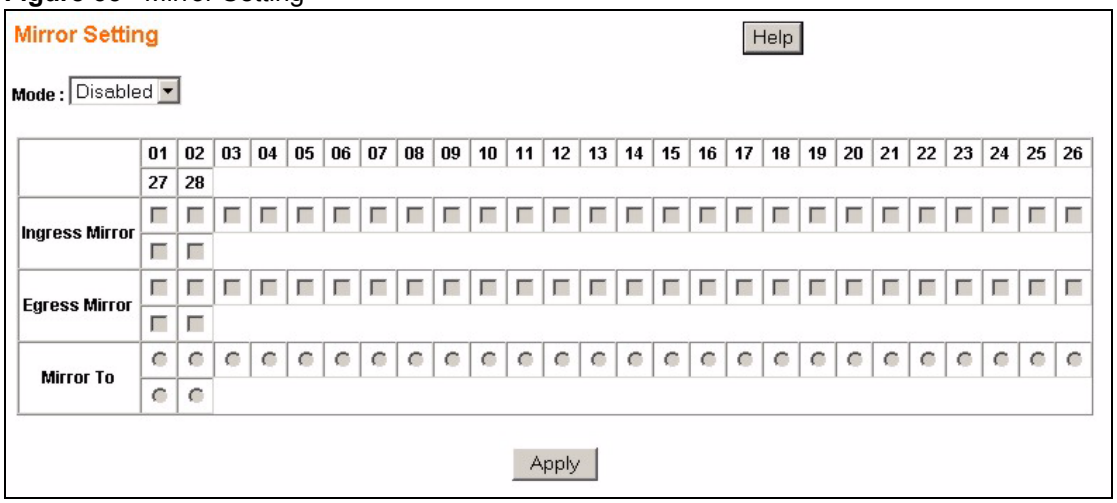
This chapter discusses port mirroring.

10.1 Port Mirroring Settings

Port mirroring allows you to copy traffic flow to a monitor port (the port you copy the traffic to) in order that you can examine the traffic from the mirrored port without interference.

Click **Mirror** in the navigation panel to display the **Mirror Setting** screen. Use this screen to select a monitor port and specify the traffic flow to be copied to the monitor port.

Figure 35 Mirror Setting



The following table describes the labels in this screen.

Table 16 Mirror Setting

LABEL	DESCRIPTION
Mode	Select **Enabled** to turn on port mirroring or select **Disabled** to turn it off.
Ingress Mirror	Select the ports for which you want to monitor the ingress (incoming) traffic.
Egress Mirror	Select the ports for which you want to monitor the egress (outgoing) traffic.
Mirror To	The **Mirror To** (monitor) port is the port you copy the traffic to in order to examine it in more detail without interfering with the traffic flow on the original port(s). Select the monitor port.
Apply	Click **Apply** to save your changes to the switch.

11

QoS

This chapter introduces the quality of service (QoS) parameters you can configure on the switch.

11.1 QoS Overview

QoS is used to help solve performance degradation when there is network congestion. Use the **QoS Setting** screen to configure queuing algorithms for outgoing traffic.

Queuing algorithms allow switches to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.

11.1.1 Weighted Round Robin (WRR)

Round Robin scheduling services queues on a rotating basis and is activated only when a port has more traffic than it can handle. A queue is given an amount of bandwidth irrespective of the incoming traffic on that port. This queue then moves to the back of the list. The next queue is given an equal amount of bandwidth, and then moves to the end of the list; and so on, depending on the number of queues being used. This works in a looping fashion until a queue is empty.

Weighted Round Robin (WRR) scheduling uses the same algorithm as round robin scheduling, but services queues based on their priority and queue weight (the number you configure in the queue **Weight** field) rather than a fixed amount of bandwidth. WRR is activated only when a port has more traffic than it can handle. Queues with larger weights get more service than queues with smaller weights. This queuing mechanism is highly efficient in that it divides any available bandwidth across the different traffic queues and returns to queues that have not yet emptied.

11.1.2 Strict Priority

Strict priority scheduling singles out the highest priority queue and ensures all queued traffic in this queue is transmitted before servicing the lower priority queues. Strict priority scheduling services the remaining queues using WRR. As traffic comes into the switch, traffic on the highest priority queue, Queue 3 is transmitted first. Only when that queue empties, traffic on the lower priority queues is transmitted using WRR scheduling.

11.2 QoS Enhancement

You can configure the switch to prioritize traffic even if the incoming packets are not marked with IEEE 802.1p priority tags or change the existing priority tags based on the criteria you select. The switch allows you to choose one of the following methods for assigning priority to incoming packets on the switch:

Port Based QoS - Assign priority to packets based on the incoming port on the switch. See Section 11.4.1 on page 74.

DSCP Based QoS - Assign priority to packets based on their Differentiated Services Code Points (DSCPs). See Section 11.4.2 on page 75.

ToS Based QoS - Assign priority to packets based on their Type of Service (ToS) tagging. See Section 11.4.5 on page 76.

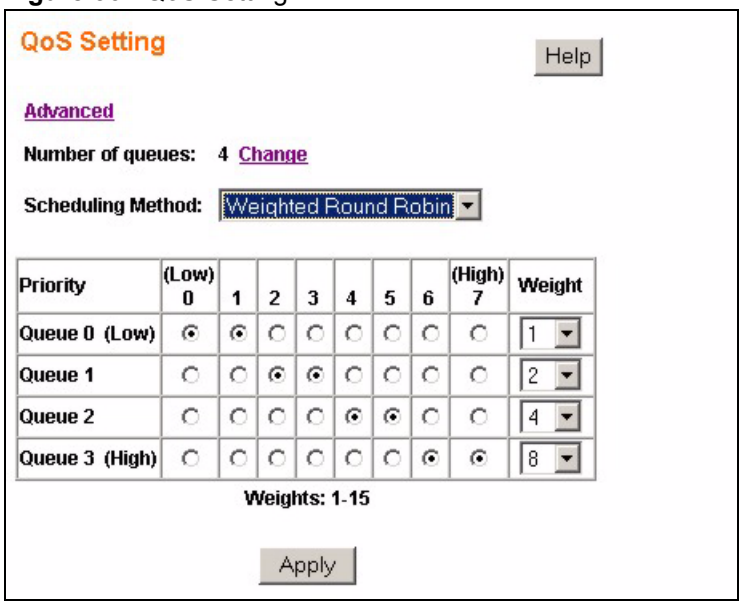
IP Address Based QoS - Assign priority to packets based on their source IP address. See Section 11.4.6 on page 77.

You can choose one of these ways to alter the way incoming packets are prioritized or you can choose not to use any QoS enhancement setting on the switch.

11.3 Configuring QoS

Use the **QoS Setting** screen to specify a queuing method and configure queue weights for the switch. Click **QoS** in the navigation panel to view the following screen.

Figure 36 QoS Setting



The following table describes the labels in this screen.

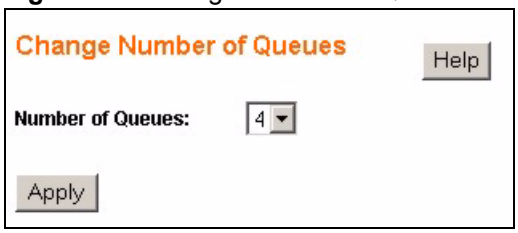
Table 17 QoS Setting

LABEL	DESCRIPTION
Advanced	Click this link to configure QoS settings based on port number, IP address or configure DSCP or ToS priority to 802.1p priority mappings.
Number of queues	This field displays the number of queues configurable on the switch. Click **Change** to edit the number of queues on the switch.
Scheduling Method	Select **Strict Priority** or **Weighted Round Robin**. **Strict Priority** scheduling singles out the highest priority queue and ensures all queued traffic in this queue is transmitted before servicing the lower priority queues. **Strict Priority** scheduling services the remaining queues using WRR. **Note: Queue weights can only be changed when Weighted Round Robin is selected.** **Weighted Round Robin** scheduling services queues on a rotating basis based on their queue weight (the number you configure in the queue **Weight** field). Queues with larger weights get more service than queues with smaller weights.
Priority	This value indicates packet priority and is retrieved from the priority tag field of incoming packets. The values range from 0 (lowest priority) to 7 (highest priority). Click the options below the priority values to send packets of a specific priority to a particular queue. You can also set this priority based on criteria you configure in the **Advanced** QoS screens. See the sections later in this chapter for more information.
Queue 0 ... Queue 3	This field indicates which Queue (0 to 3) you are configuring. Queue 0 has the lowest priority and Queue 3 the highest priority.
Weight	You can only configure the queue weights when **Weighted Round Robin** is selected. Bandwidth is divided across the different traffic queues according to their weights. **Note: If you want to use Strict Priority but want to change the weights for the queues, configure them with Weighted Round Robin selected first and then change the scheduling method to Strict Priority.**
Apply	Click **Apply** to save your changes to the switch.

11.3.1 Change Number of Queues

Use the **Change Number of Queues** screen to edit the number of queues on the switch. Click Change in the QoS Setting screen to view the following screen.

Figure 37 Change Number of Queues



Select the number of queues from the **Number of Queues** drop down list box and click **Apply** to save your settings to the switch.

11.4 Advanced QoS Settings

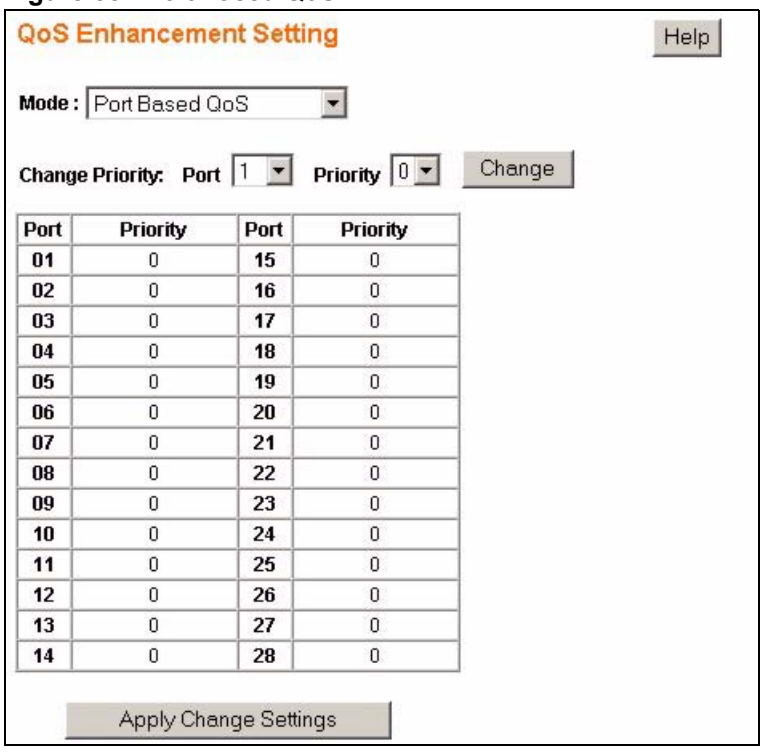
The following sections describe additional methods for setting priority for incoming packets on the ports. The switch allows you to choose one of the following methods:

Port Based QoS, **DSCP Based QoS**, **ToS Based QoS** or **IP Address Based QoS**.

11.4.1 Port Based QoS

You can configure the switch to assign a IEEE 802.1p priority to packets based on the ingress (incoming) port of the packet. Select **Port Based QoS** in the **QoS Enhancement Setting** screen to view the following screen.

Figure 38 Port Based QoS



The following table describes the labels in this screen.

Table 18 Port Based QoS

LABEL	DESCRIPTION
Mode	Select **Port Based QoS** to specify priority rules based on the port of incoming packets.
Change Priority	Configure the following: • **Port** - Select the number of the port for which you want to assign IEEE 802.1p priority to incoming frames. • **Priority** - Select the IEEE 802.1p priority you want to assign to the packets coming into the switch on the port specified in the **Port** field. Click **Change** to view your changed settings. **Note: The changes are not applied until you click Apply Change Settings.**

Table 18 Port Based QoS (continued)

LABEL	DESCRIPTION
Port, Priority	This is a summary table of your port to IEEE 802.1p priority mappings. The **Port** column indicates the port number of the incoming packets and the **Priority** column indicates what IEEE 802.1p priority gets assigned to those packets.
Apply Change Settings	Click this when you have reviewed the changes you want to make and you want to save them to the switch's memory.

11.4.2 DSCP Based QoS

The switch allows you to create a mapping table between Differentiated Services Code Points (DSCPs) tags and IEEE 802.1p priority tags.

11.4.3 Differentiated Services Code Point (DSCP) Overview

Differentiated Services (DiffServ) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

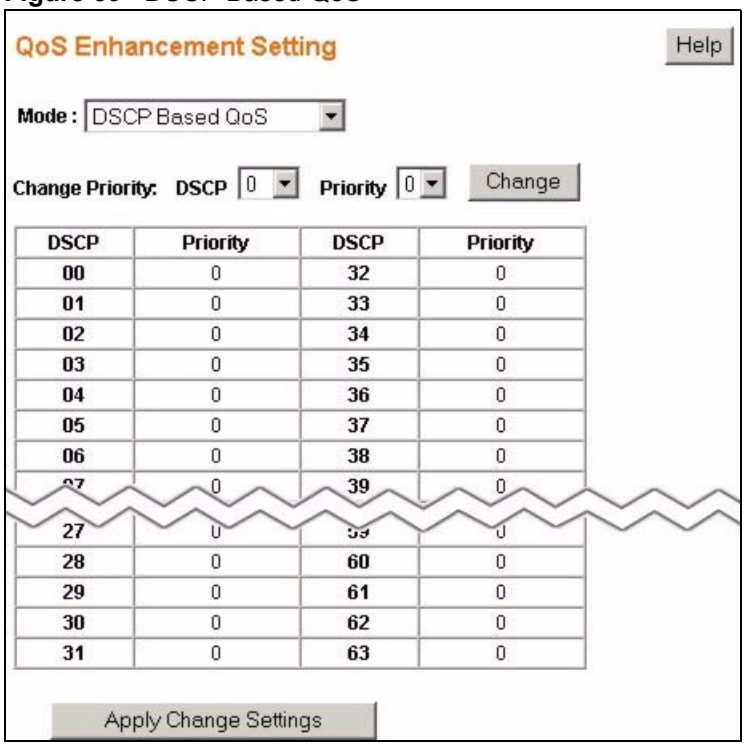
DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (ToS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels.

You can configure the DSCP to IEEE 802.1p mapping to allow the switch to prioritize all traffic based on the incoming DSCP value according to the DiffServ to IEEE 802.1p mapping table.

11.4.4 DSCP Based QoS Screen

You can configure the switch to assign a IEEE 802.1p priority to packets coming into the switch with DSCPs assigned to them. Select **DSCP Based QoS** in the **QoS Enhancement Setting** screen to view the following screen.

Figure 39 DSCP Based QoS



The following table describes the labels in this screen.

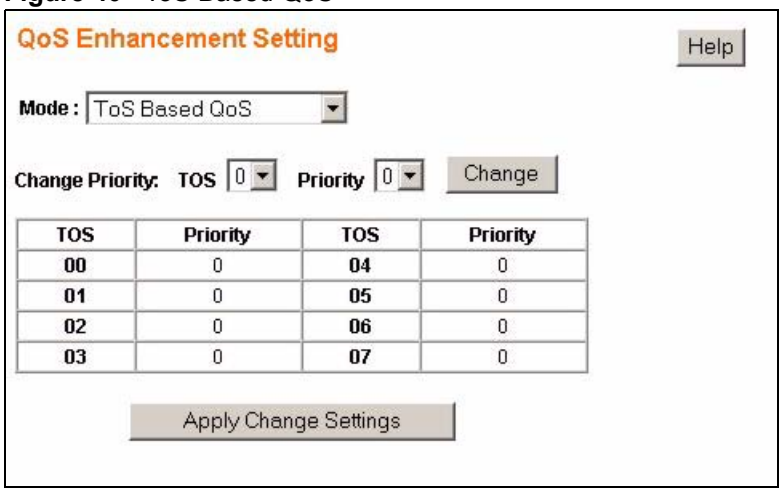
Table 19 DSCP Based QoS

LABEL	DESCRIPTION
Mode	Select **DSCP Based QoS** to specify mapping rules between DSCP priority and IEEE 802.1p priority for incoming packets on the switch.
Change Priority	Configure the following: • **DSCP** - Select the DSCP priority for which you want to change a priority mapping. • **Priority** - Select the IEEE 802.1p priority you want to assign to the packets with the DSCP priority you specified in the **DSCP** field. Click **Change** to view your changed settings. **Note: The changes are not applied until you click Apply Change Settings.**
DSCP, Priority	This is a summary table of your DSCP to IEEE 802.1p priority mappings. The **DSCP** column indicates the DSCP values of the incoming packets and the **Priority** column indicates what IEEE 802.1p priority gets assigned to those packets.
Apply Change Settings	Click this when you have reviewed the changes you want to make and you want to save them to the switch's memory.

11.4.5 ToS Based QoS

You can configure the switch to assign a IEEE 802.1p priority to packets coming into the switch with Type of Service (ToS) priority assigned to them. Select **ToS Based QoS** in the **QoS Enhancement Setting** screen to view the following screen.

Figure 40 ToS Based QoS



The following table describes the labels in this screen.

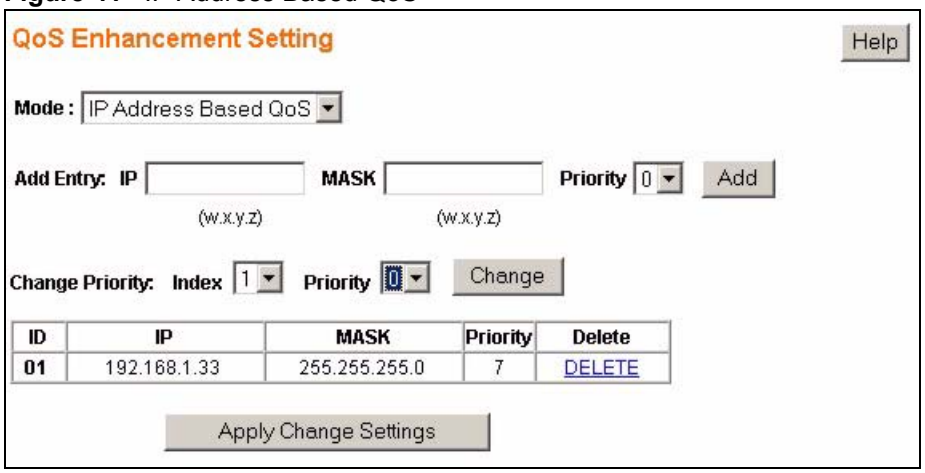
Table 20 ToS Based QoS

LABEL	DESCRIPTION
Mode	Select **ToS Based QoS** to specify mapping rules between ToS priority and IEEE 802.1p priority for incoming packets on the switch.
Change Priority	Configure the following: • **TOS** - Select the ToS priority for which you want to change a priority mapping. • **Priority** - Select the IEEE 802.1p priority you want to assign to the packets with the ToS priority you specified in the **TOS** field. Click **Change** to view your changed settings. **Note: The changes are not applied until you click Apply Change Settings.**
TOS, Priority	This is a summary table of your ToS priority to IEEE 802.1p priority mappings. The **TOS** column indicates the ToS priority of the incoming packets and the **Priority** column indicates what IEEE 802.1p priority gets assigned to those packets.
Apply Change Settings	Click this when you have reviewed the changes you want to make and you want to save them to the switch's memory.

