


GS748T Software User Manual



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FCC Information to User

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals

FCC Guidelines for Human Exposure

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Declaration Of Conformity

We NETGEAR, Inc., 4500 Great America Parkway, Santa Clara, CA 95054, declare under our sole responsibility that the model GS748T Smart Switch complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

FCC Radio Frequency Interference Warnings & Instructions

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following methods:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment into an electrical outlet on a circuit different from that which the radio receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

GS748T Smart Switch



Tested to Comply
with FCC Standards
FOR HOME OR OFFICE USE
PY306100037

Modifications made to the product, unless expressly approved by NETGEAR, Inc., could void the user's right to operate the equipment.

Canadian Department of Communications Radio Interference Regulations

This digital apparatus (GS748T Smart Switch) does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Canada ID: 4054A-WG111

Product and Publication Details

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About This Manual

The *NETGEAR® GS748T Software User Manual* describes how to install, configure, operate, and troubleshoot the GS748T Smart Switch using its included software. This book describes the software configuration procedures and explains the options available within those procedures.

Who Should Use this Book

The information in this manual is intended for readers with intermediate to advanced system management skills.


This document was created primarily for the system administrator who wishes to install and configure the GS748T switch in a network. It assumes that the reader has a general understanding of switch platforms and a basic knowledge of Ethernet and networking concepts. To install this switch, it is not necessary to understand and use all of its capabilities. Once basic configuration is performed, it will function in a network using its remaining factory default parameters. However, a greater level of configuration—anywhere from the basic up to the maximum possible—will give your network more advantage of its features. The web interface simplifies this configuration at all levels.


How to Use This Book

This document describes configuration commands for the GS748T switch software. The commands can all be accessed from the Web interface.

- [Chapter 1, “Switch Management Overview”](#) describes what you can expect from Web management and gives host system requirements.
- [Chapter 2, “Getting Started—Smart Wizard Discovery”](#) describes how to use the Smart Wizard Discovery utility to set up your switch so that you can communicate with it.
- [Chapter 4, “Configuring the Switch”](#) describes the features that your switch offers and tells you how to configure and activate them in your network.
- [Appendix A, “Specifications and Default Values”](#) gives GS748T switch specifications and lists default feature values.
- [Appendix B, “Virtual Local Area Networks \(VLANs\)”](#) describes some concepts of VLANs

- [Appendix C, “Network Cabling”](#) gives cabling requirements and describes some details of port cabling connections.

| | |
|---|--|
|  | Note: Refer to the product release notes for the GS748T switch Software application level code. The release notes detail the platform specific functionality of the Switching, SNMP, Config, and Management packages. |
|---|--|

| | |
|---|--|
|  | Note: Although this document applies to the <i>NETGEAR</i> ® GS748T Smart Switch, some of the illustrations used may show references to other switch model numbers. Where such model numbers appear, the illustration concerned should be treated as an example. The procedures described with these illustrations apply to each of the family of Smart Switches. |
|---|--|


Conventions, Formats and Scope


The conventions, formats, and scope of this manual are described in the following paragraphs:

- **Typographical Conventions.** This manual uses the following typographical conventions:

| | |
|----------------|--|
| <i>Italics</i> | Emphasis, books, CDs, URL names |
| Bold | User input |
| Fixed width | Screen text, file and server names, extensions, commands, IP addresses |

- **Formats.** This manual uses the following formats to highlight special messages:

| | |
|---|--|
|  | Note: This format is used to highlight information of importance or special interest. |
|---|--|

| | |
|---|--|
|  | Tip: This format is used to highlight a procedure that will save time or resources. |
|---|--|



Warning: This is a warning of possible malfunction or damage to the equipment.

- **Scope.** This manual is written for the GS748T switch according to these specifications:

| | |
|-------------------------|---------------------|
| Product Version | GS748T Smart Switch |
| Manual Publication Date | April 2007 |






For more information about network, Internet, firewall, and VPN technologies, use the link to the NETGEAR shown below.



Note: Product updates are available from the NETGEAR, Inc. website at:
<http://www.netgear.com/support/main.asp>

HTML Manual Navigation

If an HTML version of this manual is provided, it includes the following:

- Buttons,  and , for browsing forwards or backwards through the manual one page at a time
- A  button that displays the table of contents and an  button. Double-click on a link in the table of contents or index to navigate directly to where the topic is described in the manual.
- A  button to access the full NETGEAR, Inc. online knowledge base for the product model.
- Links to PDF versions of the full manual and individual chapters.

How to Print this Manual

To print this manual, you can choose one of the following options, according to your needs.

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- **Printing from PDF.** Your computer must have the free Adobe Acrobat reader installed in order to view and print PDF files. The Acrobat reader is available on the Adobe Web site at <http://www.adobe.com>.
 - **Printing a PDF Chapter.** Use the *PDF of This Chapter* link at the top left of any page.
 - Click the *PDF of This Chapter* link at the top left of any page in the chapter you want to print. The PDF version of the chapter you were viewing opens in a browser window.
 - Click the print icon in the upper left of your browser window.
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 - Click the *Complete PDF Manual* link at the top left of any page in the manual. The PDF version of the complete manual opens in a browser window.
 - Click the print icon in the upper left of your browser window.



Tip: If your printer supports printing two pages on a single sheet of paper, you can save paper and printer ink by selecting this feature.

Revision History

| Document Part Number | Date | Version Number | Description |
|----------------------|---------------|----------------|-----------------------------------|
| 202-10233-01 | April 2007 | 2.0 | Rate limiting feature documented. |
| 202-10233-01 | February 2007 | 1.0 | GS748T Smart Switch documentation |

Chapter 1

Switch Management Overview

Switch Management Interface

This section gives an overview of switch management, including the methods you can use to manage your NETGEAR GS748T Smart Switch.

Your NETGEAR GS748T Smart Switch contains an embedded web server and management software for managing and monitoring switch functions. This switch will function as a simple switch without using the management software but its use enables you to configure more advanced features and consequently improve switch efficiency and the overall performance of your network.

Web-Based Management enables you to monitor, configure, and control your switch remotely using a common web browser, instead of having to use expensive and complicated SNMP software products. Simply by using your web browser, you can monitor the performance of your switch, and optimize its configuration for your network. Using your browser, for example, you can set up VLANs, traffic priority, and configure port trunking.

In addition, NETGEAR provides the Smart Wizard Discovery Utility program with this product. This program runs under Microsoft Windows XP or Windows 2000 and provides a “front end” which discovers the switches on your network segment. When you power up your switch for the first time, Smart Wizard Discovery enables you to configure its basic network parameters without prior knowledge of IP address or subnet mask. Following such configuration, this program leads you into the Web Management interface.

Table 1-1 shows some features of Smart Wizard Discovery and Web Management.

Table 1-1. Switch Management Methods

| Management Method | Features |
|--|---|
| Smart Wizard Discovery Utility program | No IP address or subnet mask setup needed Discover all switches on the network User-friendly interface under Microsoft Windows Firmware upgrade capability Password change feature Provides entry to web configuration of switch |
| Web browser | Password protection Ideal for configuring the switch remotely Compatible with Internet Explorer and Netscape Navigator on any platform Extensive switch configuration possible Configuration backup and restore |

For a more detailed discussion of the Smart Wizard Discovery Utility Program, see. For a detailed discussion of the Web Browser Interface, see [Chapter 3, “Basic Web Management”](#).

System Requirements

The following hardware and software facilities are required to run the applications described in this manual:

Network facilities:

- Ethernet network with or without DHCP server as appropriate (see [Chapter 2, “Getting Started—Smart Wizard Discovery”](#))

For running the Smart Wizard Discovery Utility:

- IBM type PC with CD drive; RAM size and disk specification is not critical
- OS software: Microsoft Windows Vista, Windows XP, or Windows 2000
- Switch to PC network cable: crossover? or straight connection via hub
- IBM type PC to run web management GUI; RAM and disk requirement is not critical

For running local or remote Web Management

- Desktop computer running Microsoft Internet Explorer 5.0 or later or Netscape Navigator 6.0 or later, or equivalent.

Chapter 2

Getting Started—Smart Wizard Discovery

This section leads you through the steps necessary to begin managing your GS748T Smart Switch. It covers how to install in a network that contains a DHCP server and one without DHCP.

Network with DHCP server

To install the switch in a network with a DHCP server, proceed as follows:

1. Connect the GS748T switch to a DHCP network.
2. Power on the switch by connecting its power cord.
3. Install the Smart Wizard Discovery Utility program on your computer.
4. Start the Smart Wizard Discovery utility.
5. Click **Discover** for the Smart Wizard Discovery to find your GS748T Smart Switch. You should see a screen similar to that shown below.

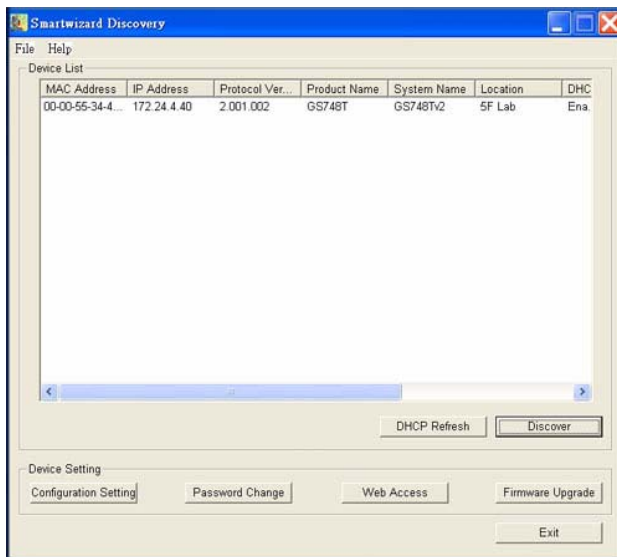


Figure 2-1

6. Make a note of the displayed IP address assigned by the DHCP server. You will need this value to access the switch directly from a web browser (without using Smart Wizard Discovery).
7. Select your switch by clicking on the line that shows it. Then click on the Web Access button. The discovery utility displays a login window similar to the following:

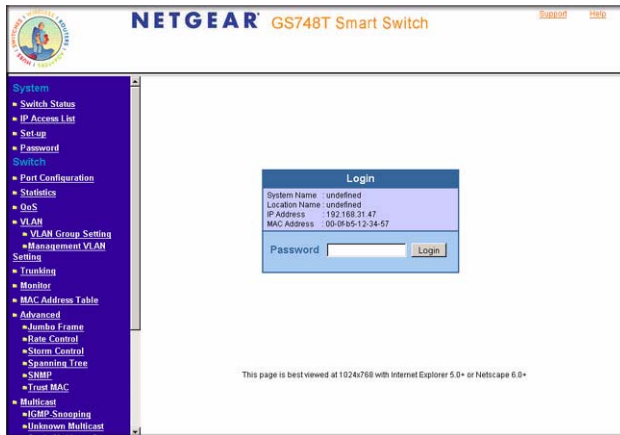


Figure 2-2

Use your web browser to manage your switch. The default password is ‘password’.

Network without DHCP Server

This section describes how to set up your switch in a network without a DHCP server, and is divided into the following tasks:

- Manually assign network parameters for your switch
- Configure the NIC settings on the host PC
- Log in to the web-based switch management utility

Manually Assigning Network Parameters

If your network has no DHCP service, you must assign a static IP address to your switch. If you choose, you can assign it a static IP address even if your network has DHCP service. Proceed as follows:

1. Connect the GS748T Smart Switch to your existing network.
2. Power on the switch by plugging in the power cord (Default IP is 192.168.0.239).
3. Install the Smart Wizard Discovery Utility program on your computer
4. Start the Smart Wizard Discovery utility.
5. Click **Discover** for the Smart Wizard Discovery Utility to find your GS748T Smart Switch. You should see a screen similar to that shown in [Figure 2-1 on page 2-1](#).
6. Click on **Configuration Setting**. A screen similar to that shown below appears.

