Dell™ PowerConnect™ 3248 and 5224 Network Switches

Addendum to the 3248 and 5224 User's Guides

Notes, Notices, and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

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

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

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Addendum to the 3248 and 5224 User's Guides

New Features:

- Remote System Logging
- Secure Access — Secure Shell (SSH), Authentication Settings, and Secure Hypertext Transfer Protocol (HTTPS)
- Increased Port Security
- Spanning Tree Protocol (STP)
- IP Filtering — Simple Network Management Protocol (SNMP)
- Enhanced Statistics Summaries

NOTE: The graphics in this section may differ slightly from the graphics on your computer.

System Logs

Remote system logging allows you to configure the logging of system messages directly from the Web interface and the command line interface (CLI).

The system log messages are categorized, by severity, into eight levels. The levels range from 0 for Emergencies to 7 for Debugging. See the following table for descriptions:

Level Argument	Level	Description
Emergencies	0	System unusable
Alerts	1	Immediate action needed
Critical	2	Critical conditions
Errors	3	Error conditions
Warnings	4	Warning conditions
Notifications	5	Normal but significant condition
Informational	6	Informational messages only
Debugging	7	Debugging messages

The system allows you to specify which levels are logged to RAM or flash memory.

To assist in troubleshooting network problems, severe error messages that are logged to flash memory are permanently stored in the switch. Up to 4 K log entries can be stored in the flash memory. When the available memory for logs exceeds 256 KB, the oldest entries are overwritten.

System Logs Configuration

The **Switch/General/System Logs** page allows you to configure and limit system messages that are logged to flash or RAM memory. The default is set for levels 0 to 3 to be logged to flash and levels 0 to 7 to be logged to RAM.

The **Switch/General/System Logs** page contains the following fields that can be edited:

- **System Log Status** — Enables/disables the logging of debug or error messages to the logging process.

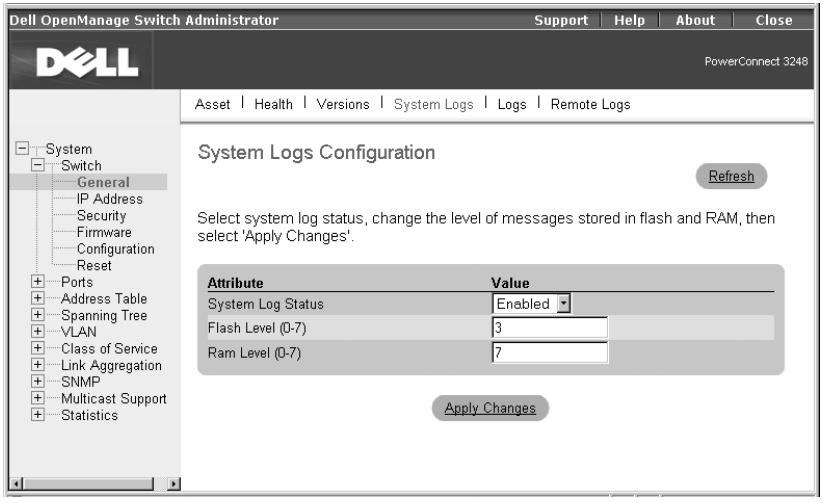
- **Flash Level** — Limits log messages saved to the switch's permanent flash memory for all levels up to the specified level. For example, if level 3 is specified, all messages from level 0 to level 3 are logged to flash.
- **Ram Level** — Limits log messages that are saved to the switch's temporary RAM memory for all levels up to the specified level. For example, if level 7 is specified, all messages from level 0 to level 7 are logged to RAM.

NOTE: The **Flash Level** must be equal to or less than the **Ram Level**.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

NOTE: System log messages are logged every 60 minutes.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Switch/General/System Logs** page.

Command	Usage
logging on	Controls the logging of debug or error messages to a logging process. The **no** form command disables the logging process.
logging history {flash | ram} *level*	Limits syslog messages saved to switch memory based on severity. The **no** form command returns the logging of syslog messages to the default level. **flash** — event history stored in flash memory (permanent memory) **ram** — event history stored in temporary RAM (memory flushed on power reset)
show logging {flash | ram | trap}	Displays the logging configuration for system and event messages

Example

```
Console(config)#logging on
Console(config)#logging history ram 0
Console(config)#
Console#show logging flash
Syslog logging: Disable
History logging in FLASH: level errors
Console#
```

Remote Logs Configuration

The **Switch/General/Remote Logs** page allows you to configure the logging of messages that are sent to syslog servers or other management stations. You can also limit the error messages sent to messages of a specified level.