11.4.6 IP Address Based QoS

You can configure the switch to assign a higher priority to packets coming into the switch from specific IP addresses. Select **IP Address Based QoS** in the **QoS Enhancement Setting** screen to view the following screen.

Figure 41 IP Address Based QoS



The following table describes the labels in this screen.

Table 21 IP Address Based QoS

LABEL	DESCRIPTION
Mode	Select **IP Address Based QoS** to give higher or lower priority to packets coming into the switch from a specified source IP address.
Add Entry	Enter the IP address and the subnet mask of the source whose traffic you want to assign a priority to in the **IP** and **MASK** fields respectively. Select the **Priority** value and click **Add**.
Change Priority	Use these fields to edit existing IP address based QoS entries. Select the index of an existing IP address based QoS entry. (This is the same value as listed in the **ID** column of this screen.) Select the **Priority** you want to assign to this entry. Click **Change** to view your changed settings. **Note: The changes are not applied until you click Apply Change Settings.**
ID, IP, MASK, Priority, Delete	This is a summary table of your IP address based QoS settings. This table updates when you click the **Change** button in this screen. Click **DELETE** in the **Delete** column to remove this IP address based QoS entry from the switch.
Apply Change Settings	Click this when you have reviewed the changes you want to make and you want to save them to the switch's memory.

12

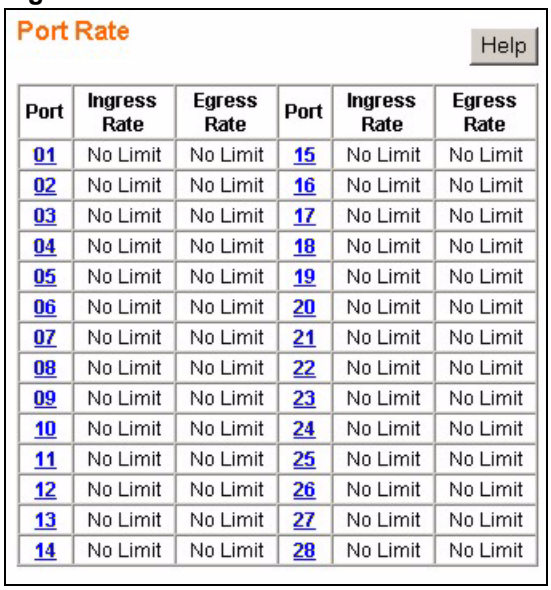
Port Rate Limit and Storm Control

This chapter shows you how you can manage bandwidth on each port and set up broadcast storm control settings using the **Port Rate** and **Storm Control** screens.

12.1 Port Rate Screen

Rate control means defining a maximum allowable bandwidth for incoming and/or out-going traffic flows on a port. Click **Rate > Port Rate** in the navigation panel to bring up the screen as shown next.

Figure 42 Port Rate Limit



The following table describes the related labels in this screen.

Table 22 Rate Limit and Storm Control

LABEL	DESCRIPTION
Port	This field displays the port number. Click on an individual port number to configure rate limits on that port.

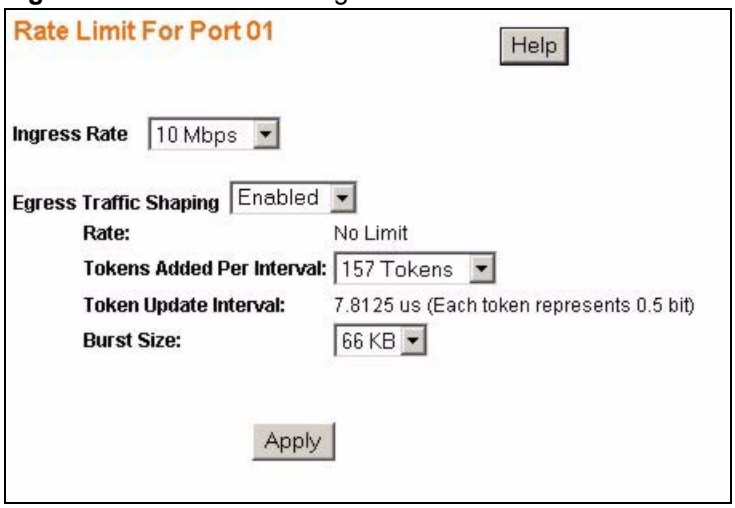
Table 22 Rate Limit and Storm Control (continued)

LABEL	DESCRIPTION
Ingress Rate	Displays the maximum bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port.
Egress Rate	Displays the maximum bandwidth allowed in kilobits per second (Kbps) for the out-going traffic flow on a port.

12.1.1 Rate Limit Screen

Click a port number in the **Port Rate** screen to bring up the screen as shown next.

Figure 43 Rate Limit Configuration



The following table describes the related labels in this screen.

Table 23 Rate Limit Configuration

LABEL	DESCRIPTION
Ingress Rate	Specify the maximum bandwidth allowed in kilobits per second (Kbps) for the incoming traffic flow on a port.
Egress Traffic Shaping	Select **Disabled** to not have any bandwidth limits for outgoing traffic on the port or select **Enabled** to enable bandwidth limits for outgoing traffic on the port.
Rate	This is a read only field indicating the rate limit of outgoing traffic on the port in Kbps. This value changes depending on the number of **Tokens Added Per Interval**.
Tokens Added Per Interval	The switch uses a “Token Bucket” algorithm to limit the outgoing rate on the ports and to limit the largest amount of packets that can leave the port in any one instance. In this algorithm each “token” represents an allowed amount of bandwidth to be sent out on the port. The “bucket” holds the tokens. In other words, the number of tokens in the bucket represents the maximum allowed bandwidth to go out on the port. The size of the bucket is specified by the “burst size” (see below). Every time traffic goes out on the port, tokens (representing used up bandwidth) are removed from the bucket, thus limiting the amount of traffic allowed to go out on the port. Tokens are also added to the bucket every **Token Update Interval**, thus resetting the amount of bandwidth allowed to go out. If the bucket is empty, the data packets are dropped until more tokens are added to the bucket. Select the number of tokens that should be added to the bucket per **Token Update Interval**. Each token represents .5 bit in bandwidth allowed to go out on the port.

Table 23 Rate Limit Configuration (continued)

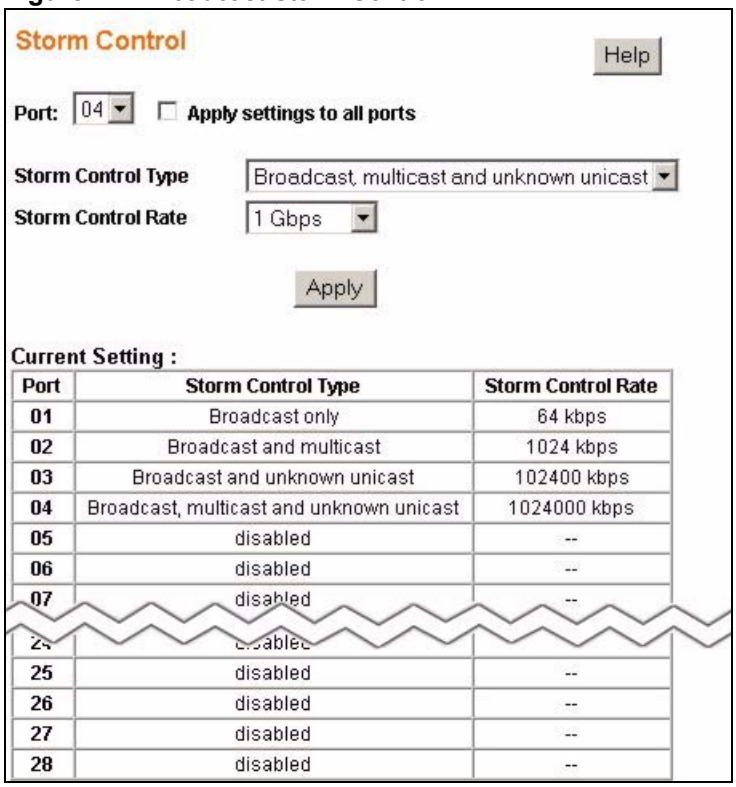
LABEL	DESCRIPTION
Burst Size	The burst size specifies the maximum amount of traffic that can be allowed out the port at any one instance. In the “Token Bucket” algorithm this is referred to as the size of the bucket as this value limits the number of tokens that can accumulate in the bucket.
Apply	Click this to save your changes to the switch.

12.1.2 Broadcast Storm Control Setup

Broadcast storm control limits the number of broadcast, multicast and unknown unicast (also referred to as Destination Lookup Failure or DLF) packets the switch receives per second on the ports. When the maximum number of allowable broadcast, multicast and unknown unicast packets is reached per second, the subsequent packets are discarded. Enable this feature to reduce broadcast, multicast and unknown unicast packets in your network.

Click **Rate > Storm Control** in the navigation panel to display the screen as shown next.

Figure 44 Broadcast Storm Control



The following table describes the labels in this screen.

Table 24 Broadcast Storm Control

LABEL	DESCRIPTION
Port	Select the port number for which you want to configure storm control settings or select **Apply settings to all ports** to configure all the ports at once.
Storm Control Type	Select **Disabled** - to turn off this feature. **Broadcast only** - to only specify a limit for the amount of broadcast packets received per second. **Broadcast and multicast** - to specify a limit for the amount of broadcast and multicast packets received per second. **Broadcast and unknown unicast** - to specify a limit for the amount of broadcast and DLF packets received per second. **Broadcast, multicast and unknown unicast** - to specify a limit for the amount of broadcast, multicast and DLF (Destination Lookup Failure) packets received per second.
Storm Control Rate	Select the number of packets (of the type specified in the **Storm Control Type** field) per second the switch can receive per second.
Apply	Click **Apply** to save your changes to the switch.

13

Level 2 (L2) Management

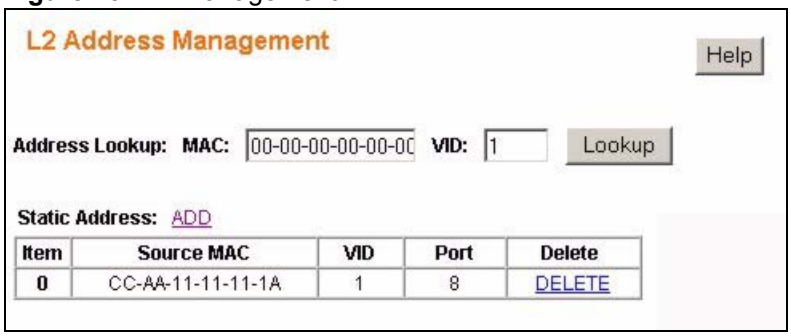
Use these screens to add, delete and view entries in the Level 2 (L2) address table.

13.1 Configuring L2 Management

Level 2 (L2) management refers to management based on the Media Access Control (MAC) address of networking devices. A static Media Access Control (MAC) address is an address that has been manually entered in the MAC address table. Static MAC addresses do not age out. When you set up static MAC address rules, you are setting static MAC addresses for a port. This may reduce the need for broadcasting.

Click **L2 Address > Management** in the navigation panel to display the configuration screen as shown.

Figure 45 L2 Management



The following table describes the labels in this screen.

Table 25 L2 Management

LABEL	DESCRIPTION
Address Lookup:	Enter the MAC address and the corresponding Vlan ID in the **MAC** and **VID** fields respectively. Click **Lookup** to search for the MAC address entry in the MAC address table.
Static Address:	This section allows you to add or delete static MAC address entries.
ADD	Click this to add a static MAC address entry to the MAC address table.
Item	This is the index number of the static MAC address entry.
Source MAC	This field displays the MAC address of a manually entered MAC address entry.
VID	This field displays the VID of a manually entered MAC address entry.

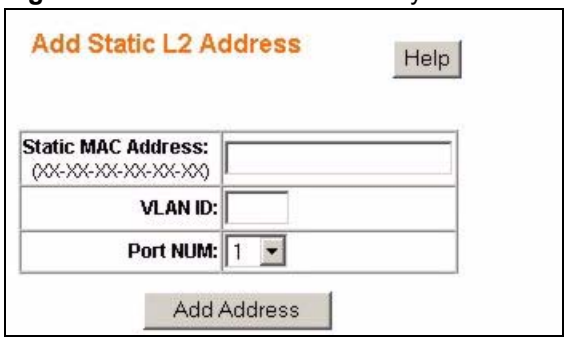
Table 25 L2 Management (continued)

LABEL	DESCRIPTION
Port	This field displays the port number of a manually entered MAC address entry.
Delete	Click DELETE to remove this manually entered MAC address entry from the MAC address table.

13.1.1 Add a Static MAC Address Entry

Click **Add** in the **L2 Address Management** screen to display the configuration screen as shown.

Figure 46 Add a Static MAC Entry



The following table describes the labels in this screen.

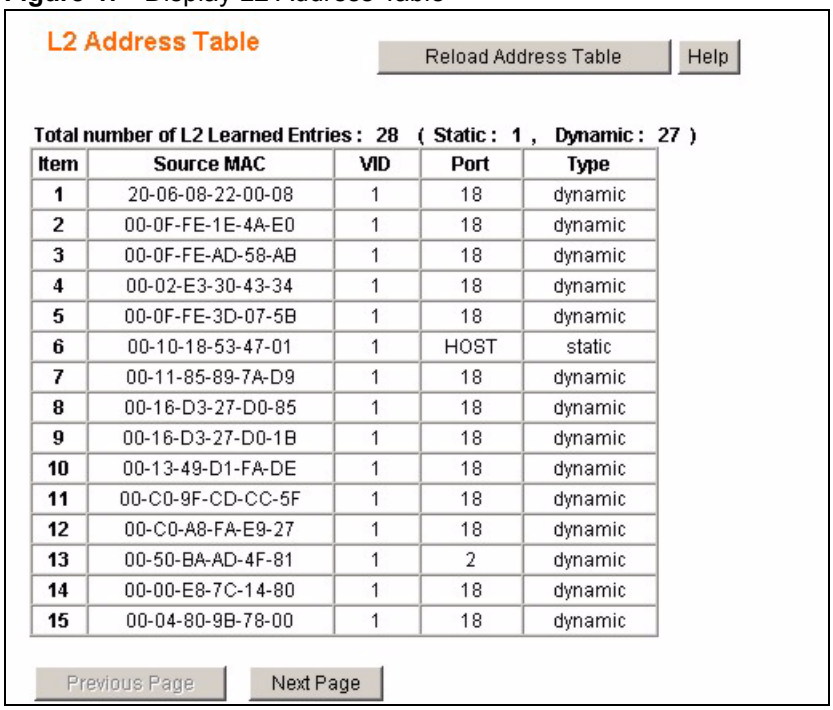
Table 26 Add a Static MAC Entry

LABEL	DESCRIPTION
MAC Address	Enter the MAC address in valid MAC address format, that is, six hexadecimal character pairs. **Note: Static MAC addresses do not age out.**
VID	Enter the VLAN identification number.
Port	Select the port where the traffic with the destination MAC address entered in the **MAC Address** field will be automatically forwarded.
Add Address	Click this to add this entry into the MAC address table.

13.2 Viewing the L2 Address Table

Use the **L2 Address Table** screen to view entries in the MAC address table. Click **L2 Address > Display** in the navigation panel to display the screen as shown.

Figure 47 Display L2 Address Table



The following table describes the labels in this screen.

Table 27 Display L2 Address Table

LABEL	DESCRIPTION
Reload Address Table	Click this to update all the fields in the L2 Address table.
Item	This is the index number of the MAC address entry.
Source MAC	This field displays the MAC address.
VID	This field displays the VID of a manually entered MAC address entry.
Port	This field displays the port number of a MAC address entry or it displays **HOST** if its the entry for the switch itself.
Type	This field displays whether this entry was entered manually into the L2 address table - **static** or whether it was learned by the switch - **dynamic**.

14

Cable Diagnostics

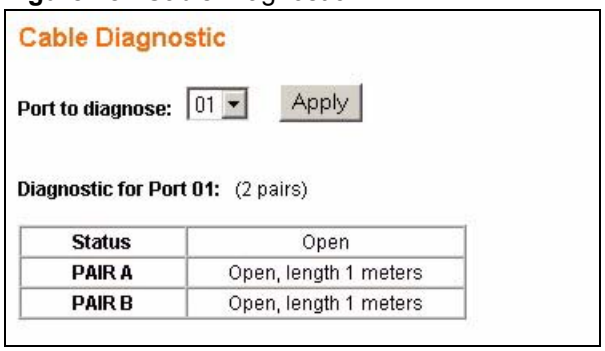
This chapter explains the **Cable Diagnostics** screen.

14.1 Diagnostics Overview

The cable diagnostics function works with systems using CAT-5 twisted-pair cables.

The switch can perform basic cable diagnostics. Click **Cable Diagnostic** in the navigation panel to view the screen as shown.

Figure 48 Cable Diagnostic



The following table describes the labels in this screen.

Table 28 Cable Diagnostic

LABEL	DESCRIPTION
Port to diagnose	Select the port you want to test.
Apply	Click this to perform cable testing on the specified port.
Status	This field displays the results of the test: **Ok** - the cable is working properly. **Open** - there is no cable connected to the port or the cable is damaged. **Short** - there is a short along the cable. **Short-between-pair** - there is a short between two twisted pairs of cable.
Pair A .. Pair D	This field displays the whether the twisted pair has a good connection - **Ok**, or it displays the type of fault the switch has detected: **Open**, **Short** or **Short-between-pair**. It also displays the length of total twisted pair length or the distance to the detected fault depending whether the cable tested **Ok** or a fault was found.

15

Auto Denial of Service (DoS)

This chapter shows you how to configure automatic Denial of Service prevention on the switch.

15.1 About Denial of Service Attacks

Denial of Service (DoS) attacks try to disable a device or network so users no longer have access to network resources. The switch has features which automatically detect and thwart currently known DoS attacks.

15.1.1 DoS Attacks Summary

The following table summarizes the types of attacks the switch can prevent.