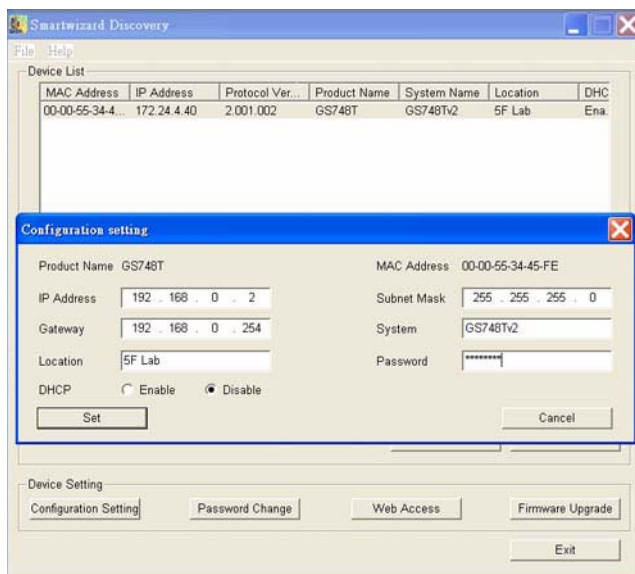


Figure 2-3

7. Choose **Disable** for DHCP.
8. Enter your chosen switch IP address, gateway IP address and subnet mask, and then type your password and click “**Set**”. Please ensure that your PC and the GS748T Smart Switch are in the same subnet. Make a note of these settings for later use.

NIC Setting on the Host that Accesses the GS748T Smart Switch

The settings of your network interface card (NIC) under MS Windows OS are made with entries into the Windows screen pages shown below. For comparison, the settings pages of the switch are also shown although they do not appear in the Windows view.

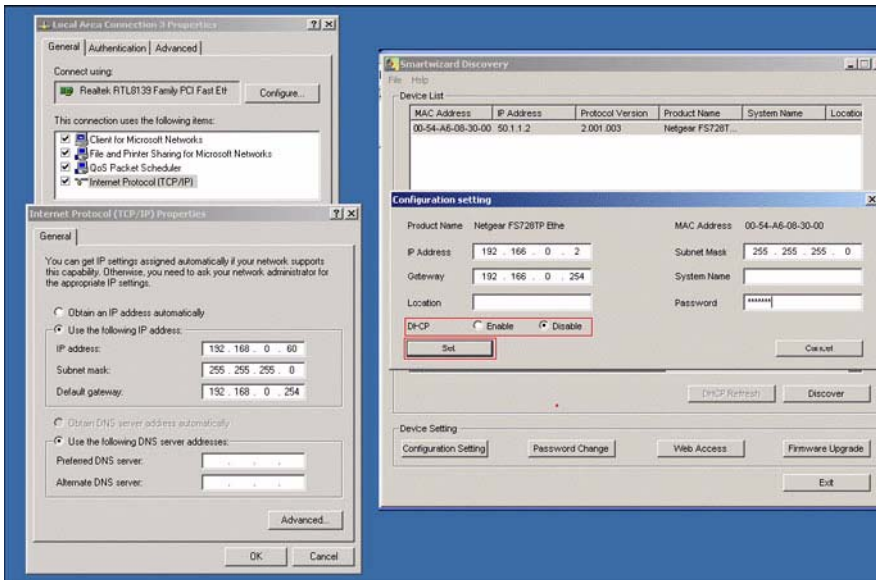


Figure 2-4

You need Windows Administrator privilege to change these settings.

1. On your PC, access the MS Windows operating system TCP/IP Properties page as shown. In MS Windows XP this is found in **Control Panel > Network Connections > Local Area Connection > General: Properties**.
2. Select Internet Protocol (TCP/IP) and click on **Properties**.
3. Set IP address and subnet mask appropriately. The subnet mask value should be identical to that set in the switch. The PC IP address must be different from that of the switch but lie in the same subnet.
4. Click on the Web Access button to enable the management screens as described in the following section

Web Access

Clicking on the Web Access button of the Smart Wizard Discovery utility reveals the page shown in below.

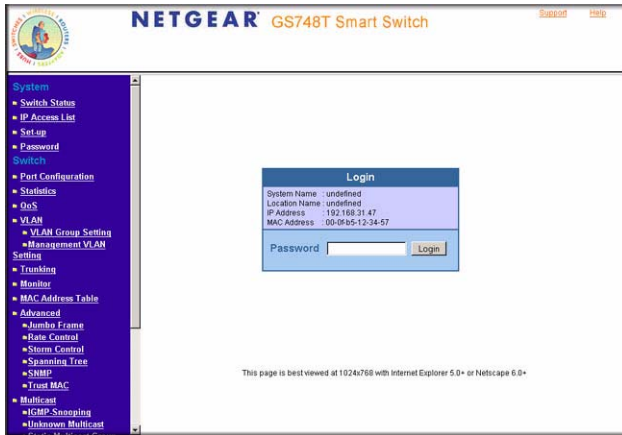


Figure 2-5

Use this page to proceed to management of the switch covered in [Chapter 3, “Basic Web Management”](#).

Additional Utilities

Alternatively, from the main page of [Figure 2-1](#) you can access the additional functions:

- Password Change
- Firmware Upgrade

Password Change

You can set a new password of up to 20 ASCII characters.

1. Click **‘Password Change’** from the Switch Setting section. The Password Change screen appears. You can set a new password. In this process, you are required to enter the old password and to confirm the new one.
2. Click **‘Set’** to enable the new password.

Firmware Upgrade

If you click **Firmware Upgrade** from the main screen of [Figure 2-1](#), after you have selected the switch to upgrade, the following screen appears:

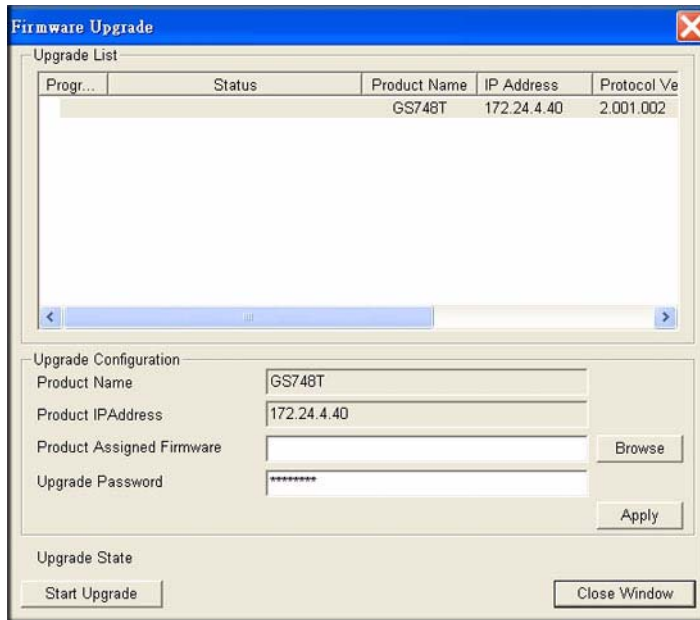


Figure 2-6

The application software for the GS748T-series switch is upgradeable, enabling your switch to take advantage of improvements and additional features as they become available. The upgrade procedure and the required equipment are described as follows. This procedure assumes that you have downloaded or otherwise obtained the firmware upgrade and that you have it available as a binary file on your computer. This procedure uses the TFTP protocol to implement the transfer from computer to switch.

1. Enter the following values into the appropriate places in the form
 - **Firmware Path:** The location of the new firmware file. You can click **Browse** to locate the file.
 - **Password:** Enter your password; the default password is “password”.
 - **Upgrade State:** Shows upgrading in progress.
2. Click **Start** to begin loading the upgrade. The system software is automatically loaded to all stacking members. When the process is complete, the switch automatically reboots.

Exit

Click **Exit** from the Switch Setting section to close the Smart Wizard Discovery Utility program.

Chapter 3

Basic Web Management

This section contains information for performing basic configuration using your web browser. It also describes how to backup your configuration and how to reboot or reset your router if necessary. The section includes this information under the following headings:

- [“Starting Web Management”](#)
- [“The NETGEAR Home Page and Switch Status”](#)
- [“System Functions”](#)
- [“Firmware Menu”](#)
- [“Factory Reset”](#)
- [“Resetting the System”](#)

Your NETGEAR Smart Switch series provides a built-in browser interface that enables you to configure and manage it remotely using a standard Web browser such as Microsoft Internet Explorer or Netscape Navigator. This interface also allows for system monitoring of the switch. The help page covers many of the basic functions and features of the switch and its web interface.

Web Management requires either Microsoft Internet Explorer 5.0 or later or Netscape Navigator 6.0 or later

Starting Web Management

This section describes setting browser interface options and using the home page for the GS748T Smart Switch. This interface is essentially similar to that entered as a result of selecting “Web Access” from the Smart Wizard Discovery utility (see [Chapter 2, “Getting Started—Smart Wizard Discovery”](#)). However, if you want to access the switch directly, i.e. without using the Smart Wizard Discovery utility, you must work from the same network segment that contains the switch (i.e. the subnet mask values of switch and PC host must be the same) and you must point your browser using the switch IP address. If you used the Smart Wizard Discovery utility to set up IP address and subnet mask, either with or without DHCP server, use that IP address in your browser window. If you are starting with an “out of the box” switch and are not using the Smart Wizard Discovery utility, you must initially configure your host PC to be on a network segment to match the default parameters of the switch, which are:

- IP address: 192.168.0.239
- Subnet Mask: 255.255.255.0

From the home page thus accessed, as described in the next section, you may want to change the network parameters to match those of your network. This is done using the “Set-up” option selected from the navigation pane of the web interface. Your host PC network parameters must then also be set back to match your network.

The NETGEAR Home Page and Switch Status

Having considered the preceding section, the NETGEAR home page for the GS748T Smart Switch can be accessed from any PC with a web browser.

To start the application:

1. Open a web browser.
2. Enter the device IP address in the address bar.
3. Press **Enter**. The Login page appears as shown below.



Figure 3-1

4. Enter the password (the factory default is “password”) and click Login. The GS748T switch home page is displayed as shown below.

The screenshot shows the NETGEAR GS748T Smart Switch web interface. The navigation pane on the left includes sections for System, Switch, and Logout. The main content area is divided into three sections: Switch Status, IP Access List Setting, and PORT Status.

Switch Status

| | |
|-------------------------|----------------------------------|
| Product Name | GS748T |
| Firmware Version | V1.3.0_0606 |
| Protocol Version | 2.001.002 |
| DHCP | Enable |
| IP Address | 192.168.31.47 |
| Subnet mask | 255.255.255.0 |
| Default gateway | 192.168.31.250 |
| MAC address | 00-0E-85-12-34-57 |
| System Name | |
| Location Name | |
| Login Timeout (minutes) | 5 |
| System Up Time | 0 days 0 hours 1 mins 21 seconds |

IP Access List Setting

| ID | IP address |
|----|-----------------------------|
| | All host IP address allowed |

PORT Status

| ID | Speed | Flow Control | Link Status | Default Priority | Port Description | ID | Speed | Flow Control | Default Priority | Link Status | Port Description |
|-------------------------|-------|--------------|-------------|------------------|------------------|----|-------|--------------|------------------|-------------|------------------|
| 10/100/1000 Mbps | | | | | | | | | | | |
| 01 | Auto | On | Down | Normal | | 02 | Auto | On | Down | Normal | |
| 03 | Auto | On | Down | Normal | | 04 | Auto | On | Down | Normal | |
| 05 | Auto | On | Down | Normal | | 06 | Auto | On | Down | Normal | |
| 07 | Auto | On | Down | Normal | | 08 | Auto | On | Down | Normal | |
| 09 | Auto | On | Down | Normal | | 10 | Auto | On | Down | Normal | |
| 11 | Auto | On | Down | Normal | | 12 | Auto | On | Down | Normal | |
| 13 | Auto | On | Down | Normal | | 14 | Auto | On | Down | Normal | |
| 15 | Auto | On | Down | Normal | | 16 | Auto | On | Down | Normal | |
| 17 | Auto | On | Down | Normal | | 18 | Auto | On | Down | Normal | |
| 19 | Auto | On | Down | Normal | | 20 | Auto | On | Down | Normal | |

Figure 3-2

The home page shows the Navigation Pane on the left side, which provides a menu to access the various configuration functions of the switch. The Navigation Pane headings can be expanded to view all the components under a specific feature or retracted to hide these components.