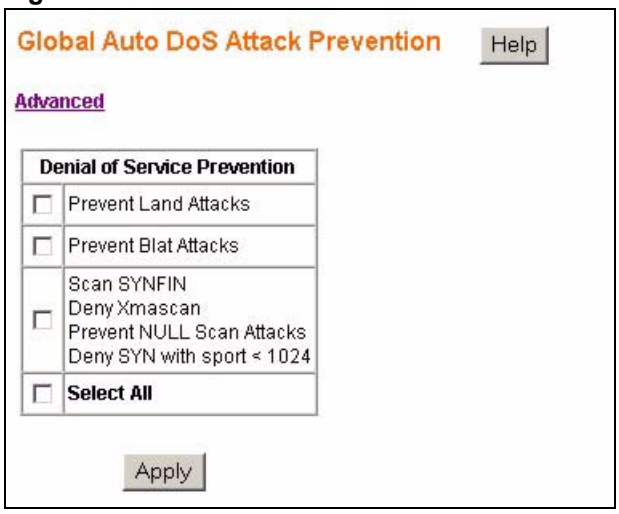
Table 29 DoS Attack Summary

ATTACK	DESCRIPTION
Land Attacks	These attacks result from sending a specially crafted packet to a machine where the source host IP address is the same as the destination host IP address. The system attempts to reply to itself, resulting in system lockup.
Blat Attacks	These attacks result from sending a specially crafted packet to a machine where the source host port is the same as the destination host port. The system attempts to reply to itself, resulting in system lockup.
SYNFIN scans	SYNchronization (SYN), ACKnowledgment (ACK) and FINish (FIN) packets are used to initiate, acknowledge and conclude TCP/IP communication sessions. The following scans exploit weaknesses in the TCP/IP specification and try to illicit a response from a host to identify ports for an attack: **Scan SYNFIN** - SYN and FIN bits are set in the packet. **Xmascan** - TCP sequence number is zero and the FIN, URG and PSH bits are set. **NULL Scan** - TCP sequence number is zero and all control bits are zeroes. **SYN with port < 1024** - SYN packets with source port less than 1024.
Smurf Attacks	This attack uses Internet Control Message Protocol (ICMP) echo requests packets (pings) to cause network congestion or outages.
Ping Flooding	This attack floods the target network with ICMP packets.
SYN/SYN-ACK Flooding	This attack floods the target network with SYN or SYN/ACK packets.

15.2 Global Auto DoS Attack Prevention

Use the **Global Auto DoS Attack Prevention** screen to configure DoS attack prevention settings for the switch. Click **Auto DoS** in the navigation panel to open the following screen.

Figure 49 Global Auto DoS Attack Prevention



The following table describes the labels in this screen.

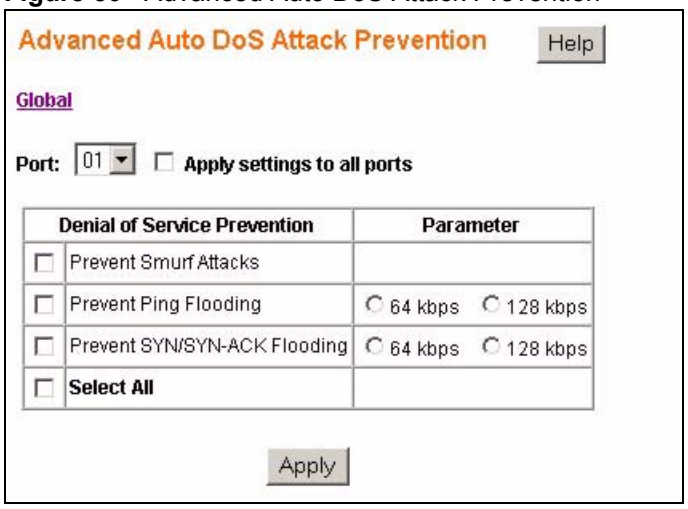
Table 30 Global Auto DoS Attack Prevention

LABEL	DESCRIPTION
Advanced	Click this link to configure advance Auto DoS settings.
Denial of Service Prevention	Select the types of attacks you want to prevent or choose **Select All** to prevent all types of attacks and scans supported by the switch. See Section 15.1.1 on page 89 for more information on specific types of attacks.
Apply	Click **Apply** to save your changes to the switch.

15.3 Advanced Auto DoS Attack Prevention

Use the **Advanced Auto DoS Attack Prevention** screen to configure DoS attack prevention settings for individual ports. Click the **Advanced** link in the **Global Auto DoS Attack Prevention** screen to view the following screen.

Figure 50 Advanced Auto DoS Attack Prevention



The following table describes the labels in this screen.

Table 31 Advanced Auto DoS Attack Prevention

LABEL	DESCRIPTION
Global	Click this link to view the **Global Auto DoS Attack Prevention** screen.
Port	Select the port you want to configure or select **Apply settings to all ports** to configure all the ports on the switch.
Denial of Service Prevention	Select the types of attacks you want to prevent or choose **Select All** to prevent all types of attacks and scans supported by the switch. See Section 15.1.1 on page 89 for more information on specific types of attacks.
Parameter	For Ping and SYN/SYN-ACK Flooding attacks you can specify thresholds for triggering the dropping of packets by the switch. Select: • **64 kbps** - the switch will drop packets when the rate of incoming Ping or SYN/SYN-ACK packets reaches this limit. • **128 kbps** - the switch will drop packets when the rate of incoming Ping or SYN/SYN-ACK packets reaches this limit.
Apply	Click **Apply** to save your changes to the switch.

16

Auto VoIP

This chapter shows you how to give higher priority to Voice over Internet Protocol (VoIP) packets over other data packets as they pass through the switch.

16.1 About Auto VoIP

Voice over Internet Protocol (VoIP) allows telephone calls to be made over a data network like the Internet. With the increased prominence of delay-sensitive applications (voice, video, and other multimedia applications) deployed in networks today, proper QoS configuration ensures high-quality application performance.

The Auto VoIP feature is intended to provide an easy classification mechanism for voice packets so that they can be given high priority in order to provide better transmission resulting in higher sound quality for the end users.

The AutoVoIP feature explicitly matches VoIP packets in Ethernet switches and provides them with the highest class of service. The AutoVoIP feature provides the capability to assign the highest priority for the following VoIP packets:

- SIP – Session Initiation Protocol is an internationally recognized standard for implementing VoIP. SIP is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet.
- MGCP – Media Gateway Control Protocol is a control and signal standard for the conversion of audio signals carried on telephone circuits (PSTN) to data packets carried over the Internet or other packet networks.
- SCCP – Skinny Client Control Protocol is a Cisco proprietary protocol used between call managers and VoIP phones.

16.2 Auto VoIP Settings

Use the **Auto VoIP Settings** enable automatic assignment of high priority to VoIP packets passing through the switch. Click **Auto VoIP** in the navigation panel to view the following screen.

Figure 51 Auto VoIP Settings

The following table describes the labels in this screen.

Table 32 Auto VoIP Settings

LABEL	DESCRIPTION
Profiles	Select **Disable** if you don't want to give higher priority to VoIP traffic or select **IP Phone** to give the highest priority to **SIP**, **MGCP** and **SCCP** packets passing through the switch.
Apply	Click **Apply** to save your changes to the switch.

PART III
Management and Troubleshooting

17

Event Logging

This chapter shows you different ways to inspect logs and how to configure an external log server.

17.1 Event Logging Overview

You can configure the switch to save specific events in four different log targets:

RAM - This log is saved into the switch's volatile memory. The logs are cleared when the switch is rebooted.

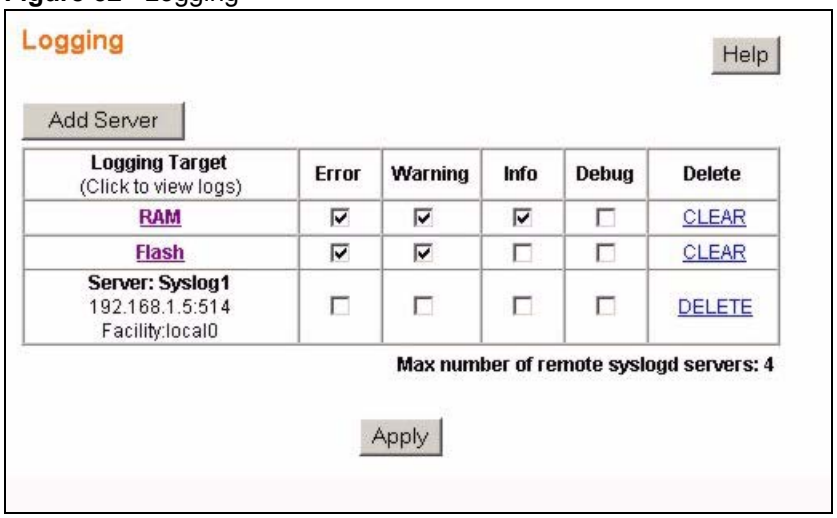
Flash - This log is saved into the switch's non-volatile memory. You can view the logs even after the switch is rebooted. Due to the space limitations on the switch the oldest log entries are overwritten as new events are recorded.

Server - You can configure syslog servers to store system events from the switch. The switch uses UDP protocol to send log messages to the remote servers. The syslog servers must be Berkeley Software Distribution (BSD) syslog protocol compliant.

17.2 Logging Screen

Use this screen to specify which system events should be recorded and where the log messages should be saved. Click **Logging > Settings** in the navigation panel to view the screen as shown.

Figure 52 Logging



The following table describes the labels in this screen.

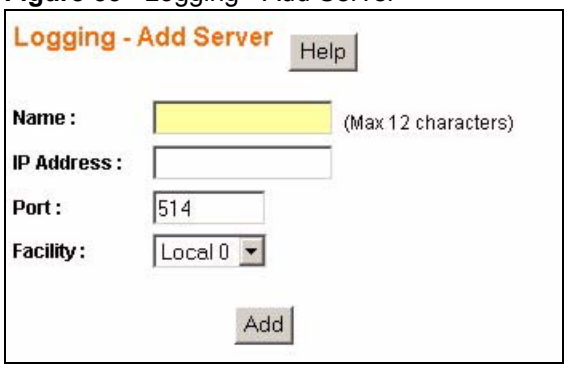
Table 33 Logging

LABEL	DESCRIPTION
Add Server	Click this to configure a new syslog server.
Logging Target	Click the **RAM** or **Flash** links to view the logs stored on the switch. Use the columns on the right to select the types of system events each logging target should record. Select: • **Error** - to record system failures, such as events which will cause the switch to malfunction and events such as invalid user input in the web configurator. • **Warning** - to record non critical errors on the switch. The switch will continue to function when warnings are recorded. • **Info** - to record regular system events, such as configuration changes or logins. • **Debug** - to record events which can be helpful for engineering debugging of the switch's function. This field is not recommended to track as it creates many messages not helpful to typical users. For **RAM** and **Flash** logs you can also hit **Clear** to delete all log entries. For each **Server** log you configured you can hit **Delete** to remove this syslog server from logging system events for the switch.
Apply	Click **Apply** to save your changes to the switch.

17.3 Logging - Add Server

Use this screen to configure a new syslog entry. Click **Add Server** in the **Logging** screen to view the screen as shown.

Figure 53 Logging - Add Server



The following table describes the labels in this screen.

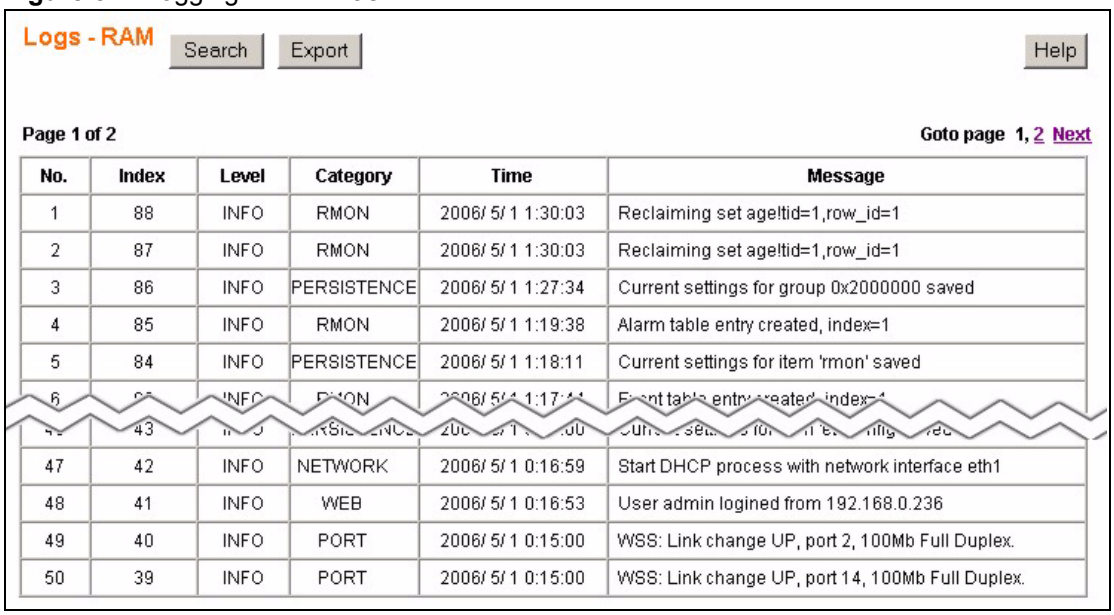
Table 34 Logging - Add Server

LABEL	DESCRIPTION
Name	Enter a short descriptive name for identifying this server.
IP Address	Enter the IP address in dotted decimal notation of the syslog server you want to add.
Port	Specify the UDP port for sending log messages to this server. Typically port 514 is used with syslog.
Facility	The log facility allows you to send logs to different files in the syslog server. Refer to the documentation of your syslog server for more details.
Add	Click **Add** to save this entry to the switch and return to the **Logging** screen.

17.4 Viewing RAM and Flash Logs

Use these screens to view or export RAM or Flash logs. Click the **RAM** or **Flash** link in the **Logging** screen to view the following screen (**Logs - RAM** is shown here).

Figure 54 Logging - RAM/Flash



The following table describes the labels in this screen.

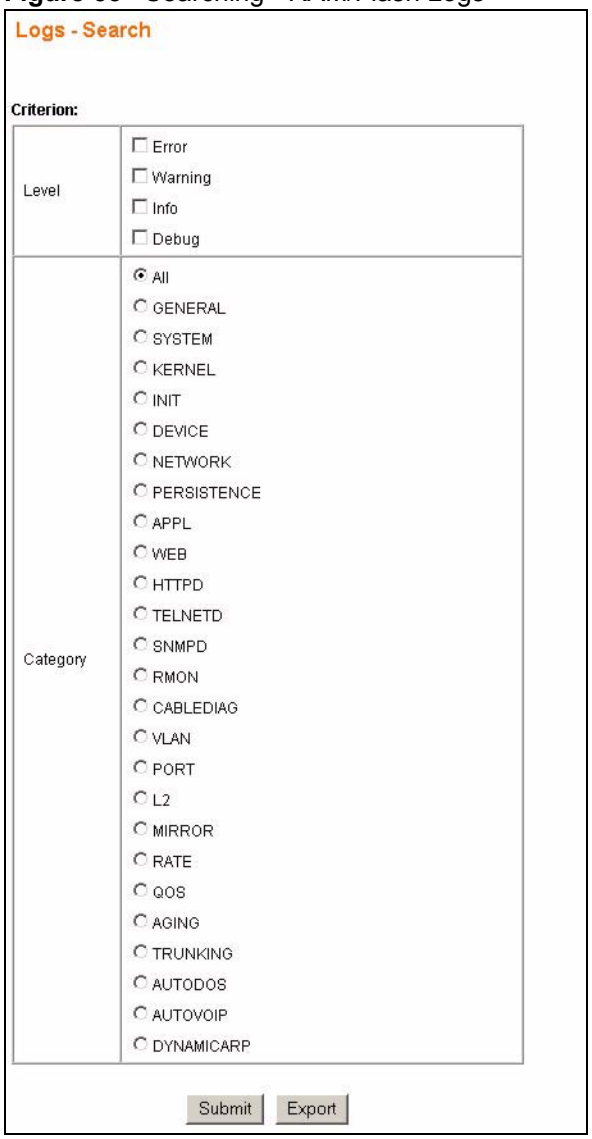
Table 35 Logging - RAM/Flash

LABEL	DESCRIPTION
Search	Click this to search for specific log entries.
Export	Click this to export (save) the log. The logs default name is “events.csv”. A .csv (Comma Separated Values) file can be viewed by most spreadsheet software such as Microsoft’s Excel.
No.	This is the number of the log entry. The log entries with the lowest numerical value are the most recent.
Index	This field indicates the index number of the log. This number doesn’t change even if some logs are deleted from the switch due to memory limits. The index number increments by one for each recorded event. The largest number represents the most recent log event.
Level	This field displays the severity level of the log event. The possible severity levels are: • **Error** - to record system failures, such as events which will cause the switch to malfunction and events such as invalid user input in the web configurator. • **Warning** - to record non critical errors on the switch. The switch will continue to function when warnings are recorded. • **Info** - to record regular system events, such as configuration changes or logins. • **Debug** - to record events which can be helpful for engineering debugging of the switch’s function. This field is not recommended to track as it creates many messages not helpful to typical users.
Category	This field displays what category the log entry fits. The categories are based on software and hardware features of the switch. For example the category **AUTODOS** records events which deal with the Auto Denial of Service features you set up and the category **SYSTEM** records events which deal with the overall operation of the switch.
Time	This field specifies the time when the switch recorded the log event. The switch resets its internal clock when it is restarted.
Message	This field displays an explanation for the log entry.
Goto page	Click **Next**, **Previous** or click on a page number to browse through the log pages.

17.5 Searching RAM and Flash Logs

Use these screens to search RAM or Flash logs based on level and category. Click the **Search** link in the **Logs - RAM** or **Logs - Flash** screen to view the following screen.

Figure 55 Searching - RAM/Flash Logs



The following table describes the labels in this screen.

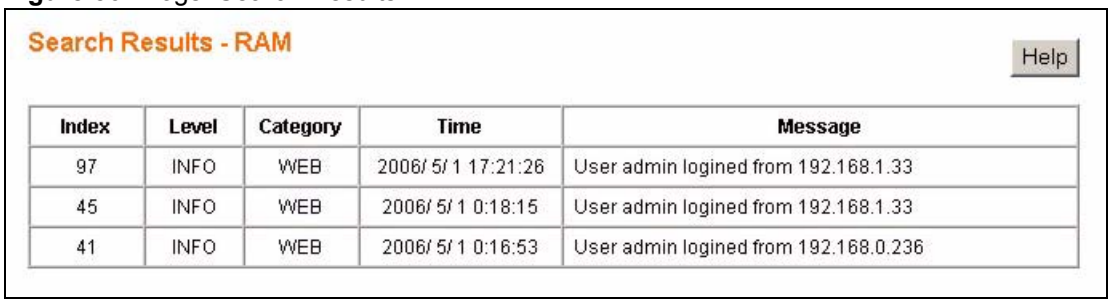
Table 36 Searching - RAM/Flash Logs

LABEL	DESCRIPTION
Level	Select the severity level(s) of the log events you want to find. The possible severity levels are: • **Error** - to search system failures, such as events which will cause the switch to malfunction and events such as invalid user input in the web configurator. • **Warning** - to search non critical errors on the switch. The switch will continue to function when warnings are recorded. • **Info** - to search regular system events, such as configuration changes or logins. • **Debug** - to search events which can be helpful for engineering debugging of the switch's function. This field is not recommended to track as it creates many messages not helpful to typical users.
Category	Select **All** to search all categories or specify the individual categories you want to search. The categories are based on software and hardware features of the switch. For example the category **AUTODOS** records events which deal with the Auto Denial of Service features you set up and the category **SYSTEM** records events which deal with the overall operation of the switch.
Submit	Click this to perform the search and view the results in the search results screen. See Section 17.5.1 on page 102.
Export	Click this to export (save) the search results. The logs default name is "events.csv". A .csv (Comma Separated Values) file can be viewed by most spreadsheet software such as Microsoft's Excel.