The main pane, entitled **Switch Status** gives a list that shows the condition of the functions available in the switch. The material that follows in this manual describes these functions and how to configure them. None of the switch parameters can be configured directly from the Switch Status view. Click the **Refresh** button at the top of the pane to display updated status information.

The header of the page shows the following links:

- Support—brings up the NETGEAR web site
- Help—provides an explanation about each of the menu items shown in the Navigation pane. Click the help to read the full Help Menu. On some pages, there is a Help button. If you click that button, you will go to the part of the Help Menu that discusses that page

This header remains displayed with each page accessed from the navigation pane.

Within the various browser interface pages, there are several buttons that you can use. Their names and functions are listed below:

- Browse: Locates a certain path for a desired file.
- Refresh: Pulls that screen's data from current values on the system
- Apply: Submits change request to system and refreshes screen data
- Add: Add new entries to table information and refreshes screen data
- Delete: Deletes selected entries from table and refreshes screen data
- Factory Reset: Restores the system factory default value.
- Help: Goes to relevant section of Help Menu

Description of Switch Status Parameters

The Switch Status page displays tabular status information under 14 headings. This information is described briefly as follows in order that the tables appear from the top of the page:

- Switch Status (subheading): Displays parameters:
 - Hardware parameters: Product Name; Firmware version; Protocol Version
 - DHCP—whether enabled as service from the switch
 - Network Parameters: IP Address; Subnet mask; Default gateway MAC address
 - System Name and Location Name user values
 - Login Timeout; System UpTime
- IP Access List Setting: shows the list of IP addresses allowed to log in to the switch
- PORT Status: shows speed setting, whether flow control is applied, Link Status and priority, and a user description against port number
- Quality of Service (QoS) IEEE 802.1P QoS Status: can be set up with *either* 802.1p or Differentiated Services Code Point (DSCP) determination. The status values displayed are those of the chosen QoS configuration:
 - IEEE 802.1P QoS Status: The 802.1p window shows the traffic priorities assigned to each of the four queues determined by the tags on incoming packets.
 - DSCP Based QoS Status: The DSCP display shows the priority levels assigned to each of the incoming DSCP classes determined by the 8-bit Diffserv field of the incoming packets.
- IEEE 802.1Q Port VLAN ID (PVID) Table: This table shows, for 802.1Q VLANs, the VLAN membership of each port, denoted by PVID number. Every port must belong to at least one VLAN—by default all belong to VLAN 1.

- VLAN Settings: Two alternatives may show, depending upon the switch configuration. These options are mutually exclusive.
 - IEEE 802.1Q VLAN Settings: shows, by VLAN ID (PVID), which ports belong and whether their egress packets are tagged or untagged.
 - Port-Based VLAN Settings: shows which ports belong to each VLAN ID.
- TRUNK Status: shows the Trunk group, the ports that belong to the group and whether trunking (Port Aggregation) is enabled for that group.
- Monitor Status: shows ports being monitored and whether this monitoring (sniffing) is of ingress or egress traffic. Monitoring copies all traffic from the ports in question to the sniffer port.
- Jumbo Frame: Oversized “Jumbo” (10240 byte) Ethernet frame support may be enabled or disabled through the switch. If it is disabled, Jumbo frames are dropped.
- IEEE 802.1W Rapid Spanning Tree Protocol (RSTP) Setting: shows the key parameters used in STP implementation. Bridge Priority determines how likely the switch is to become the root switch. Max Age determines the time for which configuration information is kept. Hello Time is the interval between sent configuration messages. Forward Delay is a value for time spent in a discarding state before passing frames.

The Switch Status page displays the port settings for both 10/100 Mbps and 10/100/1000 Mbps ports. To configure the ports, go to the Switch → Port Configuration page.

- ID: The port number on the switch
- Speed: Indicates the communication mode set for the port. The default setting for all ports is Auto-negotiation (Auto). The possible entries are Auto-negotiation (Auto), 10 Mbps half duplex (10M Half), 10 Mbps full duplex (10M Full), 100 Mbps half duplex (100M Half), 100 Mbps full duplex (100M Full), or Disable.
- Flow Control: Indicates whether Flow Control support is set for on (Enabled) or off (Disabled). The default setting for all ports is enabled.
- Link Status: Indicates the current speed and duplex for the port. DOWN means no link.

The next part of the Switch Status page shows the Virtual Local Area Network (VLAN) status. A VLAN enables specified ports on the same switch to be partitioned electronically into separate broadcast domains. By using VLANs, users can group users by logical function (for example Accounting or Engineering) instead of by physical location based upon the particular switch port connection.

This page displays the port-based IEEE 802.1Q VLAN settings. The default VLAN setting is to group all ports to belong to port-based VLAN 1. To configure user-defined VLAN groups, go to the Switch> VLAN page.

Port Trunking is a feature that enables multiple links between switches to work as one virtual link (aggregate link). Trunks can be defined for similar port types only. For example, a 10/100 port cannot form a Port Trunk with a gigabit port. Trunks can only be formed within the same bank.

This page displays the Trunk status. The default Trunk setting is all groups disabled. To configure user-defined Trunk groups, go to the Switch> Trunking page.

If the IEEE802.1Q VLAN is enabled, this page displays the VLAN tag status.

System Functions

Under the System heading in the Navigation Pane, there are four functions; click on any one to enter the appropriate configuration screen:

- **Switch Status:** Gives a snapshot of the current state of the switch. Click the **Refresh** button to display the latest status information. As described above, this page appears by default when you first login.
- **IP Access List:** This page enables you to limit the IP addresses that can access the management functions of the switch. The switch only responds to login requests from computers whose IP addresses appear in its list. The **Add** button brings up a window into which you can enter an IP address. When you have done so, click **Apply**. A typical view after a few additions is shown below.



Figure 3-3

Click **Delete** to remove an entry.

The switch default state allows access from any IP address. If you enter authorized IP addresses, be sure to include the IP address of your own management PC.

- Set-up: The following diagram shows a typical Set-up screen. Use it to enter the name and location of your switch. If you want to use a DHCP server, make the appropriate setting. If you enable Static IP Address, enter your IP address, Subnet Mask, and Gateway values as shown.

The screenshot displays the 'System Setting' page for a NETGEAR GS748T Smart Switch. On the left is a navigation menu with options like 'Switch Status', 'IP Access List', 'Set up', 'Password', 'Switch', 'Port Configuration', 'Statistics', 'QoS', 'VLAN', 'Trunking', 'Monitor', 'MAC Address Table', 'Advanced', and 'Multicast'. The main content area is titled 'System Setting' and contains the following fields:

- System Name:
- Location Name:
- Login Timeout (0 - 30 minutes):
- IP Address:
 - Get Dynamic IP from DHCP Server
 - Static IP Address
 - IP address:
 - Subnet mask:
 - Gateway:

Buttons for 'Apply' and 'Help' are located at the bottom right of the form.

Figure 3-4

- Password: Use this page to set a new password. Be sure to note your setting. If you forget the password, you must perform a factory reset of the switch to regain management access to it. In this case you will lose your configuration settings because they are overwritten by factory default values. However, if you have saved your configuration using Configuration Backup, you can recover the overwritten values.

Firmware Menu

This menu item is found at the bottom of the menu bar. It contains **Configuration Backup** and **Factory Reset** submenu items. These topics are described at this stage of the description because their utility may be needed early in the configuration process.

Managing System Files—Backup and Restore

This facility may be used to protect your system configuration and save a possibly long manual configuration in case of a loss or an accidental manual factory reset.

To back up files:

1. Select Configuration Backup => backup. The Configuration Upload Page appears:



Figure 3-5

2. Select **Backup** to save the settings to a file. Enter the name of the target file and click start.

To restore saved settings:

From the Configuration Backup screen, enter the path to the file and select: “Restore saved setting from file”. Upon your confirmation the process is started. The browser window subsequently closes and the switch reboots.

Factory Reset

Factory Reset restores factory defaults when you want or make a major configuration change or need to regain management access to the switch. Use this feature under the following conditions:

- You have lost your password
- You are installing your switch into a different network environment for which it is simpler to configure from the factory settings
- You want to make a major configuration change for another reason

Restore Factory Defaults erases any prior user configuration.

To perform Factory Reset, do either of the following:

- From the Navigation pane, navigate to Firmware > Factory Reset and click on the Factory Reset link, or

- Use the restore Factory Defaults button on the right-hand side of the front panel—see the appropriate installation guide for your switch for more details.

The effect of each of these alternatives is identical.

Resetting the System

Resetting reboots the embedded operating system. To reset the switch for any reason, either

- Power cycle it by disconnecting and reconnecting the power cord, or
- Use the Reset button on the left-hand side of the front panel—see the appropriate installation guide for your switch for more detail. This operation does not disturb your switch configuration.

Logout

Click **Logout** on the Navigation Sidebar Menu to leave the GS748T Smart Switch management web interface.

Chapter 4

Configuring the Switch

Using the Switch Configuration Utility

The Navigation Pane on the left hand side of the home page contains a Switch Menu which enables you to manage your GS748T Smart Switch with features under the following main headings:

- Port Configuration
- Statistics
- QoS
- VLAN
- Trunking
- Monitor
- MAC Address Table
- Advanced
- Multicast

The description that follows in this chapter covers these features and tells you how to configure them in the GS748T switch.

Port Configuration

You can configure port attributes per port by clicking a port ID number at the port setting menu.

1. Click on **Port Configuration** in the Menu Sidebar; the port configuration page appears.

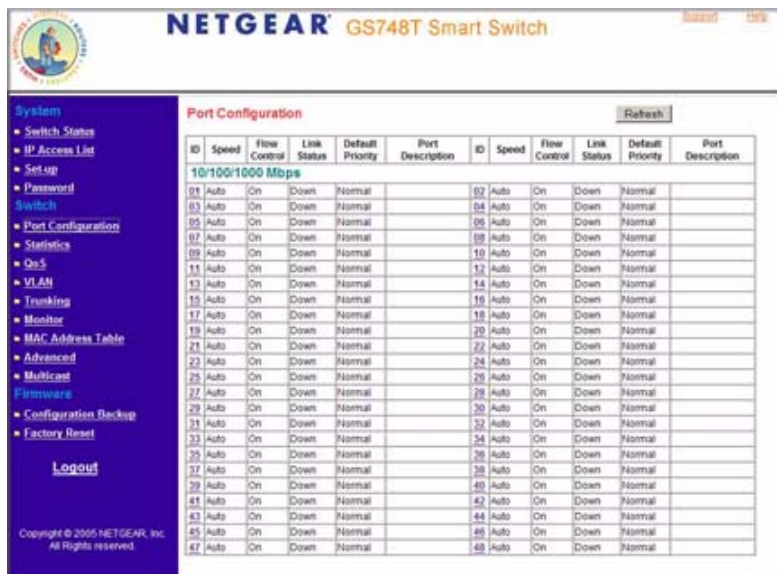


Figure 4-6

2. Click on a Port ID number in the first column; a port setting window appears.
3. Use the pull-down dialog boxes to configure the attributes.

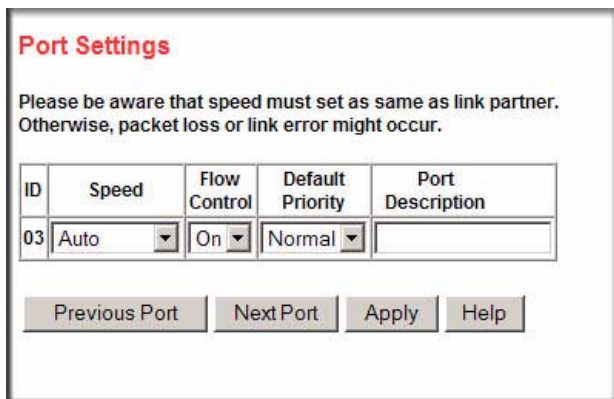


Figure 4-7

- **Speed:** Indicates the communication mode set for the port. The default setting for all ports is Auto-negotiation (Auto). The possible entries are:
 - Auto: Auto-negotiation
 - 100M Full: 100 Mbps full duplex
 - 100M Half: 100 Mbps half duplex
 - 10M Full: 10 Mbps full duplex
 - 10M Half: 10 Mbps half duplex
 - Disable
- **Flow Control:** may be set **on** for Flow Control support or **off** for no flow control.
- **Default Priority:** This value indicates the default traffic priority for the port in the implementation of Port-based Quality of Service (QoS). The values may be set to 0 - 7.



Note: In order for it to work, you must map the priority to the appropriate 4 queues in the IEEE802.1P of Switch > QoS page.

To activate the new settings, click **Apply**.



Note: Speed must be set to the same value as for the port's link partner. If this is not done, packet loss or link errors may occur.

Viewing Packet Statistics

This page shows reports of packet traffic and packet errors. The table headings meanings are explained as follows:

- **ID:** The port number on the switch
- **Tx:** Transmitted packets
- **Rx:** Received packets
- **Tx Error:** Transmitted packets with error. Packets are counted as contributing to TX Error if they:
 - Had a late collision detected during the transmission (512 bit-times into the transmission)
 - Experienced 16 failed transmission attempts due to collision.
 - Were dropped due to lack of resources

- Rx Error: Received packet/s with error. Packets are counted as contributing to RX Error if they:
 - Were less than 64 bytes or greater than 1522 bytes in size
 - Had a bad FCS
 - Were dropped due to lack of resources.
1. Click on **Statistics** in the main menu; a Statistics page appears.
 2. Click on the **Refresh** button at the top of the page to obtain current statistics data
 3. Click **Clear Counters** to start a new statistics count over time.
 4. Click on a port ID entry; the individual statistics table for the port is displayed. This table breaks down statistics in more detail as shown in the following diagram.

| Port Statistics | | | | Refresh |
|----------------------|---------|-----------------------|------|---------|
| Port | 07 | | | |
| TX | | | | |
| Bytes | 178736 | | | |
| UnicastPkts | 1051 | CarrierSenseErrors | 0 | |
| MulticastPkts | 0 | PausePkts | 0 | |
| BroadcastPkts | 27 | FrameInDisc | 0 | |
| DeferredTransmit | 0 | Collision | 0 | |
| UnderRun | 0 | ExcessiveCollision | 0 | |
| RX | | | | |
| Bytes | 1620830 | | | |
| UnicastPkts | 3134 | DropPkts | 0 | |
| MulticastPkts | 3100 | PausePkts | 0 | |
| BroadcastPkts | 5083 | ExcessSizeDisc | 0 | |
| UnderSizePkts | 0 | OverSizePkts | 0 | |
| Jabbers | 0 | Fragments | 0 | |
| FCSerrors | 0 | SACHanges | 0 | |
| 64 BytePkts | 3971 | 65 to 127 BytePkts | 3618 | |
| 128 to 255 BytePkts | 1772 | 256 to 511 BytePkts | 1751 | |
| 512 to 1023 BytePkts | 182 | 1024 to 1522 BytePkts | 23 | |

Figure 4-8

Regulating Traffic Rates using Quality of Service Settings

Quality of Service (QoS) is used to manage traffic in a network by treating different types of traffic with different levels of priority. Higher priority traffic receives preferential treatment during times of switch congestion.

Three implementations of QoS are supported:

- Port-based QoS
- IEEE 802.1p-based QoS
- DSCP-based QoS

Port-based QoS

Port-based QoS can be achieved by configuring the Default Priority of a port, as described in “Port Configuration” on page 4-2.

IEEE 802.1p-based QoS

IEEE 802.1p-based QoS enables the user to map each of the eight priority levels specified in IEEE 802.1p (p0 to p7) to one of four hardware priority queues: **High**, **Normal**, **Low**, and **Lowest**. The eight priority levels specified in IEEE 802.1p (p0 to p7) are implemented by a three-bit priority field in the VLAN tag. The switch empties the four hardware priority queues in order, from High to Lowest. Packets are transferred to empty the buffers of each higher hardware priority queue in turn before the next lower hardware priority queue can begin to transfer its received packets through the switch.

The table in the Quality of Service page below shows an example of IEEE 802.1p-based priority settings that you can set for a switch.

| Priority | QoS | Priority | QoS | Priority | QoS | Priority | QoS |
|----------|--------|----------|--------|----------|--------|----------|--------|
| 0 | Normal | 1 | Normal | 2 | Normal | 3 | Normal |
| 4 | Normal | 5 | Normal | 6 | Normal | 7 | Normal |

Figure 4-9

Differentiated Services Code Point (DSCP)-based QoS

The Differentiated Services Code Point (DSCP) 6-bit field in an IP packet header enables levels of service to be assigned to network traffic according to the field's binary value. This 6-bit field comprises three IP Precedence MSBs with a least-significant 3-bit expansion field as defined in RFC 2474. The IP Precedence bits in the DSCP field are compatible with routers that only support IP Precedence. DCSs specifically tailored to be backward compatible with routers that only support IP precedence lack the 3-bit expansion field and are called Class-selector DCSs. See the following diagram for the setting page for DSCP priorities.

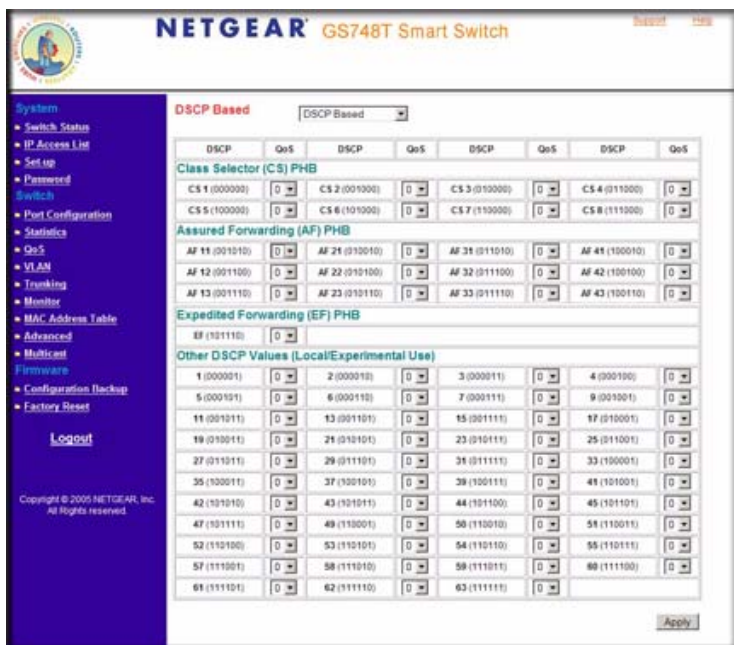


Figure 4-10

Match these DHCP values to set "Per Hop Behavior" (PHB) priorities by selecting a QoS service-class value of between 0 and 7. Packets within these service classes are treated with equal priority. RFC 2597 defines the assured forwarding (AF) PHB. It guarantees a certain amount of bandwidth to an AF class.

The Expedited Forwarding (EF) PHB is defined in RFC 2598 and uses Codepoint 101110. The EF PHB is used to build a low loss, low latency, low jitter, assured bandwidth service. This premium service can appear to the user be a point to point connection.

VLAN Page

A Virtual Local Area Network (VLAN) is a means of electronically separating ports on the same switch from a single broadcast domain into separate broadcast domains. By using VLANs, users can group nodes by logical function instead of physical location. For example, Engineering and Accounting department traffic can be separated from one another. VLAN memberships are manipulated by associating switch ports with VLAN IDs (VIDs).

You can choose from two types of VLAN to set up on the switch: IEEE 802.1Q VLAN (Tagged VLAN), or Port-based VLAN. You cannot mix the types on the same switch. In either case, any port can be a member of multiple VLANs.

- IEEE 802.1Q VLAN: The VLAN tagging option is a standard set by the IEEE to facilitate the spanning of VLANs across multiple switches (Reference: Appendix A and IEEE Std 802.1Q-1998 Virtual Bridged Local Area Networks). This switch supports the creation of 64 Static-Tag VLAN groups.

This implementation separates traffic by adding a VLAN tag into the appropriate egress frames (packets) from selected switch ports. A receiving switch associates the tagged frame with the VLAN and forwards it, according to its own VLAN-to-port lookup table, to all ports on the VLAN except the ingress port. In this way, a VLAN structure may be built across a “tree” of switches.

You have the option of setting egress frames to be:

- Tagged: this setting adds an 802.1Q tag into the frame leaving the selected port
- Untagged: this option strips the 802.1Q tags from frame leaving the selected port. The port retains its association with the VLAN. This facility is used when these ports are connected to downstream equipment that does not recognize (and which consequently may be confused by) 802.1Q tags.
- Unchanged: this option is the default and signifies that the port is not associated with a VLAN.

Every port is a member of VLAN ID 1 by default. You can change the default assignment of any port adjusting the Primary VLAN ID Setting (PVID) table. Use this feature to ensure that untagged frames reach the VLAN that you require.

- Port-based VLAN: This implementation confines VLAN members to the ports on the particular switch, that is, the VLANs cannot span multiple switches. VLAN membership of ports is determined in a lookup table that you set up when you configure the switch. You can create up to 48 port-based VLANS. Every port belongs to VLAN ID 1 by default.

Adding and Configuring IEEE 802.1Q VLAN Groups

- From the main Navigation Pane menu, select:
VLAN → VLAN Group Setting → IEEE 802.1Q VLAN; a screen appears showing a VLAN selection window with a table that lists all of the ports with their VLAN membership. If you have not previously created a VLAN, this window shows VLAN ID 1 (default) with all ports set Untagged.

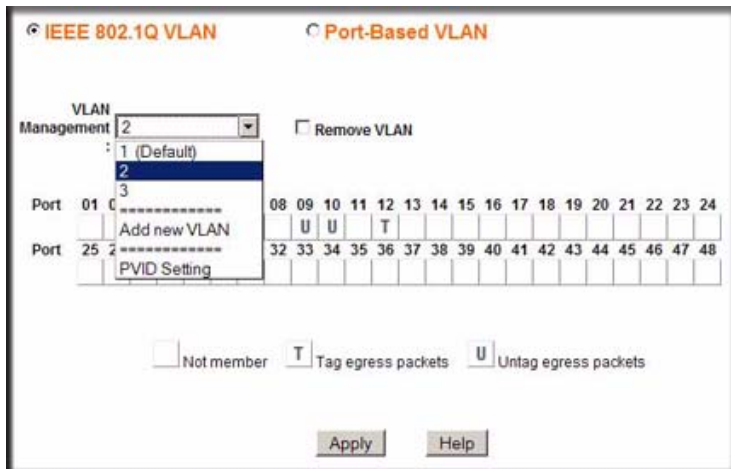


Figure 4-11

From the page, you can create a new VLAN, add new ports to an existing VLAN, remove ports from an existing VLAN or, delete a VLAN.