17.5.1 Search Results

The **Search Results - RAM/Flash** screen displays the results of your log query. Click **Submit** in the **Logs - Search** screen to view the logs which match your search criteria.

Figure 56 Logs: Search Results



The following table describes the labels in this screen.

Table 37 Logs: Search Results

LABEL	DESCRIPTION
Index	This field indicates the index number of the log. This number doesn't change even if some logs are deleted from the switch due to memory limits. The index number increments by one for each recorded event. The largest number represents the most recent log event.
Level	This field displays the severity level of the log event. The possible severity levels are, **Error**, **Warning**, **Info** and **Debug**.

Table 37 Logs: Search Results (continued)

LABEL	DESCRIPTION
Category	This field displays what category the log entry fits. The categories are based on software and hardware features of the switch. For example the category **AUTODOS** records events which deal with the Auto Denial of Service features you set up and the category **SYSTEM** records events which deal with the overall operation of the switch.
Time	This field specifies the time when the switch recorded the log event. The switch resets its internal clock when it is restarted to 2006/5/1 00:00:00.
Message	This field displays an explanation for the log entry.

18

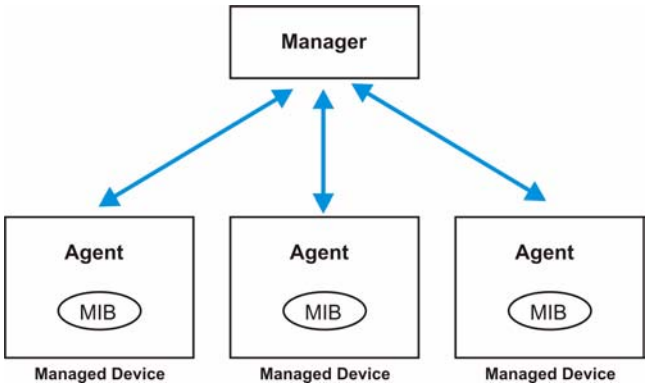
SNMP

This chapter describes how to user Simple Network Management Protocol (SNMP) to manage and monitor the switch.

18.1 About SNMP

Simple Network Management Protocol (SNMP) is an application layer protocol used to manage and monitor TCP/IP-based devices. SNMP is used to exchange management information between the network management system (NMS) and a network element (NE). A manager station can manage and monitor the switch through the network via SNMP version one (SNMPv1), SNMP version 2c or SNMP version 3. The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

Figure 57 SNMP Management Model



An SNMP managed network consists of two main components: agents and a manager.

An agent is a management software module that resides in a managed switch (the switch). An agent translates the local management information from the managed switch into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a switch. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

Table 38 SNMP Commands

COMMAND	DESCRIPTION
Get	Allows the manager to retrieve an object variable from the agent.
GetNext	Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
Set	Allows the manager to set values for object variables within an agent.
Trap	Used by the agent to inform the manager of some events.

18.1.1 Supported MIBs

MIBs let administrators collect statistics and monitor status and performance.

The switch supports the following MIBs:

- RFC 1213 SNMP MIB II
  - MIB II - System
  - MIB II - Interface
- RFC 1398 MIB - Ether-like
- RFC 1157 SNMP v1
- RFC 1155 SMI
- RFC 2674 SNMPv2, SNMPv2c
- RFC 2819 RMON
  - Group 1 (Statistics)
  - Group 2 (History)
  - Group 3 (Alarm)
  - Gropu 4 (Event)

18.1.2 SNMP v3 and Authentication

SNMP v3 adds the use of groups and users to enhance security for SNMP management. Groups are assigned access rights to SNMP objects. Users are members of groups and are therefore limited to the access rights the group has. In addition users can also be required to authenticate before conducting SNMP management sessions.

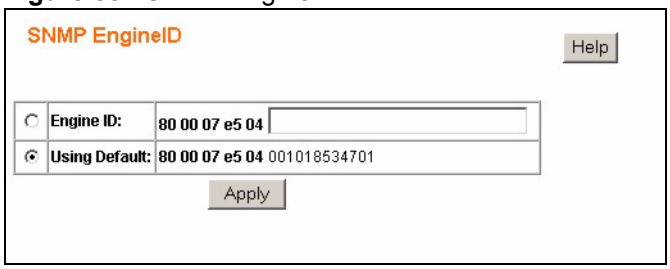
SNMP v3 is enabled by creating SNMP groups and users. Once SNMP v3 is enabled, SNMP community should be configured for SNMP v1 and/or v2c access.

18.1.3 SNMP EngineID

The Engine ID is a unique identifier in SNMP environment. The switch automatically generates a unique Engine ID based on the MAC address of the switch. The Engine ID can also be changed. Use the **SNMP EngineID** screen to specify the Engine ID for the switch.

Click **SNMP > EngineID** in the navigation panel to view the screen as shown.

Figure 58 SNMP EngineID



The following table describes the labels in this screen.

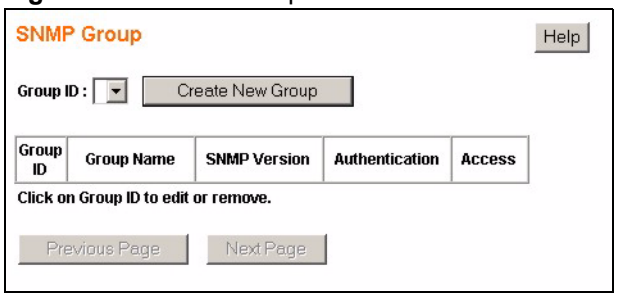
Table 39 SNMP EngineID

LABEL	DESCRIPTION
Engine ID	Select this radio button and enter a unique Engine ID for the switch. The format is limited to hexadecimal characters (0~9 and a~f) and the maximum length is 27 octets (each octet is made up of a pair of hexadecimal characters).
Using Default	Select this radio button to use the default Engine ID (based on the MAC address of the switch) for SNMP.
Apply	Click this to save your changes to the switch.

18.2 SNMP Group

SNMP groups are used to categorize SNMP managers with respect to access rights. Use the **SNMP Group** screen to create SNMP groups with different levels of access to the switch. Click **SNMP > Group** to view the screen as shown.

Figure 59 SNMP Group



The following table describes the labels in this screen.

Table 40 SNMP Group

LABEL	DESCRIPTION
Group ID	Select the SNMP group you want to edit.
Create New Group	Click this to configure a new SNMP group.

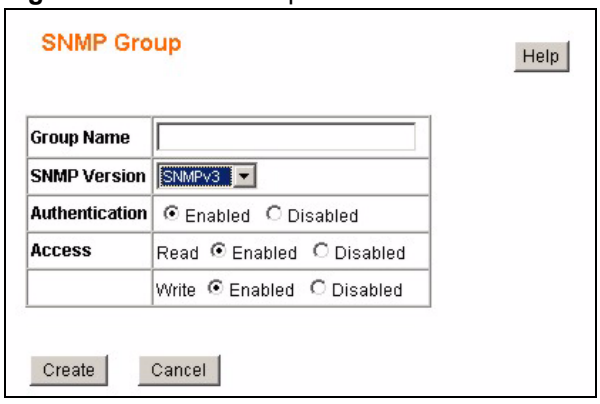
Table 40 SNMP Group (continued)

LABEL	DESCRIPTION
Group ID	This field indicates the group number. It is used for identification only. Click on the individual group number to edit the group settings.
Group Name	This field displays the name of the SNMP group.
SNMP Version	This field indicates which SNMP version this group uses to manage the switch.
Authentication	This field indicates whether authentication is required for members of this group. Authentication can only be configured for SNMP v3.
Access	This field indicates the rights this group has for SNMP management. “R” indicates that this group has read rights and “W” indicates that this group has write rights on the switch.
Previous Page/ Next Page	Use these navigation links to browse all of your SNMP groups.

18.2.1 SNMP Group - Create

Click on the **Create New Group** link in the **SNMP Group** screen to add an SNMP group. The screen displays as shown.

Figure 60 SNMP Group - Create



The following table describes the labels in this screen.

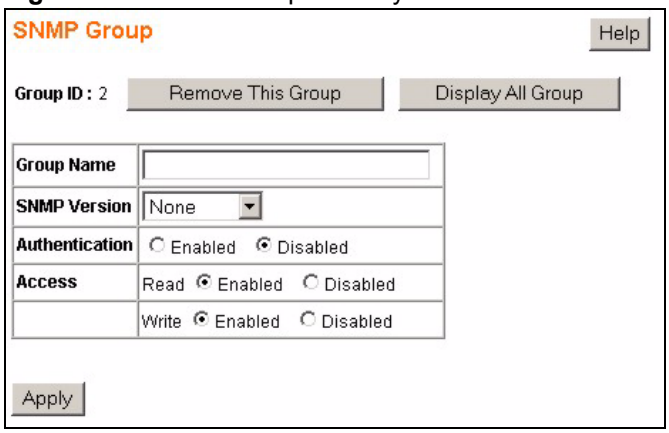
Table 41 SNMP Group - Create

LABEL	DESCRIPTION
Group Name	Specify the name for this SNMP group.
SNMP Version	Specify the SNMP version this group uses to manage the switch.
Authentication	This field is only editable if you select **SNMPv3** in the **SNMP Version** field. Select **Enabled** to force SNMP v3 groups to authenticate with the switch or select **Disabled** to deactivate authentication for the SNMP v3 groups. For SNMP v1 and SNMP v2c authentication is always disabled.
Access	Read - select Enabled to allow this group to collect information from this switch. Write - select Enabled to allow this group to create or edit SNMP objects.
Create	Click this to add this SNMP group to the switch. **Note: A maximum of ten groups can be created on the switch.**
Cancel	Click this to go back to the main **SNMP Group** screen without saving your changes.

18.2.2 SNMP Group - Modify

Click on the **Group ID** number or select a **Group ID** from the **Group ID** drop down list box in the **SNMP Group** screen to modify the settings of an existing group.

Figure 61 SNMP Group - Modify



The following table describes the labels in this screen.

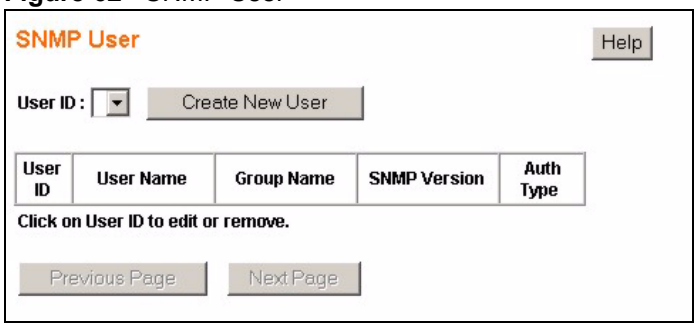
Table 42 SNMP Group - Modify

LABEL	DESCRIPTION
Group ID	This field indicates which group you are modifying. Click on **Remove This Group** to delete this group configuration from the switch. Click on **Display All Group** to view the main **SNMP Group** screen.
Group Name	Edit the name for this SNMP group.
SNMP Version	Specify the SNMP version this group uses to manage the switch.
Authentication	This field is only editable if you select **SNMPv3** in the **SNMP Version** field. Select **Enabled** to force SNMP v3 groups to authenticate with the switch or select **Disabled** to deactivate authentication for the SNMP v3 groups. For SNMP v1 and SNMP v2c authentication is always disabled.
Access	Read - select Enabled to allow this group to collect information from this switch. Write - select Enabled to allow this group to create or edit SNMP objects.
Apply	Click this to save your settings to the switch.

18.3 SNMP User

SNMP users are used to define the security parameters of SNMP clients in an SNMP v3 environment. Each SNMP user is a member of a predefined SNMP group. SNMP managers must use the proper SNMP user and group credentials to gain access to and manage the switch. Use the **SNMP User** screen to create SNMP users and associate them to SNMP groups. Click **SNMP > User** to view the screen as shown.

Figure 62 SNMP User



The following table describes the labels in this screen.

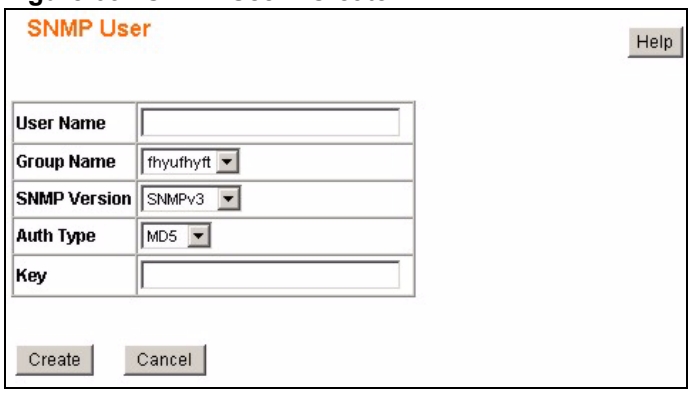
Table 43 SNMP User

LABEL	DESCRIPTION
User ID	Select the SNMP user you want to edit.
Create New User	Click this to configure a new SNMP user.
User ID	This field indicates the user number. It is used for identification only. Click on the individual user number to edit the user settings.
User Name	This field displays the name of the SNMP user.
Group Name	This field displays the name of the SNMP group the user belongs to.
SNMP Version	This field indicates which SNMP version this user uses to manage the switch.
Auth Type	This field indicates whether authentication is required for this user. Authentication can only be configured for SNMP v3. This field displays **None** if no authentication is required for this user or it displays **MD5** if Message Digest authentication is enabled.
Previous Page/ Next Page	Use these navigation links to browse all of your SNMP groups.

18.3.1 SNMP User - Create

Click on the **Create New User** link in the **SNMP User** screen to add an SNMP user. The screen displays as shown.

Figure 63 SNMP User - Create



The following table describes the labels in this screen.

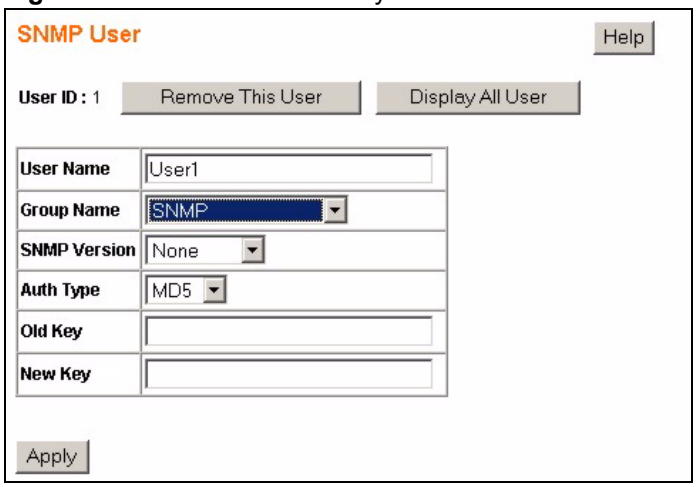
Table 44 SNMP User - Create

LABEL	DESCRIPTION
User Name	Specify the name for this SNMP user.
Group Name	Specify the SNMP group this user belongs to.
SNMP Version	Specify the SNMP version this group uses to manage the switch.
Auth Type	Authentication can only be configured for SNMP v3. Select **None** to allow this user to manage the switch without authentication or select **MD5** and configure the **Key** field to force this user to authenticate with the switch.
Key	Enter the MD5 key this user must use to authenticate with the switch.
Create	Click this to add this SNMP user to the switch.
Cancel	Click this to go back to the main **SNMP Group** screen without saving your changes.

18.3.2 SNMP User - Modify

Click on the **User ID** number or select a **User ID** from the **User ID** drop down list box in the **SNMP User** screen to modify the settings of an existing user.

Figure 64 SNMP User - Modify



The following table describes the labels in this screen.

Table 45 SNMP User - Modify

LABEL	DESCRIPTION
User ID	This field indicates which user you are modifying. Click on **Remove This User** to delete this user configuration from the switch. Click on **Display All User** to view the main **SNMP User** screen.
User Name	Edit the name for this SNMP user.
Group Name	Select the SNMP group this user should belong to.
SNMP Version	Specify the SNMP version this group uses to manage the switch.
Auth Type	Authentication can only be configured for SNMP v3. Select **None** to allow this user to manage the switch without authentication or select **MD5** and configure the **New Key** field to force this user to authenticate with the switch.

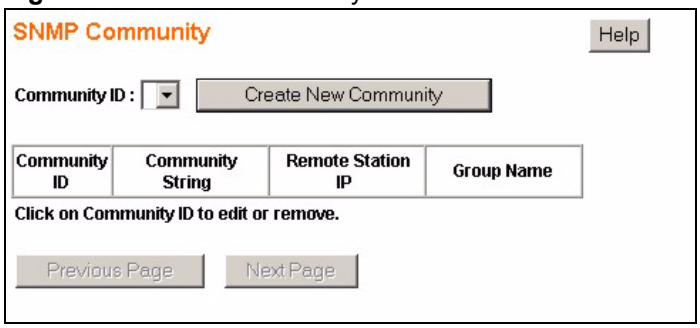
Table 45 SNMP User - Modify (continued)

LABEL	DESCRIPTION
Old Key	Enter the old MD5 key this user used for authentication, if you are setting up the key for the first time, leave this field blank.
New Key	Enter the new MD5 key this user must use to authenticate with the switch.
Apply	Click this to save your settings to the switch.

18.4 SNMP Community

SNMP communities are used to define the security parameters of SNMP clients in an SNMP v1 and SNMP v2c environments. The default SNMP community is “public” for both SNMP v1 and SNMP v2c before SNMP v3 is enabled. Once SNMP v3 is enabled, the communities of SNMP v1 and v2c have to be unique and cannot be shared. Use the **SNMP Community** screen to create SNMP communities and associate SNMP groups to them. Click **SNMP > Community** to view the screen as shown.

Figure 65 SNMP Community



The following table describes the labels in this screen.

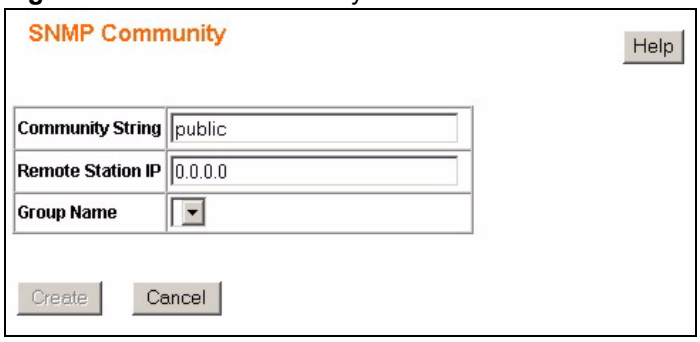
Table 46 SNMP Community

LABEL	DESCRIPTION
Community ID	Select the SNMP community you want to edit.
Create New Community	Click this to configure a new SNMP community.
Community ID	This field indicates the community number. It is used for identification only. Click on the individual community number to edit the community settings.
Community String	This field indicates the SNMP community string. An SNMP community string is a text string that acts as a password. It is used to authenticate messages that are sent between the management station (the SNMP manager) and the device (the SNMP agent). The community string is included in every packet that is transmitted between the SNMP manager and the SNMP agent.
Remote Station IP	This field displays the IP address of the remote SNMP management station.
Group Name	This field indicates the group which is part of this SNMP community.
Previous Page/ Next Page	Use these navigation links to browse all of your SNMP groups.