- Create a new VLAN Group:

From the VLAN Management pull-down window, select: **Add new VLAN**.

Enter the VLAN ID value in the VLAN ID dialog window that appears. Your VLAN ID must lie in the range 2 – 4094.

Click **Apply**

- Add VLAN group members as you require:

In the port table, click successively on the window below the port number to obtain your required symbol:

- ‘T’ (tagged): this option sets egress frames with 802.1Q VLAN tags.
- ‘U’ (untagged): this option determines that frames from these ports exit the switch untagged.

- Blank space (not a member of a VLAN); use this option to remove a port-VLAN association.

Click **Apply**.

4. Configure Primary VLAN ID (PVID):

To enable untagged packets to appear in your required VLAN, be sure to change the PVIDs for the relevant ports. Access the PVID Settings by using the PVID Setting option in the VLAN ID pull-down menu. The PVID setting for all ports is VLAN ID 1 by default and is shown thus in the table. You must have previously created your VID and attached the port to it as described above.

Click **Apply**.



Note: Every port has an initial default VID of 1 (PVID = 1). Whether a port has this VID or has been made a member of another default VID, you cannot remove any port from its prior default VLAN until you have reassigned its PVID to its new value. Use the PVID Setting menu option of VLAN Management to change its PVID before attempting to remove it from its prior default membership.

Reconfiguring an IEEE 802.1Q VLAN Group

1. From the main Navigation Pane menu, select:
Switch → **VLAN** → **VLAN Group Setting** → **IEEE 802.1Q VLAN**; a screen appears showing a VLAN selection window with a table that lists all of the ports with their VLAN membership.
2. From the VLAN Management pull-down window, click on the VLAN ID that you want to reconfigure.
3. Add or remove tag assignments by clicking on the boxes in the table.
4. Click **Apply** to set your changes.

Deleting an 802.1Q VLAN Group

1. In the VLAN Management pull down menu, select the VLAN you want to remove.
2. Select the **Remove VLAN** button with your cursor and click on it.
3. Click **Apply**; all port associations are separated from the VLAN and it is removed.

Adding and Configuring Port-based VLANs

1. From the main Navigation Pane menu, select:
Switch → **VLAN** → **VLAN Group Setting** → **Port-based VLAN**; a screen appears showing a VLAN selection window with a table that lists all of the ports with their VLAN membership.

If you have not previously created a VLAN, this window shows VLAN ID 1 (default) comprising all ports as members.

2. Create a VLAN:
Click on the **Add VLAN** button; a table for the next higher numbered VID appears.
3. Add a description for your new VLAN, for example, Accounts.
4. In the table, click on the boxes below the port numbers to assign those ports to your new VLAN. Selected ports are indicated by a check mark in the box. You can click on **Set all** to assign all ports to membership of your VLAN.
5. Click **Apply**.

Reconfiguring a Port-based VLAN

1. From the main Navigation Pane menu, select:
Switch → **VLAN** → **VLAN Group Setting** → **Port-based VLAN**; a screen appears showing a VLAN selection window with a table that lists all of the ports with their VLAN membership.
2. Click a VLAN ID number; a table for that VID appears.
3. Click boxes to select or deselect ports for VLAN membership. You can click on **Set all** to assign all ports to your VLAN or **Clear all** to remove all ports from VLAN membership.
4. Click **Apply** to activate your new settings.

Deleting a Port-based VLAN

1. From the main Navigation Pane menu, select:
Switch → **VLAN** → **VLAN Group Setting** → **Port-based VLAN**; a screen appears showing a VLAN selection window with a table that lists all of the ports with their VLAN membership.
2. Click on the **Delete VLAN** button; a VLAN Delete window is displayed.
3. Click on the box adjacent to the VLAN ID number.
4. Click **Apply** to delete this VLAN.

Selecting a Management VLAN

1. From the main Navigation Pane menu, select:
Switch → VLAN → Management VLAN; the Management VLAN window appears.
2. In the Management VLAN ID window, select the VID that you want to use for switch management.
3. Click Apply

Creating Port Trunks to Increase Link Bandwidth

Port Trunking (otherwise known as Port Aggregation) enables multiple links between switches to work as one virtual link (aggregate link) to provide greater bandwidth than would be available by confining the traffic to a single port. Trunks can be defined for similar port types only. For example, a 10/100 port cannot form a Port Trunk with a gigabit port. Trunks can only be formed within the same bank. A bank is a set of ports, such as ports 1 to 8, ports 9 to 16, or 17 to 20, on the same switch unit. Up to ten trunks can be operating at the same time.

Trunking groups in the Trunk Table are set disabled by default. For each trunk group, trunk members are pre-set for selection. The following diagram shows a typical port trunking arrangement.

Trunk Setting


All members of a trunk must be in the same VLAN Group.

| ID | Enable | Member | | | | | | | |
|----|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 01 | <input checked="" type="checkbox"/> | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |
| | | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 02 | <input checked="" type="checkbox"/> | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 03 | <input type="checkbox"/> | 17 | 18 | 19 | 20 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |
| 04 | <input type="checkbox"/> | 21 | 22 | 23 | 24 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |
| 05 | <input checked="" type="checkbox"/> | 25 | 26 | 27 | 28 | | | | |
| | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | | | |
| 06 | <input type="checkbox"/> | 29 | 30 | 31 | 32 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |
| 07 | <input checked="" type="checkbox"/> | 33 | 34 | 35 | 36 | | | | |
| | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | | | |
| 08 | <input type="checkbox"/> | 37 | 38 | 39 | 40 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |
| 09 | <input type="checkbox"/> | 41 | 42 | 43 | 44 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |
| 10 | <input type="checkbox"/> | 45 | 46 | 47 | 48 | | | | |
| | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | |

Apply Help

Figure 4-12

To select Trunk members for a Trunk group, click **Apply** to activate the new setting

| | |
|---|--|
|  | Note: The selected trunk port setting ID numbers must correspond to VLAN group IDs. |
|---|--|

Setting up Port Trunks

1. From the main Navigation Pane menu, select: **Switch** → **Trunking**; The Trunk Setting table is displayed.
2. Check the boxes against the port numbers in the table.
3. Click **Apply** to save the settings.

- Click **Apply** to save the settings.

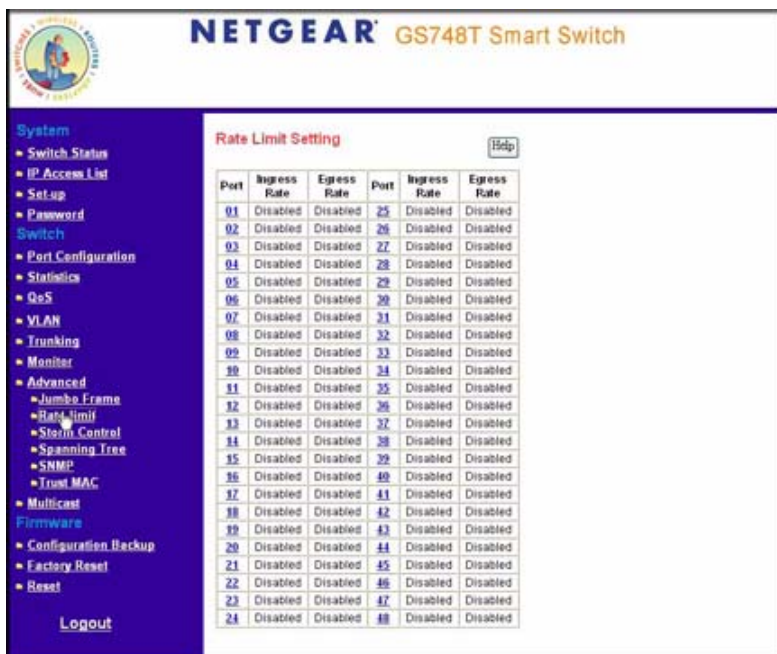
Jumbo Frame Support

Jumbo Frames are not an approved standard Ethernet frame size, so you must ensure that all of your networking equipment can support these frames to prevent them from being dropped. The GS748T switch can carry a maximum frame size of 10240 bytes.

- From the main Navigation Pane menu, select: **Switch** → **Advanced** → **Jumbo Frame**; The Jumbo Frame Setting page is displayed.
- Select **Enable** or **Disable** on this page and click **Apply**.

Controlling Per-port Packet Throughput

The Rate Limit Setting enables you to determine the bandwidth of the selected port. There are 11 options of data rate in the range 512K bps to 1000M bps with a disable option that applies no limit to the data rate. Ingress and egress rates are separately configurable. The Egress Rate settings is available only with v3h1 firmware.



NETGEAR GS748T Smart Switch

Rate Limit Setting [Help](#)

| Port | Ingress Rate | Egress Rate | Port | Ingress Rate | Egress Rate |
|------|--------------|-------------|------|--------------|-------------|
| 01 | Disabled | Disabled | 25 | Disabled | Disabled |
| 02 | Disabled | Disabled | 26 | Disabled | Disabled |
| 03 | Disabled | Disabled | 27 | Disabled | Disabled |
| 04 | Disabled | Disabled | 28 | Disabled | Disabled |
| 05 | Disabled | Disabled | 29 | Disabled | Disabled |
| 06 | Disabled | Disabled | 30 | Disabled | Disabled |
| 07 | Disabled | Disabled | 31 | Disabled | Disabled |
| 08 | Disabled | Disabled | 32 | Disabled | Disabled |
| 09 | Disabled | Disabled | 33 | Disabled | Disabled |
| 10 | Disabled | Disabled | 34 | Disabled | Disabled |
| 11 | Disabled | Disabled | 35 | Disabled | Disabled |
| 12 | Disabled | Disabled | 36 | Disabled | Disabled |
| 13 | Disabled | Disabled | 37 | Disabled | Disabled |
| 14 | Disabled | Disabled | 38 | Disabled | Disabled |
| 15 | Disabled | Disabled | 39 | Disabled | Disabled |
| 16 | Disabled | Disabled | 40 | Disabled | Disabled |
| 17 | Disabled | Disabled | 41 | Disabled | Disabled |
| 18 | Disabled | Disabled | 42 | Disabled | Disabled |
| 19 | Disabled | Disabled | 43 | Disabled | Disabled |
| 20 | Disabled | Disabled | 44 | Disabled | Disabled |
| 21 | Disabled | Disabled | 45 | Disabled | Disabled |
| 22 | Disabled | Disabled | 46 | Disabled | Disabled |
| 23 | Disabled | Disabled | 47 | Disabled | Disabled |
| 24 | Disabled | Disabled | 48 | Disabled | Disabled |

Figure 4-14

To enable Rate Limits:

1. From the main Navigation Pane menu, select: **Switch** → **Advanced** → **Rate Limits**; The Rate Limit Setting page is displayed. with a table of port numbers.
2. Click on a Port number in the table; the Rate Limit window for that port appears.
3. From the pull-down menus on this page, select from the optional rates shown, or select **Disabled**.
4. Click **Apply** to save your setting.

Storm Control (Dropping Traffic that is Flooding a Port)

The Storm Control feature enables you to prevent your network performance from being disrupted by excessive traffic arriving at a switch port. The source of this traffic may be selected as Multicast and Broadcast, Broadcast only, or as a result of Destination Lookup Failure (DLF). A selected received threshold rate of between 0 and 65535 packets per second may be selected in each case. Where Multicast and Broadcast is selected as the source of the traffic, the threshold value is the combined rate of those two types of packet. If packets of the selected type arrive at a rate exceeding the threshold, they are dropped.

Storm Control is disabled on every port by default.

To enable Storm Control:

1. From the main Navigation Pane menu, select:
Switch → **Advanced** → **Storm Control**; The Storm Control Setting page is displayed. with a table of port numbers that can be set as enabled or disabled.
2. In the Ingress Control Mode window, select from: **Multicast and Broadcast**, **Broadcast only**, or **DLF**.
3. Click on the window against your selected port to enable Storm Control.
4. Click **Apply** to save your setting.

Using Spanning Tree Protocol to Prevent Path Loops

Selection of Spanning Tree results in the IEE 802.1W RSTP Setting page being displayed.

To achieve reliability in a network, some path redundancy must be provided. However, multiple paths between network nodes can cause loops to exist and result in switching confusion and duplication of traffic. Spanning Tree Protocol (defined by IEE 802.1D) controls the duplicate paths by accounting for statistical weights in the available paths. It blocks the least efficient alternate paths and causes traffic only to be carried over the optimal paths between nodes.

The GS748T switch supports Rapid Spanning Tree Protocol (defined by IEEE 802.1w), which is an improvement (over the 802.1D STP) that shortens connection latency between nodes. The resultant path between nodes determined by RSTP is the same as that eventually determined by STP. The following concepts are associated with this protocol.

- **Fast Link:** When a port running the standard Spanning Tree Protocol (STP) is connected, it will go through the STP negotiation (listening → learning → forwarding or blocking) before it is fully available. If a server is trying to access a client through the switch running the STP negotiation, it is not able to connect to it immediately. This can be a problem for some networks. Fastlink mode solves this problem by setting the port directly to forwarding mode, thus allowing any server access request to be forwarded. Fastlink mode can cause temporary loops in your network, but the STP eliminates them. Fastlink is best used on end node ports, i.e. ports connected to PCs or servers, to avoid network loops.
- **Bridge Priority:** Priority setting of this switch in the Spanning Tree.
- **Bridge Max Age:** Amount of time before a configuration message is discarded by the system.
- **Bridge Hello Time:** Interval between configuration messages sent by the Spanning Tree algorithm.
- **Bridge Forward Delay:** Amount of time system spends in 'learning' and 'listening' states.
- **Path Cost:** The switch uses this to determine which port is the forwarding port. All other factors being equal, the path with the lowest cost to the root bridge is the active path.
- **Path Priority:** STP bases on this to determine the port to use for forwarding. The port with the lowest number has the highest priority.

The IEEE 802.1W RSTP Setting page of the GS748T switch contains a set of default values which are optimal for most applications. Adjust these values if you must provide for special conditions.

To set up RSTP:

- From the main Navigation Pane menu, select:
Switch → **Advanced** → **Spanning Tree**; The IEEE 802.1W RSTP Setting page shown in The following screen is displayed. with a table of port numbers that can be set as enabled or disabled.

IEEE 802.1W RSTP Setting

RSTP Function Disable
 Enable

| | Root Status | Bridge Setting |
|--------------------------|-------------|----------------|
| Designated Root Bridge | 32768 | 32768 |
| Priority (0 - 61440) | 32768 | 32768 |
| Max Age (6-40 sec) | 20 | 20 |
| Hello Time (1-10 sec) | 2 | 2 |
| Forward Delay (4-30 sec) | 15 | 15 |

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

Apply

Path Cost: 1-65535 (Default 4 for 1000M, 19 for 100M, 100 for 10M)
Priority: 0-255 (Default 128)

| Port | Path Cost | Priority | Edge | P2P Force | State | Port | Path Cost | Priority | Edge | P2P Force | State | Port | Path Cost | Priority | Edge | P2P Force | State |
|------|-----------|----------|------|-----------|---------|------|-----------|----------|------|-----------|---------|------|-----------|----------|------|-----------|---------|
| 01 | 4 | 128 | No | Yes | Forward | 02 | 4 | 128 | No | Yes | Disable | 03 | 4 | 128 | No | Yes | Disable |
| 04 | 4 | 128 | No | Yes | Disable | 05 | 4 | 128 | No | Yes | Disable | 06 | 4 | 128 | No | Yes | Disable |
| 07 | 4 | 128 | No | Yes | Forward | 08 | 4 | 128 | No | Yes | Disable | 09 | 4 | 128 | No | Yes | Disable |
| 10 | 4 | 128 | No | Yes | Disable | 11 | 4 | 128 | No | Yes | Disable | 12 | 4 | 128 | No | Yes | Disable |
| 13 | 4 | 128 | No | Yes | Disable | 14 | 4 | 128 | No | Yes | Disable | 15 | 4 | 128 | No | Yes | Disable |
| 16 | 4 | 128 | No | Yes | Disable | 17 | 4 | 128 | No | Yes | Disable | 18 | 4 | 128 | No | Yes | Disable |
| 19 | 4 | 128 | No | Yes | Disable | 20 | 4 | 128 | No | Yes | Disable | 21 | 4 | 128 | No | Yes | Disable |
| 22 | 4 | 128 | No | Yes | Disable | 23 | 4 | 128 | No | Yes | Disable | 24 | 4 | 128 | No | Yes | Disable |
| 25 | 4 | 128 | No | Yes | Disable | 26 | 4 | 128 | No | Yes | Disable | 27 | 4 | 128 | No | Yes | Disable |
| 28 | 4 | 128 | No | Yes | Disable | 29 | 4 | 128 | No | Yes | Disable | 30 | 4 | 128 | No | Yes | Disable |
| 31 | 4 | 128 | No | Yes | Disable | 32 | 4 | 128 | No | Yes | Disable | 33 | 4 | 128 | No | Yes | Disable |
| 34 | 4 | 128 | No | Yes | Disable | 35 | 4 | 128 | No | Yes | Disable | 36 | 4 | 128 | No | Yes | Disable |
| 37 | 4 | 128 | No | Yes | Disable | 38 | 4 | 128 | No | Yes | Disable | 39 | 4 | 128 | No | Yes | Disable |
| 40 | 4 | 128 | No | Yes | Disable | 41 | 4 | 128 | No | Yes | Disable | 42 | 4 | 128 | No | Yes | Disable |
| 43 | 4 | 128 | No | Yes | Disable | 44 | 4 | 128 | No | Yes | Disable | 45 | 4 | 128 | No | Yes | Disable |
| 46 | 4 | 128 | No | Yes | Disable | 47 | 4 | 128 | No | Yes | Disable | 48 | 4 | 128 | No | Yes | Disable |

Apply Help

Figure 4-15

- Select **Enable** (RSTP is disabled by default).
- Modify the page settings if required, or accept the defaults.
- Click **Apply** to save your settings.

Enabling Switch Management using SNMP

SNMP (Simple Network Management Protocol) is a transport protocol used for network management. The protocol is used in communication between a Manager—the management station—and an agent within the managed device, in this case your switch. The Manager polls the agent which responds by returning data from the Management Information Bases (MIBs) that it maintains on the managed device to indicate its status. An agent can return Traps to the Manager, Traps are messages that alert the manager to conditions that may need attention. Managers and Agents work within Communities which are defined to confine messaging within named groups. An agent only responds to requests from Managers within its community.

The SNMP page enables you to limit the IP addresses from which the MIBs of the switch can be accessed and to which IPs the switch sends SNMP traps. The switch only responds to requests from management computers whose IP addresses are carried in a list. This list also holds Privilege information that controls which IPs have read-only or read-write access. You can also select the traps which the switch sends to the hosts from the following trap events. An “Admin” field must be set to “Enable” to allow management host communication.

Trap Events are indicated in 3 columns:

- T1: Authentication fail - The switch generates an SNMP trap when a host tries to gain access to the switch but the host's IP is not in the SNMP host table.
- T2: Device bootup - The switch generates an SNMP trap when it reboots.
- T3: Link Up/Down - The switch generates an SNMP trap when one of its ports changes its link status.

To enable management from an SNMP Manager:

1. From the main Navigation Pane menu, select:
Switch → **Advanced** → **SNMP**; the switch configuration utility displays the following screen.

| Host IP Address | | | | Community | Privilege | | Trap | | | Admin | |
|-----------------|-----|---|----|-----------|----------------------------------|----------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|---------|
| | | | | | ReadOnly | ReadWrite | T1 | T2 | T3 | Enable | Disable |
| 192 | 168 | 1 | 27 | service1 | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="radio"/> | |
| | | | | | <input checked="" type="radio"/> | <input type="radio"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="radio"/> | |
| | | | | | <input checked="" type="radio"/> | <input type="radio"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="radio"/> | |
| | | | | | <input checked="" type="radio"/> | <input type="radio"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="radio"/> | |

Note:
T1: authentication fail
T2: device bootup
T3: link up / link down

Apply Help

Figure 4-16

- In the text boxes along one line, enter the following:
 - Your Manager host IP address
 - Community name
 - Privilege—select **ReadOnly** or **ReadWrite**
 - Traps—select the those that you want to receive from **T1**, **T2**, and **T3** (explained above)
 - Admin—set to **Enable** to allow management
- Click **Apply** to save your settings.

Controlling Switch Access by MAC Address and VLAN ID

A configuration page enables you to select the source MAC address and VLAN members that are allowed to access this switch.

If the VLAN mode for the switch is set up as Port-based, you enter a MAC address and port number that you want to permit access this switch. If the VLAN is set up in 802.1Q mode, you enter a MAC address and VID to permit access.

To Add a MAC Address

- From the main Navigation Pane menu, select:
Switch → **Advanced** → **Trust MAC**; the Trusted MAC Settings page is displayed.
- Click on **Add**; a dialog window is appears.
- Enter your trusted MAC address:

If your switch is set up with Port-based VLANs, in the windows provided, enter the **Port** and **MAC Address** in conventional six hexadecimal pair and colon separator format.

If your switch is set up with 802.1Q VLANs, enter: **Port, VLAN ID**, and **MAC Address** in conventional six hexadecimal pair and colon separator format.

4. Click **Apply** to save your settings.

To Remove a MAC Address from the Table

1. From the main Navigation Pane menu, select:
Switch → **Advanced** → **Trust MAC**; the Trusted MAC Settings page is displayed.
2. Check the **Delete** box for the MAC address that you want to remove.
3. Click on the **Delete** button.

Using IGMP Snooping to Route Packets Based on Content

IGMP Snooping enables your switch to examine IGMP packets and forward them in ways based on their content. IGMP specifies how a host can register a router to receive specific multicast traffic. Configure the switch to use IGMP snooping in subnets that receive IGMP queries from either IGMP or the IGMP snooping querier. IGMP snooping constrains multicast traffic at Layer 2 by configuring Layer 2 LAN ports dynamically to forward multicast traffic only to those ports that want to receive it. The IGMP Snooping Function allows Snooping to be enabled or disabled on a per-switch basis. It is disabled by default.

To enable or disable IGMP snooping:

1. From the main Navigation Pane menu, select: **Switch** → **Multicast** → **IGMP Snooping**. The IGMP Snooping Setting page is displayed.
2. Select **Enable** or **Disable**.
3. Click **Apply** to save your settings.

Filtering Unknown Multicast Packets

You can enable or disable the blocking of unknown multicast packets that enter the switch.

To enable or disable blocking of unknown multicast addresses:

1. From the main Navigation Pane menu, select:
Switch → **Multicast** → **Unknown Multicast**; the Unknown Multicast Setting page is displayed.