18.4.1 SNMP Community - Create

Click on the **Create New Community** link in the **SNMP Community** screen to add an SNMP community. The screen displays as shown.

Figure 66 SNMP Community - Create



The following table describes the labels in this screen.

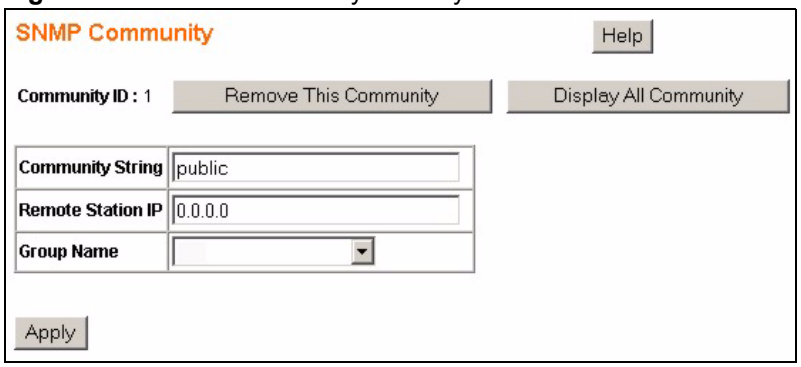
Table 47 SNMP Community - Create

LABEL	DESCRIPTION
Community String	An SNMP community string is a text string that acts as a password. It is used to authenticate messages that are sent between the management station (the SNMP manager) and the device (the SNMP agent). The community string is included in every packet that is transmitted between the SNMP manager and the SNMP agent. Type the community string for this community.
Remote Station IP	Specify the IP address of the remote SNMP management station in dotted decimal notation.
Group Name	Select the SNMP group you want to belong to this community.
Create	Click this to add this SNMP community to the switch.
Cancel	Click this to go back to the main **SNMP Community** screen without saving your changes.

18.4.2 SNMP Community - Modify

Click on the **Community ID** number or select a **Community ID** from the **Community ID** drop down list box in the **SNMP Community** screen to modify the settings of an existing community.

Figure 67 SNMP Community - Modify



The following table describes the labels in this screen.

Table 48 SNMP Community - Modify

LABEL	DESCRIPTION
User ID	This field indicates which community you are modifying. Click on **Remove This Community** to delete this user configuration from the switch. Click on **Display All Community** to view the main **SNMP Community** screen.
Community String	An SNMP community string is a text string that acts as a password. It is used to authenticate messages that are sent between the management station (the SNMP manager) and the device (the SNMP agent). The community string is included in every packet that is transmitted between the SNMP manager and the SNMP agent. Type the community string for this community.
Remote Station IP	Specify the IP address of the remote SNMP management station in dotted decimal notation.
Group Name	Select the SNMP group you want to belong to this community.
Apply	Click this to save your settings to the switch.

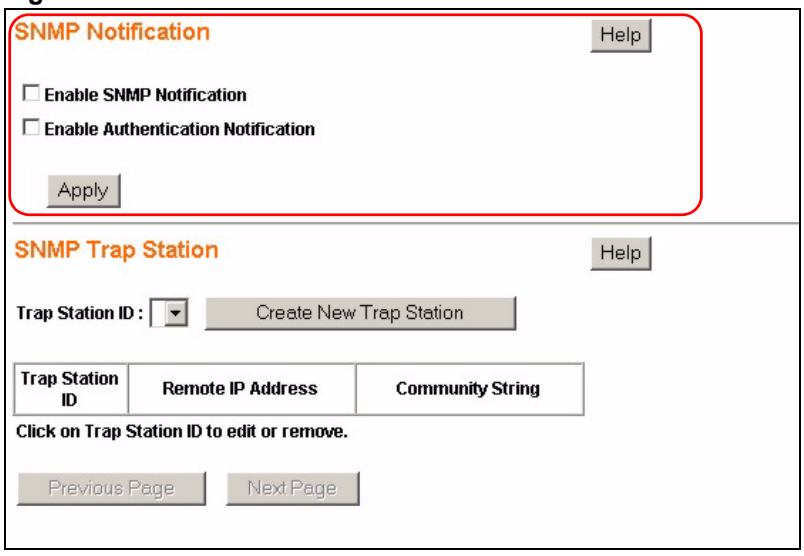
18.5 SNMP Notification

SNMP supports a notification mechanism to alert SNMP managers when events occur. There are two types of notification mechanisms supported by the switch.

- SNMP Notification - SNMP traps are sent to external SNMP management stations.
- Authentication Notification - Failed authentication attempts are logged by the switch.

Use the **SNMP Notification** section of the **SNMP Trap Station** screen to enable the notification mechanisms. Click **SNMP > Trap Station** to view the screen as shown.

Figure 68 SNMP Notification



The following table describes the labels in this screen.

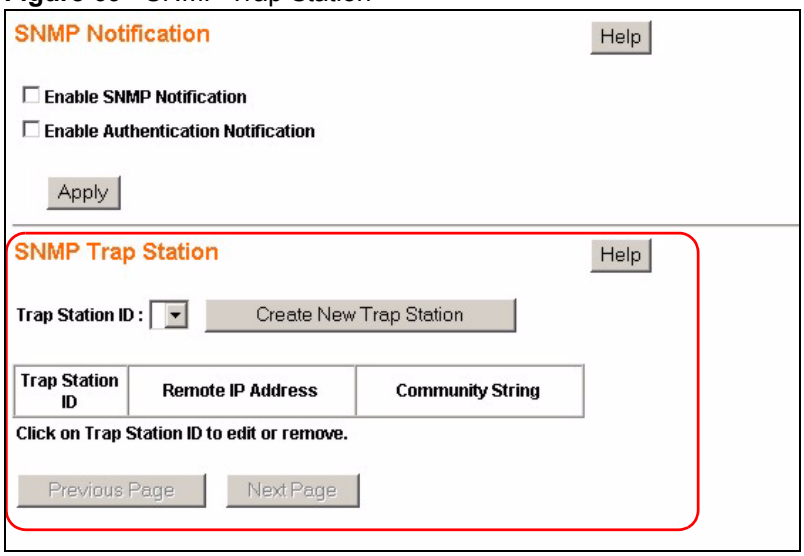
Table 49 SNMP Notification

LABEL	DESCRIPTION
Enable SNMP Notification	Select this to enable the sending of SNMP traps to a remote SNMP management station.
Enable Authentication Notification	Select this to enable logging of failed authentication attempts.
Apply	Click this to save your settings to the switch.

18.6 SNMP Trap Station

SNMP traps are used to send out SNMP notifications of urgent or normal events in the system to external management stations. Use the **SNMP Trap Station** screen to enable the sending of SNMP traps to a remote SNMP management station(s). Click **SNMP > Trap Station** to view the screen as shown.

Figure 69 SNMP Trap Station



The following table describes the labels in this screen.

Table 50 SNMP Trap Station

LABEL	DESCRIPTION
Trap Station ID	Select the SNMP trap station you want to edit.
Create New Trap Station	Click this to configure a new SNMP Trap Station.
Trap Station ID	This field indicates the trap station number. It is used for identification only. Click on the individual trap station number to edit the trap station settings.
Remote IP Address	This field displays the IP address of the remote SNMP management station.

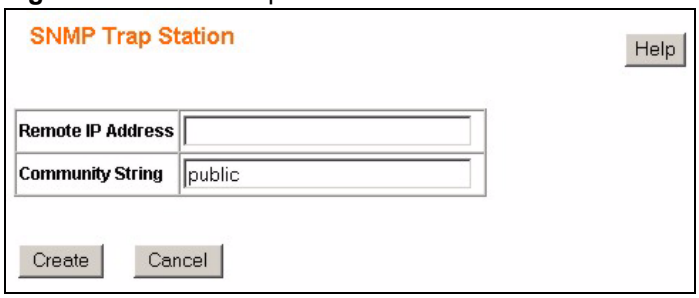
Table 50 SNMP Trap Station (continued)

LABEL	DESCRIPTION
Community String	An SNMP community string is a text string that acts as a password. It is used to authenticate messages that are sent between the management station (the SNMP manager) and the device (the SNMP agent). The community string is included in every packet that is transmitted between the SNMP manager and the SNMP agent. This field displays the community string of this remote trap station.
Previous Page/ Next Page	Use these navigation links to browse all of your SNMP groups.

18.6.1 SNMP Trap Station - Create

Click on the **Create New Trap Station** link in the **SNMP Trap Station** screen to add an SNMP Trap Station. The screen displays as shown.

Figure 70 SNMP Trap Station - Create



The following table describes the labels in this screen.

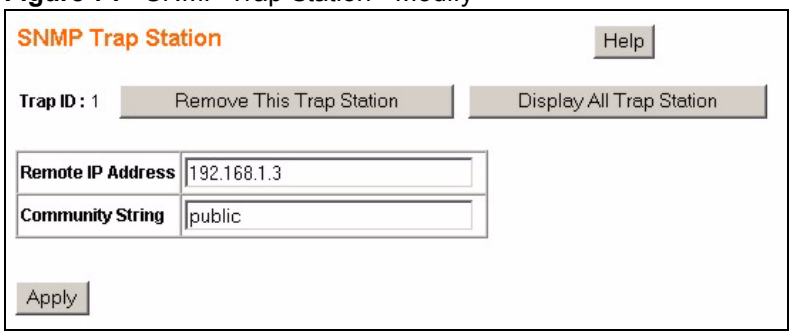
Table 51 SNMP Trap Station - Create

LABEL	DESCRIPTION
Remote IP Address	Enter the IP address of the remote trap station in dotted decimal notation.
Community String	Specify the community string used with this remote trap station.
Create	Click this to add this SNMP user to the switch.
Cancel	Click this to go back to the main **SNMP Group** screen without saving your changes.

18.6.2 SNMP Trap Station - Modify

Click on the **Trap Station ID** number or select a **Trap Station ID** from the **Trap Station ID** drop down list box in the **SNMP Trap Station** screen to modify the settings of an existing trap station.

Figure 71 SNMP Trap Station - Modify



The following table describes the labels in this screen.

Table 52 SNMP Trap Station - Modify

LABEL	DESCRIPTION
Trap ID	This field indicates which trap station you are modifying. Click on **Remove This Trap Station** to delete this trap station configuration from the switch. Click on **Display All Trap Station** to view the main **SNMP Trap Station** screen.
Remote IP Address	Enter the IP address of the remote trap station in dotted decimal notation.
Community String	Specify the community string used with this remote trap station.
Apply	Click this to save your settings to the switch.

19

RMON-Lite

This chapter explains how to configure the **RMON-Lite** screens.

19.1 RMON-Lite Overview

The Remote Network Monitoring Management Information Base (RMON MIB) defines objects for managing remote network monitoring devices. The remote network monitoring devices, referred to as monitors or probes, are usually stand-alone devices and devote significant internal resources for the purposes of managing a network. There are a total of nine RMON MIB groups defined in RFC 2819. The switch supports four of the RMON MIB groups:

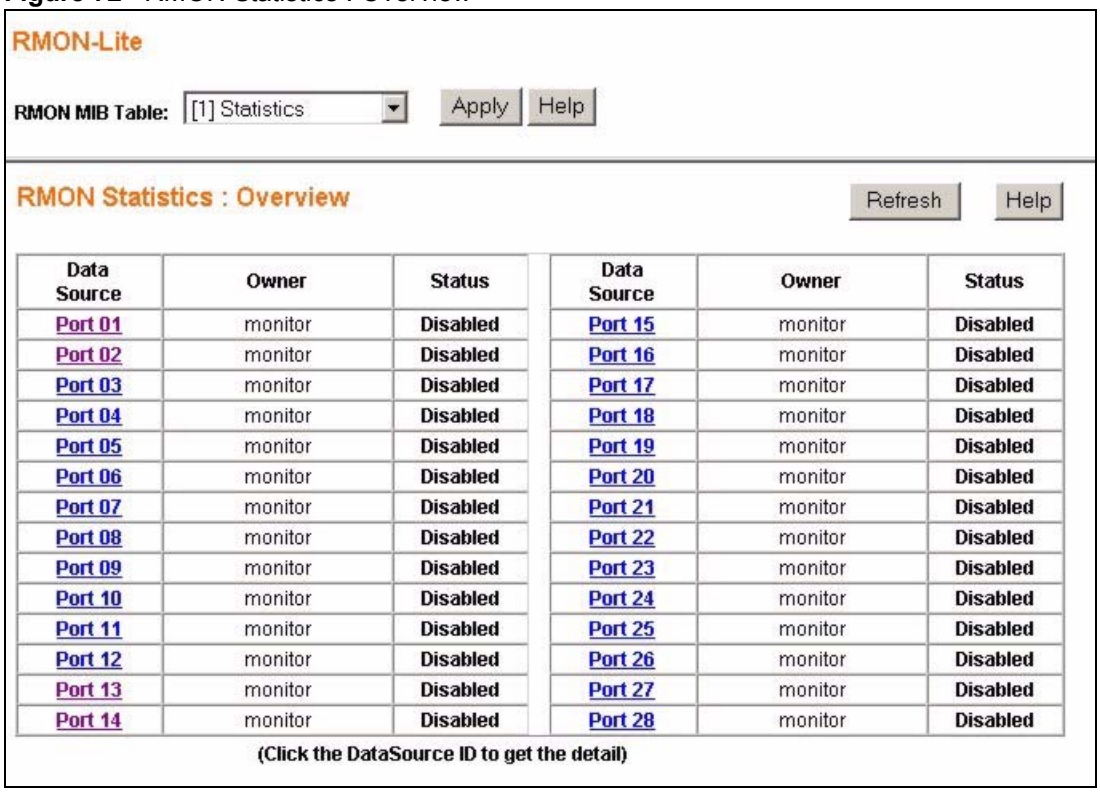
- Group 1 (Statistics)
- Group 2 (History)
- Group 3 (Alarm)
- Group 9 (Event)

The switch's implementation is therefore referred to as RMON-Lite. The following sections describe how to configure the RMON-Lite settings on the switch. Refer to RFC 2819 for more information on RMON MIBs.

19.2 RMON Statistics : Overview

Click **RMON-Lite** in the navigation panel to open the **RMON Statistics : Overview** screen. Use this screen to look at and configure settings for gathering statistics for the Ethernet ports on the switch.

Figure 72 RMON Statistics : Overview



The following table describes the labels in this screen.

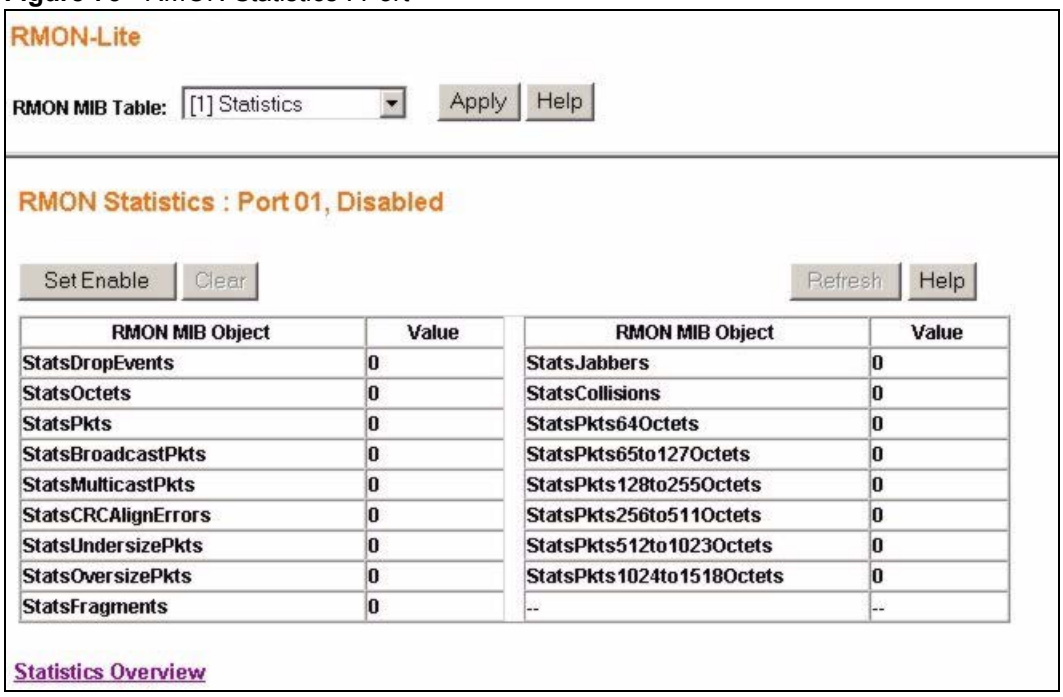
Table 53 RMON Statistics : Overview

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON-Lite Statistics : Overview** screen.
Data Source	This field displays the ports on the switch. Click on the port number to configure the settings for that port.
Owner	This field displays the entry creator. It displays **monitor** if the entry was created by the switch itself.
Status	This field displays **Enabled**, if statistics are being collected on this port. It displays **Disabled**, if statistics are not being collected on this port.

19.3 RMON-Lite Statistics : Port

Use this screen to enable statistics gathering and view the statistics for individual ports. Click on a port number in the **RMON Statistics: Overview** screen to view the screen as shown.

Figure 73 RMON Statistics : Port



The following table describes the labels in this screen.

Table 54 RMON Statistics : Port

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Set Enable	Click this to activate statistics gathering for this port.
Clear	Click this to reset all statistics values to “0”.
Refresh	Click this to update all the fields in the **RMON Statistics : Port** screen.
RMON MIB Object	This column displays all types of statistics gathered for this port. It displays the results in the **Value** column.
StatsDropEvents	This field displays the total number of packets that were dropped.
StatsOctets	This field displays the total number of octets received.
StatsPkts	This field displays the total number of all good packets received.
StatsBroadcastPkts	This field displays the total number of good broadcast packets received.
StatsMulticastPkts	This field displays the total number of good multicast packets received.
StatsCRCAlignErrors	This field displays the number of packets (between 64 ~ 1518 octets long) dropped because they either had bad Frame Check Sequence (FCS) or non-integral number of octets (alignment error).
StatsUndersizePkts	This field displays the number of packets (including bad packets) received that were between 0 and 64 octets in length.
StatsOversizePkts	This field displays the number of untagged packets (including bad packets) received that were greater than 1518 octets in length.
StatsFragments	This field displays the number of frames dropped because they were less than 64 octets long, and contained an invalid FCS, including non-integral and integral lengths.
StatsJabbers	This field displays the number of frames dropped because they were longer than 1518 octets and contained an invalid FCS, including alignment errors.
StatsCollisions	This field displays the total number of collisions occurred.

Table 54 RMON Statistics : Port (continued)

LABEL	DESCRIPTION
StatsPkts64Octets	This field displays the number of packets (including bad packets) received that were 64 octets in length.
StatsPkts65to127Octets	This field displays the number of packets (including bad packets) received that were between 65 and 127 octets in length.
StatsPkts128to255Octets	This field displays the number of packets (including bad packets) received that were between 128 and 255 octets in length.
StatsPkts256to511Octets	This field displays the number of packets (including bad packets) received that were between 256 and 511 octets in length.
StatsPkts512to1023Octets	This field displays the number of packets (including bad packets) received that were between 512 and 1023 octets in length.
StatsPkts1024to1518Octets	This field displays the number of untagged packets (including bad packets) received that were between 1024 and 1518 octets in length. This number also includes tagged packets received that were 1522 octets in size.

19.4 RMON-Lite History MIB

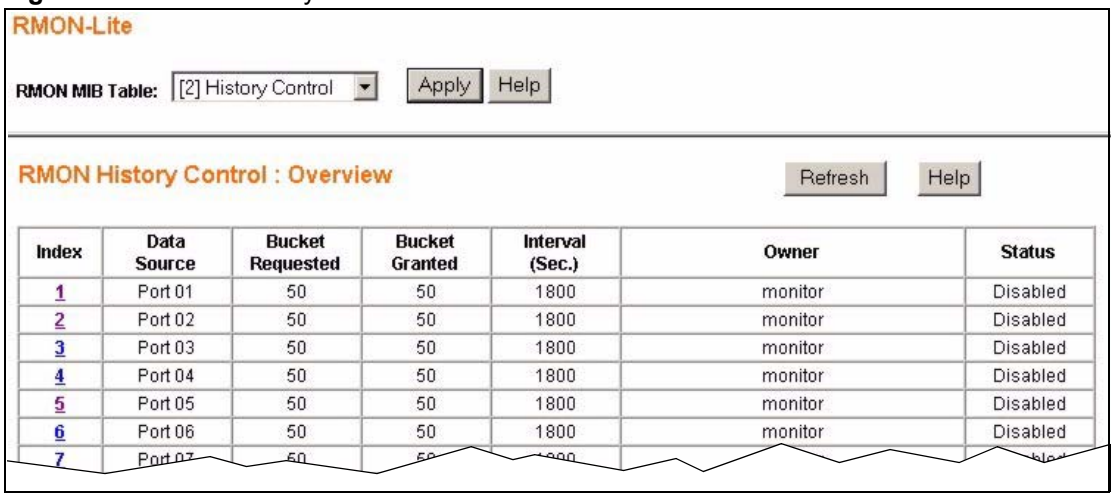
RMON-Lite History MIB configuration is divided into two parts: **[2] History Control** and **[2] History Statistics**.

- Use the **[2] History Control** screens to view and define the statistical sampling of data from activity in your network. Statistical sampling is controlled by defining the interface (port), polling period and the number of samples to be taken per polling period.
- Use the **[2] History Statistics** screens to view the results of statistical sampling on the ports.

19.4.1 RMON History Control : Overview

Click **RMON-Lite** in the navigation panel and select **[2] History Control** to open the **RMON History Control: Overview** screen. Use this screen to view and configure RMON history configuration settings.

Figure 74 RMON History Control : Overview.



The following table describes the labels in this screen.

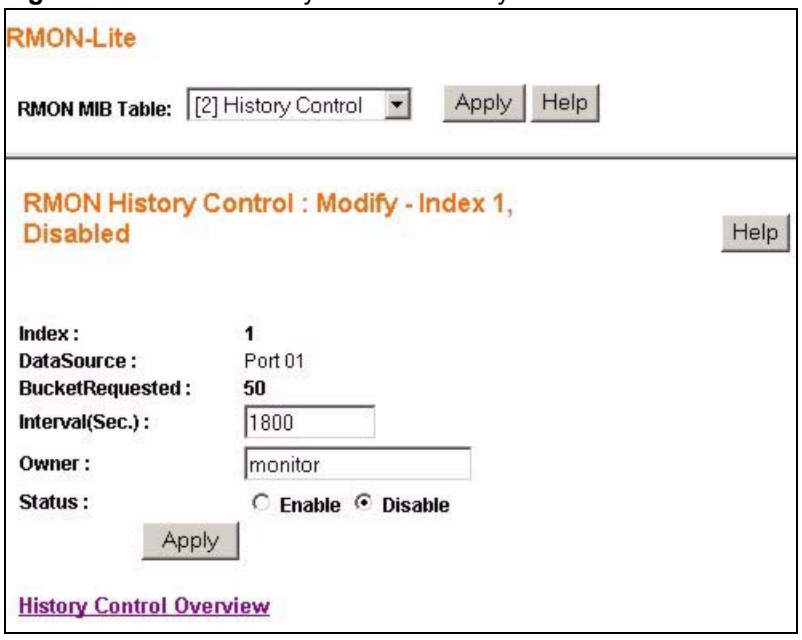
Table 55 RMON History Control : Overview.

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON History Control : Overview** screen.
Index	This field displays the configuration index number.
Data Source	This is the port of the switch polled for data.
Bucket Requested	This field displays the number of data samplings the network manager requests the probe to store.
Bucket Granted	This field displays the number of data samplings the probe allows to store.
Interval (sec)	This field displays the time between data samplings.
Owner	This field displays the entry creator. It displays “monitor” if the entry was created by the switch itself.
Status	This field displays **Enabled** if historical polling is activated on the port. It displays **Disabled** if historical polling is not activated on the port.

19.4.2 RMON History Control : Modify

Use the **RMON History Control : Modify** screen to define the statistical sampling of data from activity in your network. Click an index number in the **RMON History Control : Overview** screen to see the screen as shown.

Figure 75 RMON History Control : Modify



The following table describes the labels in this screen.

Table 56 RMON History Control : Modify

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Index	This field displays the entry index number.
Data Source	This field displays the port number associated with the **Index** entry.

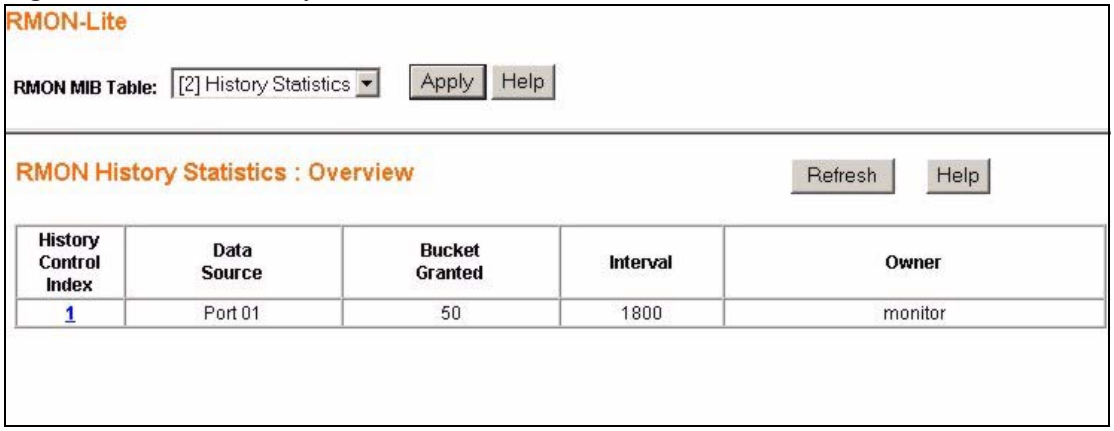
Table 56 RMON History Control : Modify (continued)

LABEL	DESCRIPTION
BucketRequested	This field displays the number of samplings the Owner of the entry requests.
Interval	Enter the time (in seconds) between data samplings.
Owner	Enter a descriptive name of the application that creates this entry. You can use 1-64 printable characters. Spaces are not allowed.
Status	Select **Enable**/**Disable** to activate or deactivate statistical sampling on the port.
Apply	Click this to save the settings on the switch.
History Control Overview	Click this to go back to the **RMON History Control : Overview** screen.

19.4.3 RMON History Statistics : Overview

Use the **RMON History Statistics : Overview** screen to view the results of statistical sampling on the ports. Select **[2] History Statistics** from the **RMON MIB Table:** drop down listbox in the **RMON-Lite** screen to view the screen as shown.

Figure 76 RMON History Statistics : Overview.



The following table describes the labels in this screen.

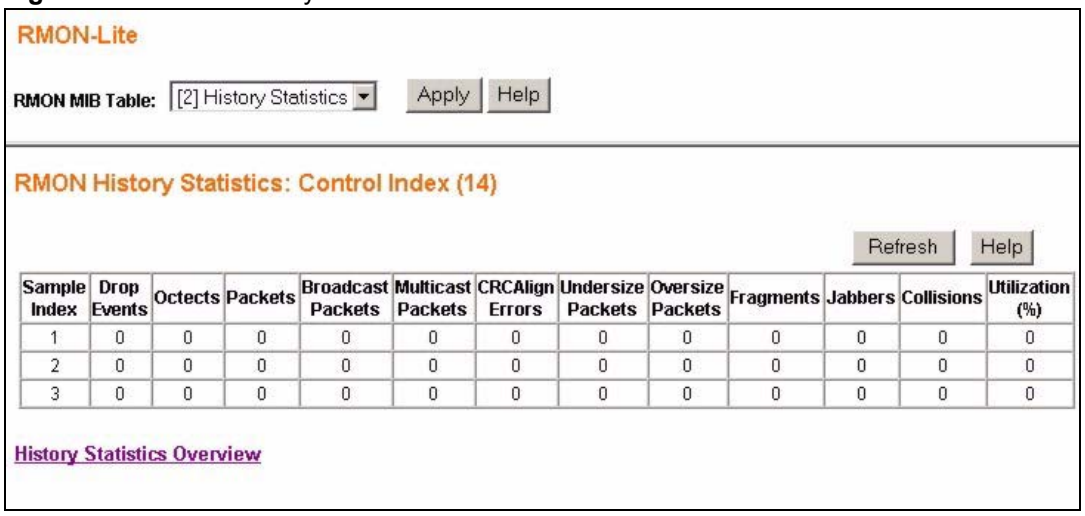
Table 57 RMON History Statistics : Overview

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON History Statistics : Overview** screen.
History Control Index	This field displays the configuration index number. Click on the index number to view the details for this entry.
Data Source	This is the port of the switch polled for data.
Bucket Granted	This field displays the number of data samplings the probe allows to store.
Interval	This field displays the time between data samplings in seconds.
Owner	This field displays the creator of this entry.

19.4.4 RMON History Statistics: Control

Use the **RMON History Statistics: Control** screen to view the details of each polling sample collected for the history control index entries you configured. Click on an individual **History Control Index** entry in the **RMON History Statistics: Overview** screen to view the screen as shown.

Figure 77 RMON History Statistics: Control



The following table describes the labels in this screen.

Table 58 RMON History Statistics: Control

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON History Statistics : Control Index** screen.
Sample Index	This field displays the index number of the polling sample collected on the port.
Drop Events	This field displays the total number of packets that were dropped in this polling sample.
Octets	This field displays the total number of octets received in this polling sample.
Packets	This field displays the total number of all good packets received in this polling sample.
Broadcast Packets	This field displays the total number of good broadcast packets received in this polling sample.
Multicast Packets	This field displays the total number of good multicast packets received in this polling sample.
CRCAlign Errors	This field displays the number of packets (between 64 ~ 1518 octets long) dropped in this polling sample because they either had bad Frame Check Sequence (FCS) or non-integral number of octets (alignment error).
Undersize Packets	This field displays the number of packets (including bad packets) received in this polling sample that were between 0 and 64 octets in length.
Oversize Packets	This field displays the number of untagged packets (including bad packets) received in this polling sample that were greater than 1518 octets in length.
Fragments	This field displays the number of frames dropped in this polling sample because they were less than 64 octets long, and contained an invalid FCS, including non-integral and integral lengths.

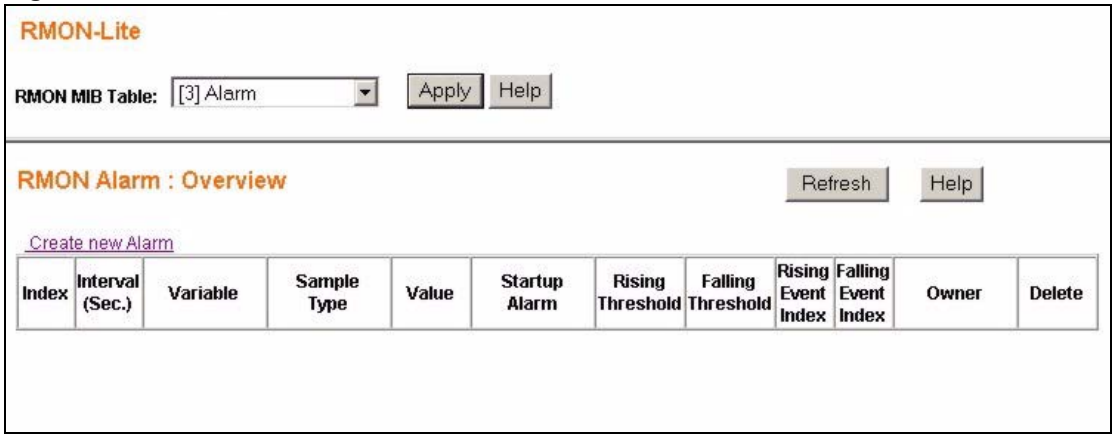
Table 58 RMON History Statistics: Control (continued)

LABEL	DESCRIPTION
Jabbers	This field displays the number of frames dropped in this polling sample because they were longer than 1518 octets and contained an invalid FCS, including alignment errors.
Collisions	This field displays the total number of collisions that occurred in this polling sample.
Utilization (%)	This field displays the utilization as a percentage of maximum utilization allowed on the port in this polling sample.
History Statistics Overview	Click this to go back to the **RMON History Statistics: Overview** screen.

19.5 RMON Alarm: Overview

Use the **RMON Alarm: Overview** screen to view configured alarms that occur when the sampled data exceeds the specified threshold. To open this screen select **[3] Alarm** in the **RMON MIB Table:** drop down list box in the **RMON-Lite** screen.

Figure 78 RMON Alarm: Overview.



The following table describes the labels in this screen.

Table 59 RMON Alarm: Overview

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON Alarm: Overview** screen.
Create new Alarm	Click this to view the RMON Alarm: Create New Alarm screen where you can configure the parameters for an alarm.
Index	This field displays the alarm configuration index number. Click this number to edit the alarm entry.
Interval (sec)	This field displays the time interval (in seconds) between data samplings.
Variable	This field displays the name of the MIB field whose data is to be sampled.
Sample Type	This field displays the method of obtaining the sample value (**absoluteValue** or **deltaValue**).
Value	This field displays the value of the statistic during the last sampling period. This value is for comparing against the **RisingThreshold** and **FallingThreshold** values.
Startup Alarm	This field displays the alarm type (**1:rising**, **2:falling**, or **3:risingOrFallingAlarm**) that can be sent when this alarm is first activated.

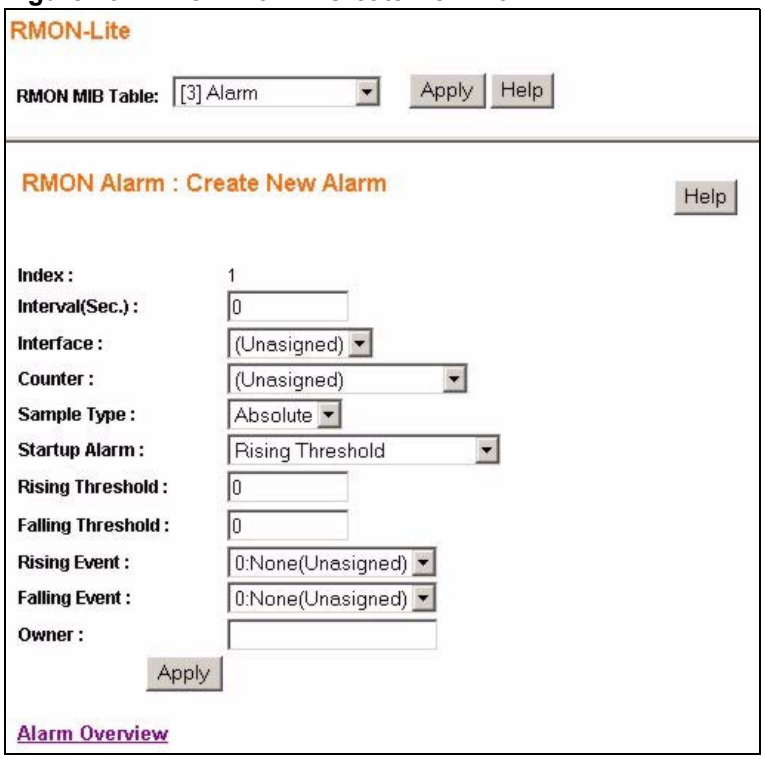
Table 59 RMON Alarm: Overview (continued)

LABEL	DESCRIPTION
RisingThreshold	This field displays the rising threshold value set up for this alarm.
FallingThreshold	This field displays the falling threshold value set up for this alarm.
Rising Event Index	This field indicates the index number of the event entry which corresponds to the time when the alarm threshold was crossed.
Falling Event Index	This field indicates the index number of the event entry which corresponds to the time when the alarm threshold was crossed.
Owner	This field displays the name of the creator of this entry.
Delete	Click this to remove the selected alarm entry.

19.5.1 RMON Alarm : Create New Alarm

Use the **RMON Alarm : Create New Alarm** screen to configure RMON alarms. Click **Create new Alarm** or click on an existing alarm index entry in the **RMON Alarm : Overview** screen to view the screen as shown.

Figure 79 RMON Alarm : Create New Alarm



The following table describes the labels in this screen.

Table 60 RMON Alarm : Create New Alarm

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Index	This field displays the index number of this alarm entry.
Interface	Select the port which is monitored for this alarm.
Counter	Select the data which is used to test if this alarm is triggered, the choices are **Drop Events**, **Octets**, **Packets** and so on.

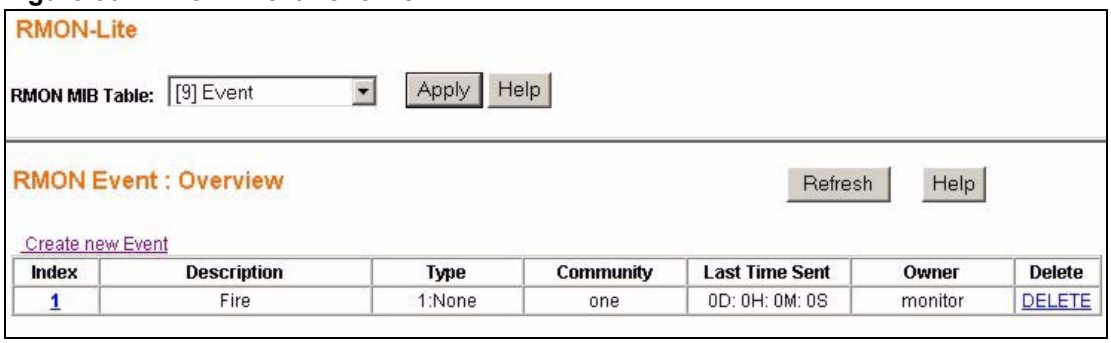
Table 60 RMON Alarm : Create New Alarm (continued)

LABEL	DESCRIPTION
Sample Type	Select the method of obtaining the sample value. Choices are **Absolute** and **Value**.
Startup Alarm	Select the startup alarm type (**Rising Threshold**, **Falling Threshold**, **Rising Or Falling Threshold**).
Rising Threshold	Specify a rising threshold (between 0 and 2147483647). When a value is greater or equal to this threshold, the probe triggers an alarm.
Falling Threshold	Specify the falling threshold (between 0 and 2147483647). When a value is smaller or equal to this threshold, the probe triggers an alarm.
Rising Event	Select an index number of a rising event.
Falling Event	Select an index number of a falling event.
Owner	Enter a descriptive name of the application that creates this entry. You can use 1-64 printable ASCII characters. Spaces are not allowed.
Apply	Click this to save the settings to the switch.
Alarm Overview	Click this to go back to the **RMON Alarm : Overview** screen.