2. Select **Enable** or **Disable**
3. Click **Apply** to save your settings.

Setting Up Static Multicast Groups

You can specify specific ports and VLANs for receiving Multicast packets with specific MAC addresses. The MAC addresses are IPv4 Multicast Addresses (RFC1112A) of the form: 01:00:5E-XX-XX-XX. A maximum of 64 groups is supported.

To define a multicast group:

1. From the main Navigation Pane menu, select:
Switch → **Multicast** → **Static Multicast Group**; the Static Multicast Groups Setting page is displayed as shown below.

Static Multicast Groups

VLAN ID (1-4094) MAC Address:
(Format 01:00:5E:XXXXXX)

Port 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
 Port 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

| ID | VLAN Group | MulticastEntry | PortMembers | Delete |
|----|------------|-------------------|-------------|--------------------------|
| 1 | 1 | 01:00:5E:53:93:FF | 4 | <input type="checkbox"/> |

Figure 4-17

2. In the appropriate windows, enter the **VLAN ID** and **Port** to receive the Multicast packets
3. In the MAC Address window, specify the Multicast **MAC Address** for the packets you want to receive.
4. Click **Apply** to save your settings.

To remove a multicast group:

1. In the line of the table that specifies the group, check the **Delete** box.
2. Click **Apply** to remove the group.

Appendix A

Specifications and Default Values

GS748T Smart Switch Specifications

The GS748T Smart Switch conforms to the TCP/IP, UDP, HTTP, ICMP, TFTP, DHCP, 802.1D, 802.1p, and 802.1Q standards.

Table A-1. GS748T Smart Switch Specifications

| Feature | Value |
|--------------------|-------------------------------|
| Interfaces | 48G (P01 - P48) |
| Fiber Option | 4 Mini-GBIC Combo (P45 - P48) |
| PoE | N/A |
| Flash Memory Size | 2MB |
| SRAM Size and Type | 16MB DDR |

Table A-2. Switch Performance

| Feature | Value |
|----------------------------|--|
| Switching Capacity | 48 x 1Gbps |
| Forwarding Method | Store and Forward |
| Packet Forwarding Rate | 10M:14,880 pps / 100M:148,809 pps / 1G:1,488,095 pps |
| MAC addresses | 8K |
| Packet RAM buffer capacity | 512K-bytes |

GS748T Smart Switch Features and Defaults

Table A-3. Port Characteristics

| Feature | Sets Supported | Default |
|--|----------------|---------------------------------|
| Auto-Negotiation / Static Speed / Duplex | 48 (per-port) | Auto-Negotiation |
| Auto MDI/MDIX | N/A | Enabled |
| 802.3x flow control / Back Pressure | 48 (per-port) | Enabled |
| Port Mirroring | 1 | Disabled |
| Port Trunking (Aggregation) | 10 | Disabled |
| 802.1D Spanning Tree | 1 | Disabled |
| 802.1w RSTP | 1 | Disabled |
| IGMP Snooping | 1 | Disabled |
| Static 802.1Q Tagging | 256 | VID = 1 MemberPorts = [1-48] |
| Port Based Private VLAN | 48X1 | MemberPorts[1] = [1-48] |
| Learning Process | N/A | N/A |

Table A-4. Quality Of Service

| Feature | Sets Supported | Default |
|------------------|----------------|----------------------|
| Number of Queues | N/A | N/A |
| Port Based | 48 (per port) | Normal for all ports |
| 802.1p | 1 | Disabled |
| DSCP | 1 | Disabled |

Table A-5. Security

| Feature | Sets Supported | Default |
|-------------------------|----------------|---|
| ACL | 10 | All IP addresses allowed |
| Password Control Access | 1 | LoginTimeOut = 5 mins. Password = "password" |

Table A-5. Security (continued)

| Feature | Sets Supported | Default |
|-------------------------|----------------|----------|
| Trust MacAddress Filter | 256 | Disabled |
| Port -MAC lock down | 48 (per port) | Disabled |
| Management VLAN | 1 | 0 |

Table A-6. Traffic Control

| Feature | Sets Supported | Default |
|---------------|----------------|----------|
| Rate control | 48 (per port) | Disabled |
| Storm control | 1 (per switch) | Disabled |
| Jumbo frame | 48 (per port) | Disabled |

Table A-7. System Setup

| Feature | Sets Supported | Default |
|----------------------------|----------------|---------------|
| DHCPManual IP | 1 | 192.168.0.239 |
| System Name Configuration | 1 | NULL |
| Configuration Save/Restore | 1 | N/A |
| Firmware Upgrade | 1 | N/A |
| Factory Reset | 1 | N/A |

Table A-8. Other Features

| Feature | Sets Supported | Default |
|--------------------------|----------------|----------|
| Static Multicast Entry | 64 | Disabled |
| Filter Multicast Control | 1 | Disabled |

Table A-9. Management

| Feature | Sets Supported | Default |
|-------------|----------------|----------|
| SNMPv1/V2c | 4 | Disabled |
| MIB Support | 1 | Disabled |

Table A-9. Management

| Feature | Sets Supported | Default |
|----------------|-----------------------|----------------|
| Smart Wizard | N/A | Enabled |
| Statistics | 48 (per port) | N/A |

Appendix B

Virtual Local Area Networks (VLANs)

A Local Area Network (LAN) can generally be defined as a broadcast domain. Hubs, bridges or switches in the same physical segment or segments connect all end node devices. End nodes can communicate with each other without the need for a router. Routers connect LANs together, routing the traffic to the appropriate port.

A virtual LAN (VLAN) is a local-area network with a definition that maps workstations on some other basis than geographic location (for example, by department, type of user, or primary application). To communicate between VLANs, traffic must go through a router, just as if they were on two separate LANs.

A VLAN is a group of PCs, servers and other network resources that behave as if they were connected to a single, network segment—even though they may not be. For example, all marketing personnel may be spread throughout a building. Yet if they are all assigned to a single VLAN, they can share resources and bandwidth as if they were connected to the same segment. The resources of other departments can be invisible to the marketing VLAN members, accessible to all, or accessible only to specified individuals, depending on how the IT manager has set up the VLANs.

The Advantages of VLANs:

- Easy to do network segmentation: Users that communicate most frequently with each other can be grouped into common VLANs, regardless of physical location. Each group's traffic is largely contained within the VLAN, reducing extraneous traffic and improving the efficiency of the whole network.
- Easy to manage: The addition of nodes, as well as moves and other changes, can be dealt with quickly and conveniently from a management interface rather than from the wiring closet.
- Increased performance: VLANs free up bandwidth by limiting node-to-node and broadcast traffic throughout the network.
- Enhanced network security: VLANs create virtual boundaries that can only be crossed through a router. So standard, router-based security measures can be used to restrict access to each VLAN

IEEE 802.1Q VLANs

Packets received by the switch are treated in the following way:

- When an untagged packet enters a port, it is automatically tagged with the port's default VLAN ID tag number. Each port has a default VLAN ID setting that is user-configurable (the default setting is 1). The default VLAN ID setting for each port can be changed in the PVID Setting page.
- When a tagged packet enters a port, the tag for that packet is unaffected by the default VLAN ID Setting. The packet proceeds to the VLAN specified by its VLAN ID (VID) tag number.
- If the port in which the packet entered does not have membership with the VLAN specified by the VLAN ID tag, the packet is dropped.
- If the port is a member of the VLAN specified by the packet's VLAN ID, the packet is able to be sent to other ports with the same VLAN ID.
- Packets leaving the switch are either tagged or untagged, depending on the setting for that port's VLAN membership properties. A 'U' for a given port means that packets leaving the switch from that port are Untagged. Inversely, a 'T' for a given port means that packets leaving the switch from that port are tagged with the VLAN ID associated with the port.

The example given in this section comprises numerous steps to illustrate a wide range of configurations to help provide an understanding of tagged VLANs.

Example

This example demonstrates several scenarios of VLAN use and describes how the switch handles Tagged and Untagged traffic.

1. Setup the following VLANs: VLAN 10, 20.
2. Configure the VLAN membership. Be sure to set all of them as follows.
 - Setting up first VLAN group, VLAN ID = 10:
 - Setting up second VLAN group, VLAN ID = 20:
3. Modify PVID Setting to apply previous two VLAN groups: Modify Default VLAN group (VLAN ID = 1) to apply two new VLAN groups:

The specific ports above have the following Port VLAN ID settings:

- Default VLAN: Port 7 – Port 26 (all U), VID = 1
- VLAN 1: Port 1 (U), Port 2 (U), Port 3 (T), VID = 10
- VLAN 2: Port 4 (U), Port 5 (T), Port 6 (U), VID = 20.

4. The following situations produce results as described:

- If an untagged packet enters Port 1, the switch tags it with a VLAN tag value 10. The packet has access to Port 2 and Port 3. The outgoing packet is stripped of its tag to leaves Port 2 as an untagged packet. For Port 3, the outgoing packet leaves as a tagged packet with a VLAN tag value of 10.
- If a tagged packet with a VLAN tag value 10 enters Port 3, the packet has access to Port 1 and Port 2. If the packet leaves Port 1 and/or Port 2, it is stripped of its tag to leave the switch as an untagged packet.
- If an untagged packet enters Port 4, the switch tags it with a VLAN tag value 20. The packet will have access to Port 5 and Port 6. The outgoing packet is stripped of its tag to become an untagged packet as it leaves Port 6. For Port 5, the outgoing packet leaves as a tagged packet with a VLAN tag value of 20.

Port-based VLANs

Port-based VLANs help to confine broadcast traffic to the switch ports. This switch allows up to 26 port-based VLAN group, Any one port can belong to different VLAN groups. The default VLAN group is a port-based VLAN that has all ports belonging to VLAN 1.

Packets received by the switch are treated in the following way:

- When a packet enters a port, it can only proceed to ports with the same VLAN membership as that ingress port.
- If a port on the switch does not have a common VLAN membership with the source port, the packet is dropped.

Port-based VLAN Example Configuration

This example basically demonstrates how the port-based VLANs work to meet your needs.

Setup the following VLANs, each with defined descriptions:

- VLAN 1 (IT department)
- VLAN 2 (Sales department)
- VLAN 3 (Marketing department)
- VLAN 4 (Accounting department).
- Configure the VLAN membership. Be sure to set all of them as follows.
- Setting up second VLAN group (Sales), VLAN ID = 02, with membership of ports 1~8, 25.

- Setting up third VLAN group (Marketing), VLAN ID = 03, with membership of ports 7~14, 25.
- Setting up fourth VLAN group (Accounting), VLAN ID = 04, with membership of ports 19~20, 25.
- Setting up first VLAN group (IT), VLAN ID = 01, with membership of all ports.
- Since VLAN ID 01 has been setup by default, you will have to remove the ports that belong to all other VLAN groups except port 25.
- Ports 7 and 8 are kept for connected file server and printer server use. Sales and Marketing departments can share file archives and printing services.
- Port 25 provides Gigabit speed for e-mail server and Internet connection.

The specific ports above have the following functions:

- VLAN 1: Port 15 – Port 18, Port 21 – Port 24, Port 26, for IT department to monitor and control activities on all other VLANs
- VLAN 2: Port 1 – Port 8, for Sales department, port 7 and 8 connect to file archives and printer server.
- VLAN 3: Port 7 – Port 14, for Marketing department, port 7 and 8 connect to file archives and printer server.
- VLAN 4: Port 19 – Port 20, for Accounting department, its work is kept secret from other departments except IT.

Results of this Configuration

If a packet comes in on port 2, it can go to ports 1, 3, 4, 5, 6, 7, 8, and 25, as those are the only ports in that VLAN. A Sales person on Port 2 can get to the Internet, send and receive e-mail, but cannot access the marketing department print server or file archives.

If a Marketing user sends out a broadcast message, the Sales and Accounting departments are not affected by the message, because it does not go out on their ports. Only the Marketing department and the IT group will receive the broadcast message.