19.6 RMON Event : Overview

Use the **RMON Event : Overview** screen to view and delete event entries configured on the switch. Select **[9] Event** from the **RMON MIB Table:** drop down listbox in the **RMON-Lite** screen to view the screen as shown.

Figure 80 RMON Event : Overview.



The following table describes the labels in this screen.

Table 61 RMON Event : Overview

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON Event : Overview** screen.
Create new Event	Click this to configure new events on the switch.
Index	This field displays an event index number. Click this number to edit the event entry.
Description	This field displays a description of the event.
Type	This field displays the event type (**1:None**, **2:Log**, **3:SNMP-Trap**, **4:Log-and-Trap**).
Community	This field displays the community or SNMP trap.
Last Time Sent	This field indicates the value of system up time on the switch when this event was last generated. It appears in the following format “XXD: XXH: XXM: XXS”, where “XX” stands for a number and “D” stands for days, “H” for hours, “M” for minutes and “S” for seconds.

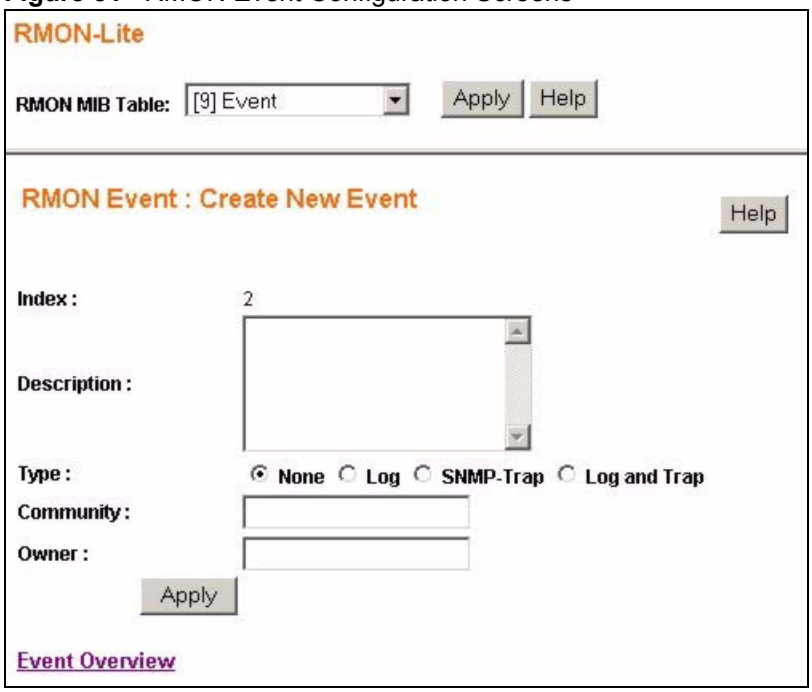
Table 61 RMON Event : Overview (continued)

LABEL	DESCRIPTION
Owner	This field displays the name of the creator of this entry.
Delete	Click this to remove the selected event configuration.

19.6.1 RMON Event Configuration Screens

Use the **RMON Event: Create** and the **RMON Event: Modify** screens to configure RMON events. Click **Create new Event** in the **RMON Event : Overview** screen to view the screen as shown. You can also click an event index number in the **RMON Event : Overview** screen to edit an existing event configuration. Only the **RMON Event : Create** screen is shown as the modify screen contains the same fields.

Figure 81 RMON Event Configuration Screens



The following table describes the labels in this screen.

Table 62 RMON Event Configuration Screens

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Index	This field displays the index number of the event entry.
Description	Enter a description of the event. You can use 1-127 printable ASCII characters. Spaces are allowed. You can also leave this field blank.
Type	Select an event type: • **None** to do nothing. • **Log** to generate a log when an associated alarm is generated. • **Trap** to generate a trap when an associated alarm is generated. • **Log and Trap** to generate a log entry and trap when an associated alarm is generated.
Community	This field displays the community (or password). You can use 1-31 printable ASCII characters. Spaces are not allowed.

Table 62 RMON Event Configuration Screens (continued)

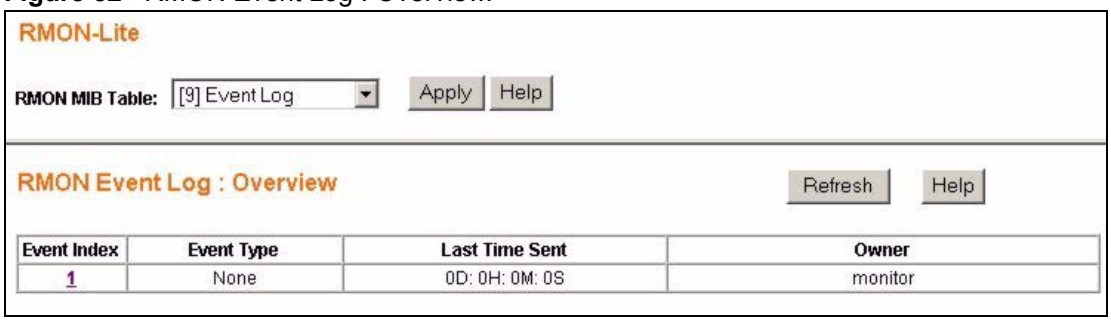
LABEL	DESCRIPTION
Owner	Enter a descriptive name of the application that creates this entry. You can use 1-64 printable ASCII characters. Spaces are not allowed.
Apply	Click this to save the settings to the switch.
Event Overview	Click this to go to the **RMON Event : Overview** screen.

19.7 RMON Event Log : Overview

Use the **RMON Event Log : Overview** screen to view the event log entries generated on the switch. All the entries in this table are generated by the RMON-Lite probe when the event value meets the **risingEventThreshold** or **fallingEventThreshold** assigned in the **RMON Alarm** screens.

Select **[9] Event Log** in the **RMON MIB Table:** drop down list box in any **RMON Lite** screen to view the screen as shown.

Figure 82 RMON Event Log : Overview.



The following table describes the labels in this screen.

Table 63 RMON Event Log : Overview

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON Event Log : Overview** screen.
Event Index	This field displays an event index number.
Event Type	This field displays the action taken when this event occurred: **None**, **Log**, **Trap**, or **Log and Trap**.
Last Time Sent	This field indicates the value of system up time on the switch when this event was last generated. It appears in the following format “XXD: XXH: XXM: XXS”, where “XX” stands for a number and “D” stands for days, “H” for hours, “M” for minutes and “S” for seconds.
Owner	This field displays the entry creator. It displays “monitor” if the entry was created by the switch itself.

19.7.1 RMON Event Log : Event

Use the **RMON Event Log : Event** screen to view the details of existing RMON event log entries. Click on the specific **Event Index** numbers in the **RMON Event Log : Overview** screen to view the screen as shown.

Figure 83 RMON Event Log : Event

The following table describes the labels in this screen.

Table 64 RMON Event Log : Event

LABEL	DESCRIPTION
RMON MIB Table:	Use this drop down list box to select the MIB table you want to view. Click **Apply** to refresh the screen to the selected MIB table view.
Refresh	Click this to update all the fields in the **RMON Event Log : Event Index** screen.
Log Index	This field displays a log index number.
Log Time	This field displays the time a log was generated.
Log Description	This field displays an implementation dependent description of the event that activated this log entry.
Event Log Overview	Click this to view the **RMON Event Log : Overview** screen.

20

Dynamic ARP

This chapter describes how to activate dynamic Address Resolution Protocol (ARP) learning and how to enter static ARP table entries.

20.1 ARP Table Overview

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network.

An IP (version 4) address is 32 bits long. In an Ethernet LAN, MAC addresses are 48 bits long. The ARP table maintains an association between each MAC address and its corresponding IP address.

20.1.1 ARP Table Entries

The ARP table is populated with MAC and corresponding IP address mappings in two different ways.

- **DHCP Snooping** - The switch listens to traffic from a DHCP server on a trusted port and learns IP-to-MAC address bindings by parsing DHCP ACK packets.
- **Static Entries** - The switch administrator can enter static IP-to-MAC address mappings via the web configurator.

20.1.2 How Dynamic ARP Works

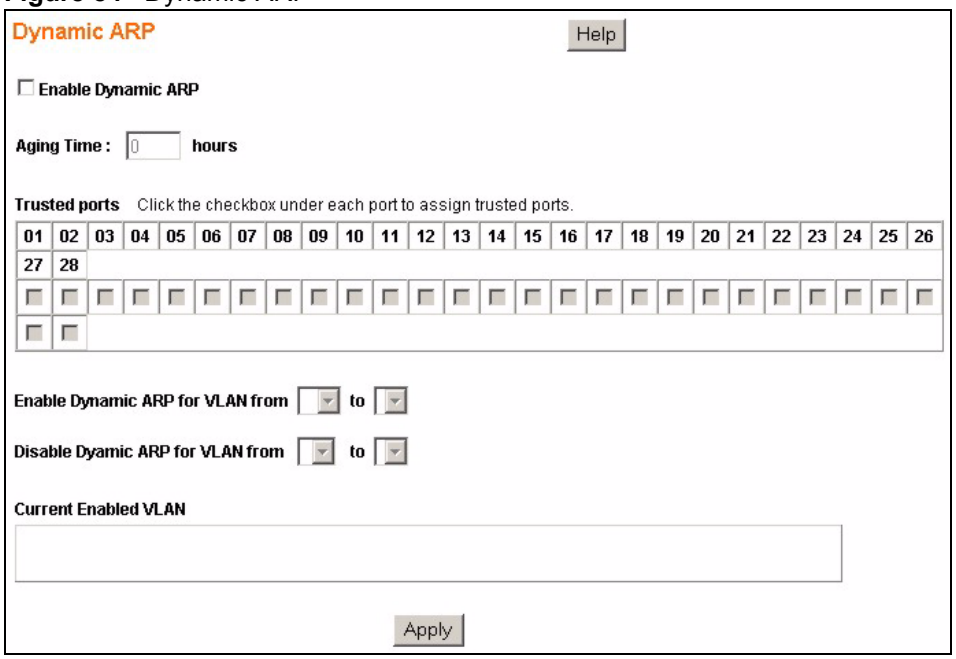
When an incoming ARP packet destined for a host device on a local area network arrives at the switch, the switch's ARP program looks in the ARP table and, if it finds the address, sends it to the device.

If no entry is found for the IP address, dynamic ARP discards the ARP packet.

20.2 Enabling Dynamic ARP

Click **Dynamic ARP > Settings** in the navigation panel to open the following screen. Use the **Dynamic ARP** screen to configure ARP filtering on the specified VLANs.

Figure 84 Dynamic ARP



The following table describes the labels in this screen.

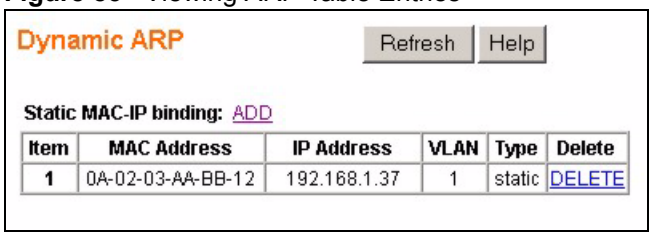
Table 65 ARP Table

LABEL	DESCRIPTION
Enable Dynamic ARP	Select or deselect this to activate or deactivate Dynamic ARP on the switch.
Aging Time	Specify how long (in hours) the switch remembers the learned ARP table entries. Specify “0” to have the switch remember the ARP table entries for an unlimited time period.
Trusted ports	Packets arriving on trusted ports bypass all Dynamic ARP validation checks, and those arriving on untrusted ports undergo the validation process. Default state of all ports is untrusted. Select the trusted ports for each Dynamic ARP configuration you set up.
Enable Dynamic ARP for VLAN from .. to ..	Select the range of VLANs you want to perform validation checks based on the ARP entries in the ARP table.
Disable Dynamic ARP for VLAN from .. to ..	Select the range of VLANs you want to bypass validation checks based on the ARP entries in the ARP table.
Current Enabled VLAN	This field shows the VLANs for which Dynamic ARP validation is enabled.
Apply	Click this to save your settings to the switch.

20.3 Viewing ARP Table Entries

Click **Dynamic ARP > ARP Entries** in the navigation panel to open the following screen. Use this screen to view and add entries to the ARP table.

Figure 85 Viewing ARP Table Entries



The following table describes the labels in this screen.

Table 66 ARP Table

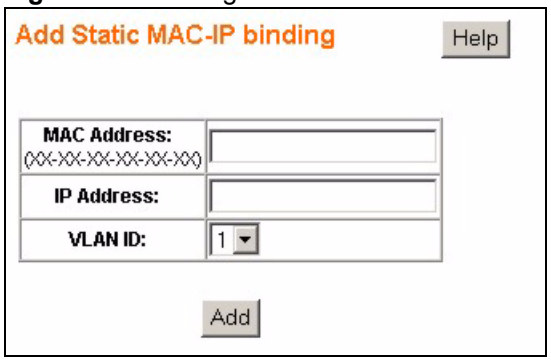
LABEL	DESCRIPTION
Static MAC-IP binding: ADD	This field is only available when you enable dynamic ARP in the **Dynamic ARP > Settings** screen. Click ADD to add a static entry to the ARP table. See Section 20.4 on page 135.
Item	This is the ARP table entry number.
MAC Address	This is the MAC address of the device connected to the switch with the corresponding IP address below.
IP Address	This is the learned IP address of a device connected to a switch port with corresponding MAC address above.
VLAN	This is the VLAN number of the device connected to the switch.
Type	This shows whether the MAC address is **dynamic** (learned by the switch) or **static** (manually entered in the **Add Static MAC-IP binding** screen).
DELETE	Click this to remove this ARP table entry.

20.4 Adding ARP Table Entries

Click **ADD** in the **Dynamic ARP > ARP Entries** screen to open the **Add Static MAC-IP binding** screen. Use this screen to add entries to the ARP table.

You must first enable dynamic ARP in the Dynamic ARP > Settings screen before you can add static ARP table entries.

Figure 86 Viewing ARP Table Entries



The following table describes the labels in this screen.

Table 67 ARP Table

LABEL	DESCRIPTION
MAC Address (XX-XX-XX-XX-XX-XX)	Enter the MAC address in 6 pair hexadecimal format of the network device you want to be allowed to communicate via the switch. An example entry of a MAC address is “0a-b1-c2-d3-e4-f5”.
IP Address	Enter the corresponding IP address (in dotted decimal notation, ex 192.168.1.5) of the network device you want to be allowed to communicate via the switch.
VLAN ID	Select the VLAN ID for this ARP entry.
Add	Click this to save this entry to the ARP table and view the **Dynamic ARP** screen.

21

Troubleshooting

This chapter covers potential problems and possible remedies.

21.1 Problems Starting Up the Switch

Table 68 Troubleshooting the Start-Up of Your Switch

PROBLEM	CORRECTIVE ACTION
None of the LEDs turn on when you turn on the switch.	Check the power connection and make sure the power source is turned on.
	If the error persists, you may have a hardware problem. In this case, you should contact your vendor.

21.2 Problems Accessing the Switch

Table 69 Troubleshooting Accessing the Switch

PROBLEM	CORRECTIVE ACTION
I cannot access the web configurator.	The administrator username is “admin”. The default administrator password is “admin”. The username and password are case-sensitive. Make sure that you enter the correct password and username using the proper casing. If you have changed the password and have now forgotten it, you will need to reset the switch to its factory defaults. Press the **RESET** button on the front panel of the switch for one second and the switch automatically reloads its default configuration file. The IP address of the switch reverts to “192.168.1.1”. Your computer’s and the switch’s IP addresses must be on the same subnet. See the following section to check that pop-up windows, JavaScripts and Java permissions are allowed.

21.2.1 Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

21.2.1.1 Internet Explorer Pop-up Blockers

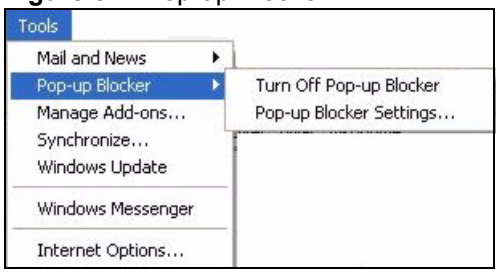
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

21.2.1.1.1 Disable pop-up Blockers

1. In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

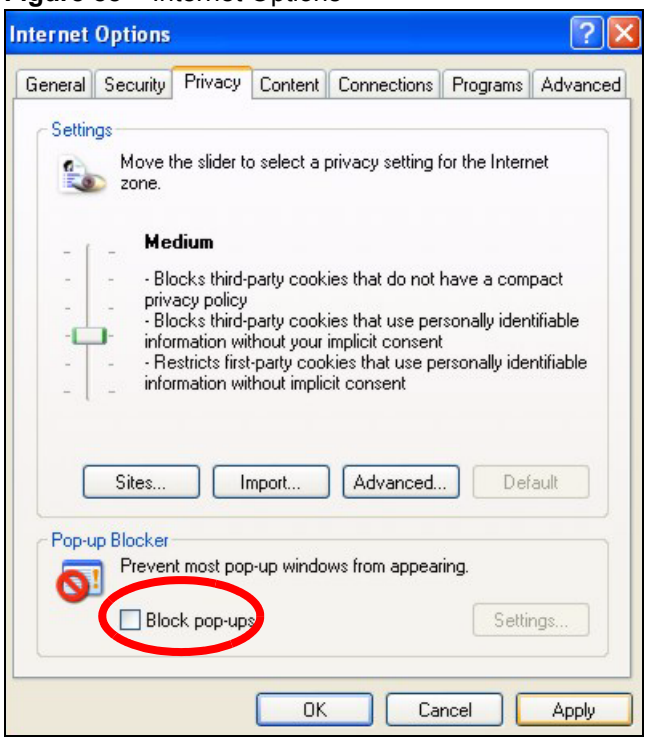
Figure 87 Pop-up Blocker



You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1. In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.
2. Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 88 Internet Options



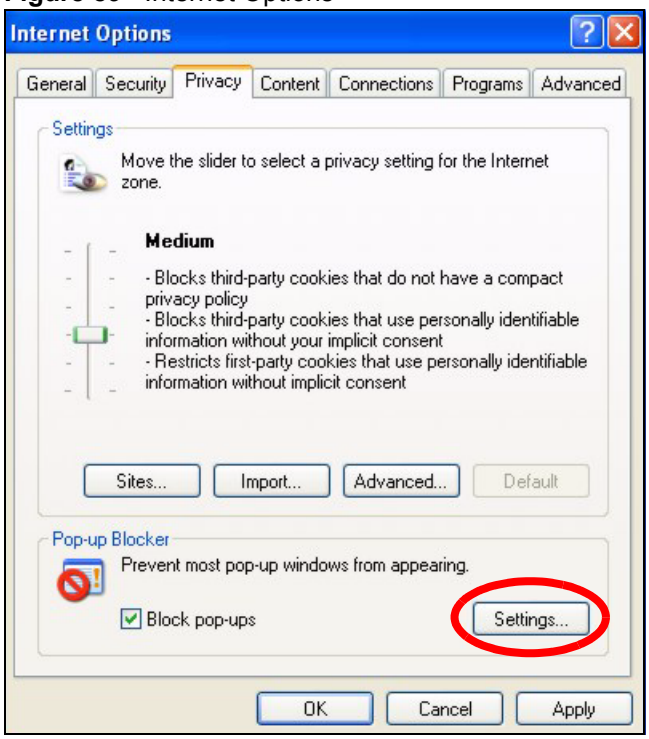
3 Click **Apply** to save this setting.

21.2.1.1.2 Enable pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.
2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

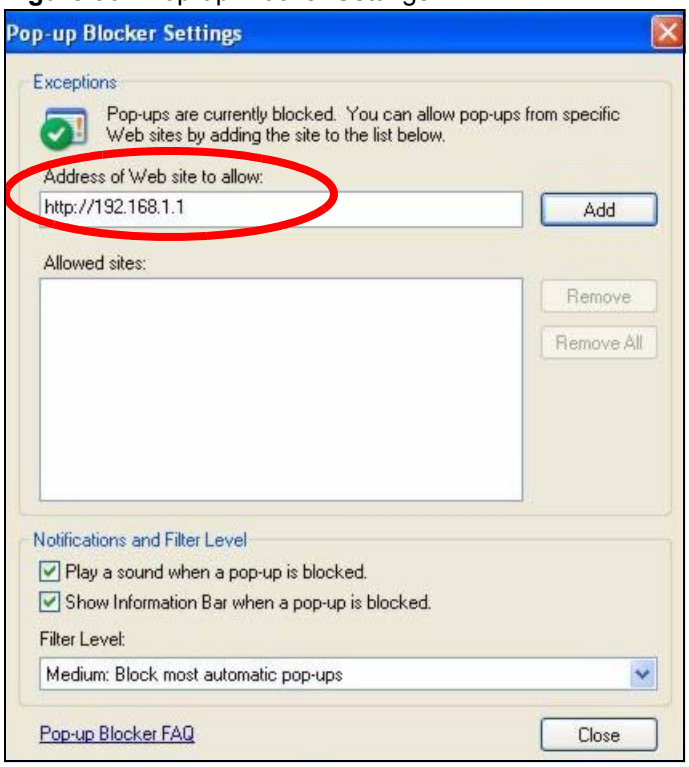
Figure 89 Internet Options



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.1.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 90 Pop-up Blocker Settings



5 Click **Close** to return to the **Privacy** screen.

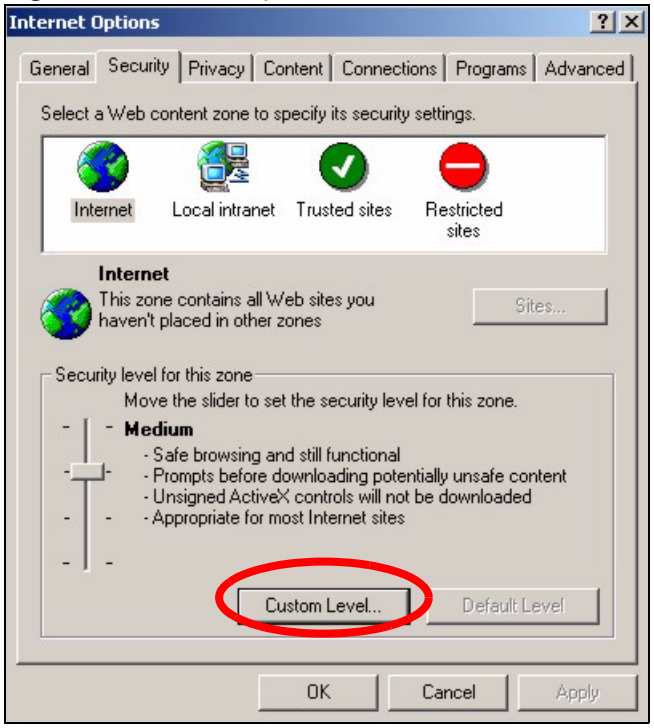
6 Click **Apply** to save this setting.

21.2.1.2 JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 91 Internet Options



2 Click the **Custom Level...** button.

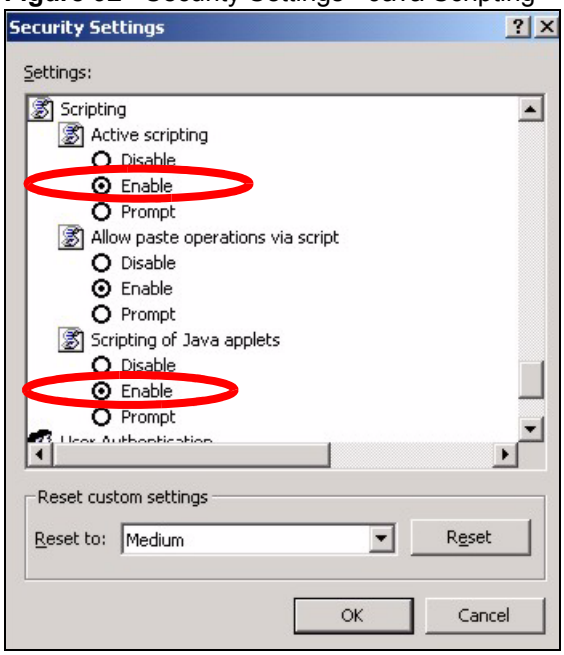
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

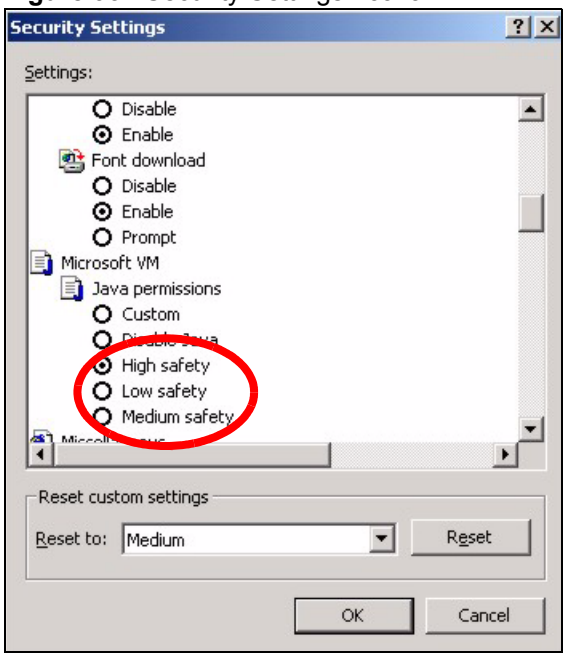
Figure 92 Security Settings - Java Scripting



21.2.1.3 Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

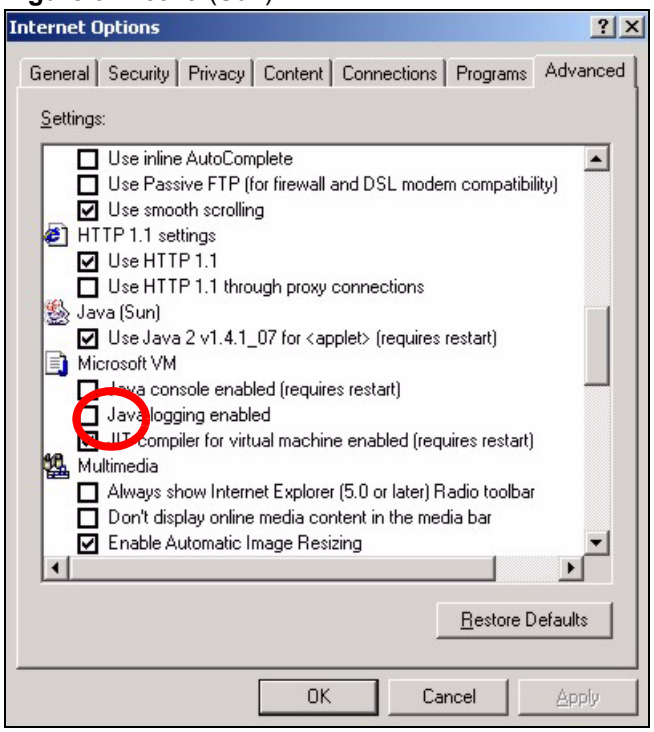
Figure 93 Security Settings - Java



21.2.1.3.1 JAVA (Sun)

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2. make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3. Click **OK** to close the window.

Figure 94 Java (Sun)



PART IV Appendices and Index

This part contains the following chapters.

A

Product Specifications

This section describes the general software features of the switch.

Table 70 Firmware Features

FEATURE	DESCRIPTION
VLAN	A VLAN (Virtual Local Area Network) allows a physical network to be partitioned into multiple logical networks. Devices on a logical network belong to one group. A device can belong to more than one group. With VLAN, a device cannot directly talk to or hear from devices that are not in the same group(s); the traffic must first go through a router.
Level 2 Management	Forward traffic based on the destination MAC address and VLAN group (ID).
QoS	Queuing is used to help solve performance degradation when there is network congestion. Two scheduling services are supported: Strict Priority (SP) and Weighted Round Robin (WRR). This allows the switch to maintain separate queues for packets from each individual source or flow and prevent a source from monopolizing the bandwidth.
Rate Control	Rate control is a combination of bandwidth management and broadcast storm control. This feature allows you to set limits for incoming and outgoing traffic on the ports. The broadcast storm control feature helps prevent broadcast, multicast or unknown unicast traffic from flooding your network.
Port Mirroring	Port mirroring allows you to copy traffic going from one or all ports to another or all ports in order that you can examine the traffic from the mirror port (the port you copy the traffic to) without interference.
Link Aggregation	Link aggregation (trunking) is the grouping of physical ports into one logical higher-capacity link. You may want to trunk ports if for example, it is cheaper to use multiple lower-speed links than to under-utilize a high-speed, but more costly, single-port link.
Device Management	Use the web configurator to easily configure the rich range of features on the switch.
Firmware Upgrade	Download new firmware (when available) from the ZyXEL web site and use the web configurator to put it on the switch. **Note: Only upload firmware for your specific model!**
Configuration Backup & Restoration	Make a copy of the switch's configuration and put it back on the switch later if you decide you want to revert back to an earlier configuration.
Auto DoS	The Automatic Denial of Service (DoS) attack detection and prevention feature helps protect you from hackers trying to disrupt or shut down your network.
Auto VoIP	The Automatic VoIP feature grants the highest priority to VoIP traffic ensuring better sound quality and reliability for end users.

Table 70 Firmware Features

FEATURE	DESCRIPTION
Dynamic ARP	Dynamic ARP allows you to filter incoming traffic based on the MAC to IP address mapping. The switch can be configured to only allow trusted devices to communicate via its ports.
RMON-Lite	Remote Network Monitoring Management (RMON) allows you to gather information about the switch's performance, view statistics and create alarms.
Cable Diagnostics	Use this feature to inspect the Ethernet cables connected to the switch for shorts, open faults or shorts-between-pairs.
Logging	The switch allows you to specify what information should be logged and where it should be stored. It supports internal logging as well as external logging via a syslog server.

The following tables list the product specifications.

Table 71 General Product Specifications

Interface		24 10/100 Base-Tx ports 2 Mini GBIC ports (Small Form-Factor Pluggable (SFP) fiber ports). Two 10/100/1000 Base-Tx ports Auto-negotiation Auto-MDIX Compliant with IEEE 802.3ad/u/x Back pressure flow control for half duplex Flow control for full duplex (IEEE 802.3x)
Layer 2 Features	Bridging	8K MAC addresses Static MAC address forwarding by destination - 8 static entries Broadcast storm control Static MAC address forwarding
	Switching	Switching fabric: 12.8Gbps, non-blocking Max. Frame size: 1522 bytes Forwarding frame: IEEE 802.3, IEEE 802.1q, Ethernet II, PPPoE Prevent the forwarding of corrupted packets
	QoS	IEEE 802.1p 4 priority queues per port Port-based egress traffic shaping DSCP to IEEE 802.1p mapping ToS to IEEE 802.1p mapping Source IP-based prioritization of traffic
	VLAN	Tag-based (IEEE 802.1Q) VLAN Number of VLAN: 4K, 256 static maximum
	Port Aggregation	Supports static port trunking Six groups (up to 8 ports each)
	Port mirroring	All ports support port mirroring
	Rate control	Supports rate limiting from 64 Kbps to 1 Gbps on a port by port basis for incoming traffic Supports egress traffic shaping via the "bucket - token" algorithm
Security		Static MAC address filtering Dynamic ARP filtering - 16 Static Entries

Table 72 Management Specifications

System Control	Alarm/Status surveillance LED indication for power status Performance monitoring Line speed Four RMON groups (history, statistics, alarms, and events) Throughput monitoring Port mirroring and aggregation Firmware upgrade and download through HTTP FLASH memory Reset to default button
Network Management	Web-based management SNMP v1, v2c and v3; 10 Trap Stations supported RMON groups (history, statistics, alarms and events) 4 Logging servers supported
MIB	RFC1213 MIB II - System RFC1213 MIB II - Interface RFC 1398 MIB - Ether-like RFC2819 Four groups of RMON (history, statistics, alarms and events)

Table 73 Physical and Environmental Specifications

LEDs	Main switch: PWR Per Gigabit port: ACT, 100/1000 Per mini-GBIC port: LNK, ACT Per 100 Mbps Ethernet port: LNK/ACT, FDX/COL
Dimension	Standard 19” rack mountable 441 mm (W) x 130mm (D) x 44 mm (H)
Weight	2 Kg
Temperature	Operating: 0º C ~ 45º C (32º F ~ 113º F) Storage: -10º C ~ 70º C (13º F ~ 158º F)
Humidity	10 ~ 90% (non-condensing)
Power Supply	AC: 100 - 240V 50/60Hz 1.5A max internal universal power supply
Wire Gauge Specifications	
Ground Wire	18 AWG or larger
Power Wire	18 AWG or larger
Safety	CSA 60950-1 EN 60950-1 IEC 60950-1
EMC	FCC Part 15 (Class A) CE EMC (Class A)

B

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

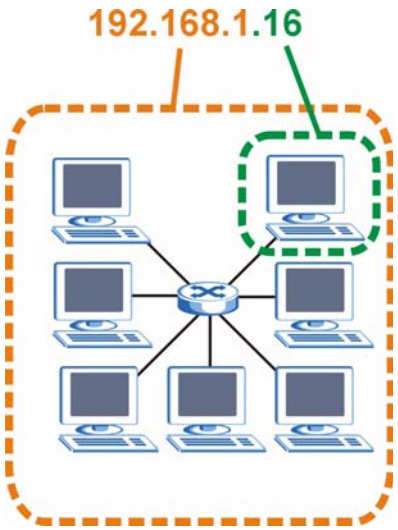
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 95 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 74 Subnet Mask Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 75 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 76 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 77 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 77 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

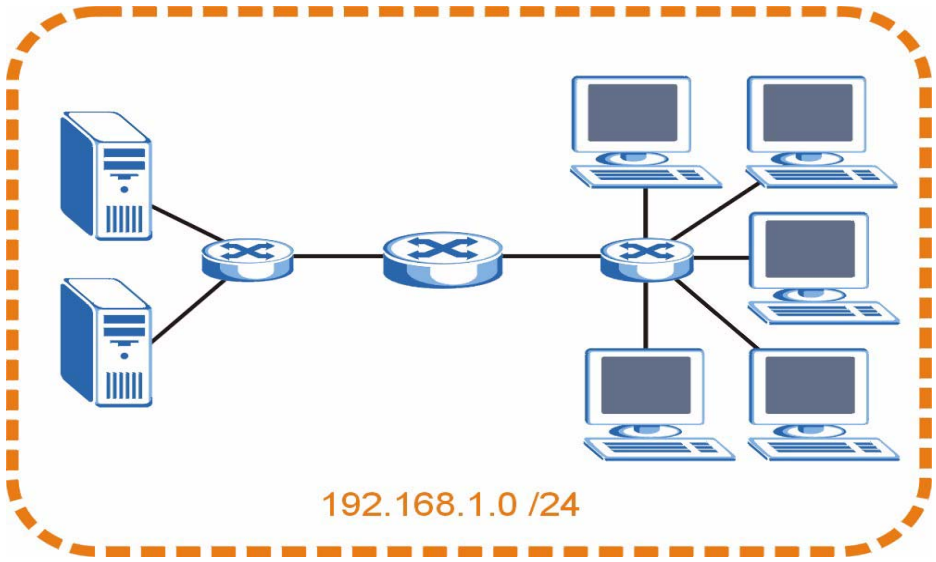
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 96 Subnetting Example: Before Subnetting

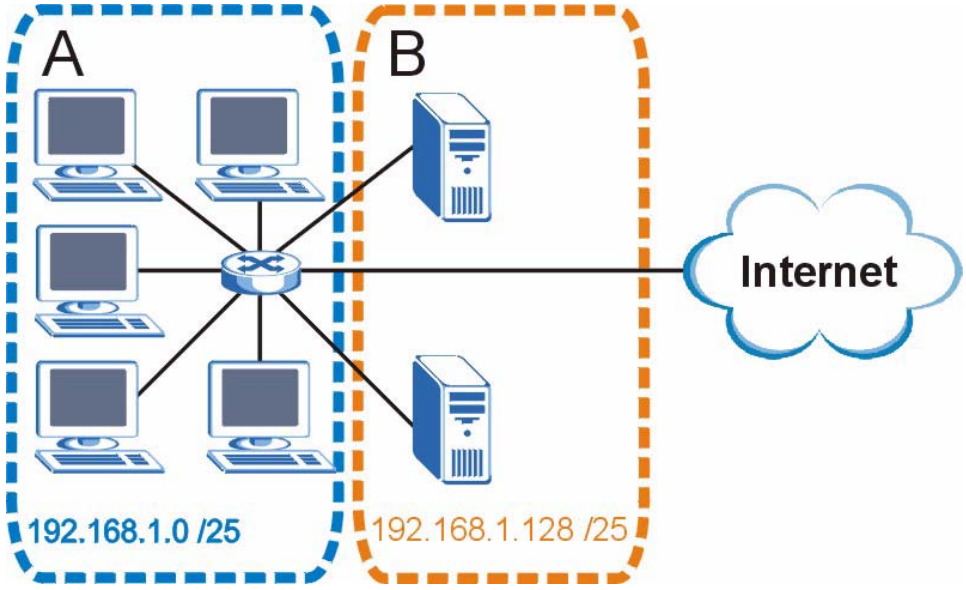


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 97 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 78 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 79 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 80 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 81 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 82 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 82 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 83 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 84 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 84 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the switch.

Once you have decided on the network number, pick an IP address for your switch that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your switch will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the switch unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, *Address Allocation for Private Internets* and RFC 1466, *Guidelines for Management of IP Address Space.*

C

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D

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