If an IT user sends out a broadcast message, everyone receives it.

Appendix C

Network Cabling

This appendix provides specifications for cables used with a NETGEAR GS748T Smart Switch.

Fast Ethernet Cable Guidelines

Fast Ethernet uses UTP cable, as specified in the IEEE 802.3u standard for 100BASE-TX. The specification requires Category 5 UTP cable consisting of either two-pair or four-pair twisted, insulated copper conductors bound in a single plastic sheath. Category 5 cable is certified up to 100 MHz bandwidth. 100BASE-TX operation uses one pair of wires for transmission and the other pair for receiving and for collision detection.

When installing Category 5 UTP cabling, use the following guidelines to ensure that your cables perform to the following specifications:

- **Certification:** Ensure that your Category 5 UTP cable has completed the Underwriters' Laboratories (UL) or Electronic Testing Laboratories (ETL) certification process.
- **Termination method:** To minimize cross-talk noise, maintain the twist ratio of the cable up to the point of termination; untwist at any RJ-45 plug or patch panel should not exceed 0.5 inch (1.5 cm).

Category 5 Cable

Category 5 distributed cable that meets ANSI/EIA/TIA-568-A building wiring standards can be a maximum of 328 feet (ft.) or 100 meters (m) in length, divided as follows:

20 ft. (6 m) between the hub and the patch panel (if used)

295 ft. (90 m) from the wiring closet to the wall outlet

10 ft. (3 m) from the wall outlet to the desktop device

The patch panel and other connecting hardware must meet the requirements for 100 Mbps operation (Category 5). Only 0.5 inch (1.5 cm) of untwist in the wire pair is allowed at any termination point.

Category 5 Cable Specifications

Ensure that the fiber cable is crossed over to guarantee link.

[Table C-1](#) lists the electrical requirements of Category 5 UTP cable.

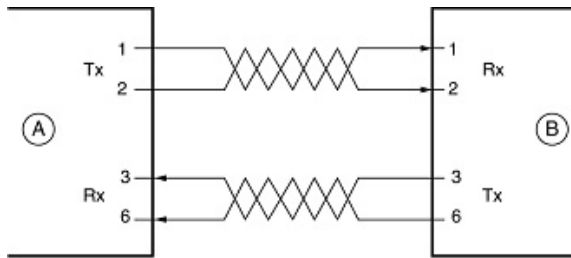
Table C-1. Electrical Requirements of Category 5 Cable

| Specifications | Category 5 Cable Requirements |
|---|--|
| Number of pairs | Four |
| Impedance | 100 \pm 15% |
| Mutual capacitance at 1 KHz | 5.6 nF per 100 m |
| Maximum attenuation (dB per 100 m, at 20° C) | at 4 MHz: 8.2 at 31 MHz: 11.7 at 100 MHz: 22.0 |
| NEXT loss (dB minimum) | at 16 MHz: 44 at 31 MHz: 39 at 100 MHz: 32 |

Twisted Pair Cables

For two devices to communicate, the transmitter of each device must be connected to the receiver of the other device. The crossover function is usually implemented internally as part of the circuitry in the device. Computers and workstation adapter cards are usually media-dependent interface ports, called MDI or uplink ports. Most repeaters and switch ports are configured as media-dependent interfaces with built-in crossover ports, called MDI-X or normal ports. Auto Uplink technology automatically senses which connection, MDI or MDI-X, is needed and makes the right connection.

[Figure C-1](#) illustrates straight-through twisted pair cable.



Key:

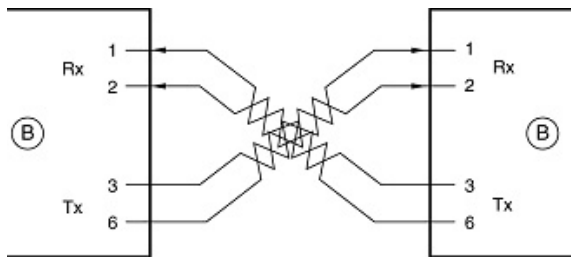
A = UPLINK OR MDI PORT (as on a PC)

B = Normal or MDI-X port (as on a hub or switch)

1, 2, 3, 6 = Pin numbers

Figure C-1 Straight-Through Twisted-Pair Cable

Figure C-2 illustrates crossover twisted pair cable.



Key:

B = Normal or MDI-X port (as on a hub or switch)

1, 2, 3, 6 = Pin numbers

Figure C-2 Crossover Twisted-Pair Cable

Patch Panels and Cables

If you are using patch panels, make sure that they meet the 100BASE-TX requirements. Use Category 5 UTP cable for all patch cables and work area cables to ensure that your UTP patch cable rating meets or exceeds the distribution cable rating.

To wire patch panels, you need two Category 5 UTP cables with an RJ-45 plug at each end, as shown in [Figure C-3](#).

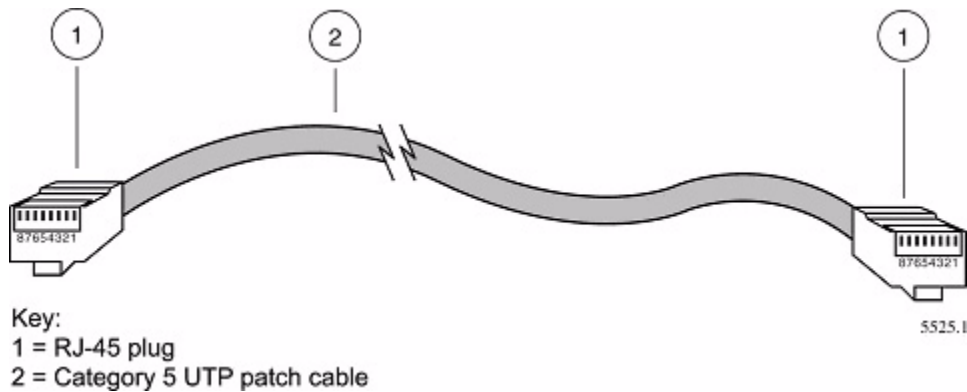


Figure C-3



Note: Flat “silver satin” telephone cable may have the same RJ-45 plug. However, using telephone cable results in excessive collisions, causing the attached port to be partitioned or disconnected from the network.

Using 1000BASE-T Gigabit Ethernet over Category 5 Cable

When using the new 1000BASE-T standard, the limitations of cable installations and the steps necessary to ensure optimum performance must be considered. The most important components in your cabling system are patch panel connections, twists of the pairs at connector transition points, the jacket around the twisted-pair cable, bundling of multiple pairs on horizontal runs and punch down blocks. All of these factors affect the performance of 1000BASE-T technology if not correctly implemented. The following sections are designed to act as a guide to correct cabling for 1000BASE-T.

Cabling

The 1000BASE-T product is designed to operate over Category 5 cabling. To further enhance the operation, the cabling standards have been amended. The latest standard is Category 5e, which defines a higher level of link performance than is available with Category 5 cable.

If installing new cable, we recommend using Category 5e cable, since it costs about the same as Category 5 cable. If using the existing cable, be sure to have the cable plant tested by a professional who can verify that it meets or exceeds either ANSI/EIA/TIA-568-A:1995 or ISO/IEC 11801:1995 Category 5 specifications.

Length

The maximum distance limitation between two pieces of equipment is 100 m, as per the original Ethernet specification. The end-to-end link is called the “channel.”

TSB-67 defines the “Basic Link” which is the portion of the link that is part of the building infrastructure. This excludes patch and equipment cords. The maximum basic link length is 295 feet (90 m).

Return Loss

Return loss measures the amount of reflected signal energy resulting from impedance changes in the cabling link. The nature of 1000BASE-T renders this measurement very important; if too much energy is reflected back on to the receiver, the device does not perform optimally.

Unlike 10BASE-T and 100BASE-TX, which use only two of the four pairs of wires within the Category 5, 1000BASE-T uses all four pairs of the twisted pair. Make sure all wires are tested — this is important.

Factors that affect the return loss are:

The number of transition points, as there is a connection via an RJ-45 to another connector, a patch panel, or device at each transition point.

Removing the jacket that surrounds the four pairs of twisted cable. It is highly recommended that, when RJ-45 connections are made, this is minimized to 1-1/4 inch (32 mm).

Untwisting any pair of the twisted-pair cabling. It is important that any untwisting be minimized to 3/8 inch (10 mm) for RJ-45 connections.

Cabling or bundling of multiple Category 5 cables. This is regulated by ANSI/EIA/TIA-568A-3. If not correctly implemented, this can adversely affect all cabling parameters.

Near End Cross Talk (NEXT)

This is a measure of the signal coupling from one wire to another, within a cable assembly, or among cables within a bundle. NEXT measures the amount of cross-talk disturbance energy that is detected at the near end of the link — the end where the transmitter is located. NEXT measures the amount of energy that is “returned” to the sender end. The factors that affect NEXT and cross talk are exactly the same as outlined in the Return Loss section. The cross-talk performance is directly related to the quality of the cable installation.

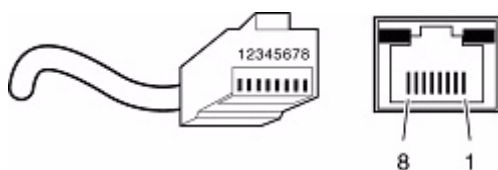
Patch Cables

When installing your equipment, replace old patch panel cables that do not meet Category 5e specifications. As pointed out in the NEXT section, this near end piece of cable is critical for successful operation.

RJ-45 Plug and RJ-45 Connectors

In a Fast Ethernet network, it is important that all 100BASE-T certified Category 5 cabling use RJ-45 plugs. The RJ-45 plug accepts 4-pair UTP or shielded twisted-pair (STP) 100-ohm cable and connects into the RJ-45 connector. The RJ-45 connector is used to connect stations, hubs, and switches through UTP cable; it supports 10 Mbps, 100 Mbps, or 1000 Mbps data transmission.

Figure C-4 shows an RJ-45 plug and RJ-45 jack.



Key:

1 to 8 = pin numbers

Figure C-4

Table C-2 lists the pin assignments for the 10/100 Mbps RJ-45 plug and the RJ-45 connector.

Table C-2. 0/100 Mbps RJ-45 Plug and RJ-45 Connector Pin Assignments

| Pin | Normal Assignment on Ports 1 to 8 | Uplink Assignment on Port 8 |
|------------|--|-----------------------------|
| 1 | Input Receive Data + | Output Transmit Data + |
| 2 | Input Receive Data - | Output Transmit Data - |
| 3 | Output Transmit Data + | Input Receive Data + |
| 6 | Output Transmit Data - | Input Receive Data - |
| 4, 5, 7, 8 | Internal termination, not used for data transmission | |

Table C-2 lists the pin assignments for the 100/1000 Mbps RJ-45 plug and the RJ-45 connector.

Table C-3. 100/1000 Mbps RJ-45 Plug and RJ-45 Connector Pin Assignments

| Pin | Channel | Description |
|--------|---------|----------------------------|
| 1 2 | A | Rx/Tx Data + Rx/Tx Data |
| 3 6 | B | Rx/Tx Data + Rx/Tx Data |
| 4 5 | C | Rx/Tx Data + Rx/Tx Data |
| 7 8 | D | Rx/Tx Data + Rx/Tx Data |

Conclusion

For optimum performance of your 1000BASE-T product, it is important to fully qualify your cable installation and ensure that it meets or exceeds ANSI/EIA/TIA-568-A:1995 or ISO/IEC 11801:1995 Category 5 specifications. Install Category 5e cable where possible, including patch panel cables. Minimize transition points, jacket removal, and untwisted lengths. Cable bundles must be properly installed to meet the requirements in ANSI/EIA/TIA-568A-3.

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