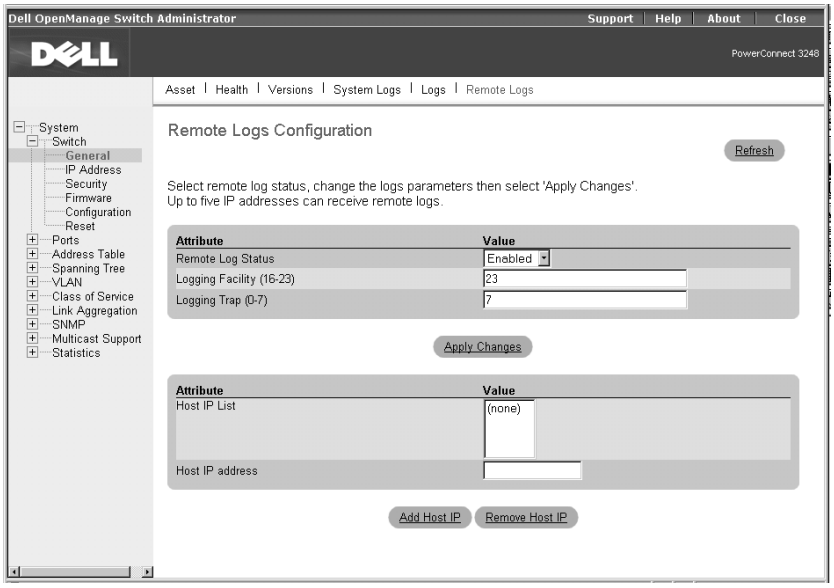
The **Switch/General/Remote Logs** page contains the following fields that can be edited:

- **Remote Log Status** — Enables/disables the logging of debug or error messages to the remote logging process. (Default: Enabled)
- **Logging Facility** — Sets the facility type for remote logging of syslog messages. There are eight facility types specified by values of 16 to 23. The syslog server uses the facility type to dispatch log messages to an appropriate service. (Default: 23)
- **Logging Trap** — Limits log messages that are sent to the remote syslog server for all levels up to the specified level. For example, if level 3 is specified, all messages from level 0 to level 3 are sent to the remote server. (Default: 3)
- **Host IP List** — Displays the list of remote server IP addresses that receive the syslog messages. The maximum number of host IP addresses allowed is five.
- **Host IP Address** — Specifies a new server IP address to add to the **Host IP List**.

To add an IP address to the **Host IP List**, type the new IP address in the **Host IP Address** box, and click **Add IP Host**. To delete an IP address, click the entry in the **Host IP List**, and click **Remove Host IP**.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Switch/General/Remote Logs** page.

Command	Usage
logging host *host_ip_address*	Adds a syslog server host IP address that receives logging messages. The **no** form command removes a syslog server host.
logging facility facility_*type*	Sets the facility type for remote logging of syslog messages. The **no** form command returns the facility type to the default.
logging trap *level*	Limits syslog messages saved to a remote server based on severity. The **no** form command returns the remote logging of syslog messages to the default level.

Command	Usage
show logging {flash | ram | trap}	Displays the logging configuration for system and event messages

Example

```
Console(config)#logging host 10.1.0.9
Console(config)#logging facility 23
Console(config)#logging trap 4
Console(config)#
Console#show logging trap
Syslog logging: Enable
REMOTELOG status: enable
REMOTELOG facility type: local use 7
REMOTELOG level type: Warning conditions
REMOTELOG server ip address: 10.1.0.9
REMOTELOG server ip address: 0.0.0.0
REMOTELOG server ip address: 0.0.0.0
REMOTELOG server ip address: 0.0.0.0
REMOTELOG server ip address: 0.0.0.0
Console#
```

Security

The **Switch/Security** page contains new links to Secure Shell (SSH) and Secure Hypertext Transfer Protocol (HTTPS) configuration. The **RADIUS Settings page was renamed Authentication Settings and updated to** include Terminal Access Controller Access Control System Plus (TACACS+).

- **SSH**
- **Authentication Settings**
- **HTTPS**

Secure Shell

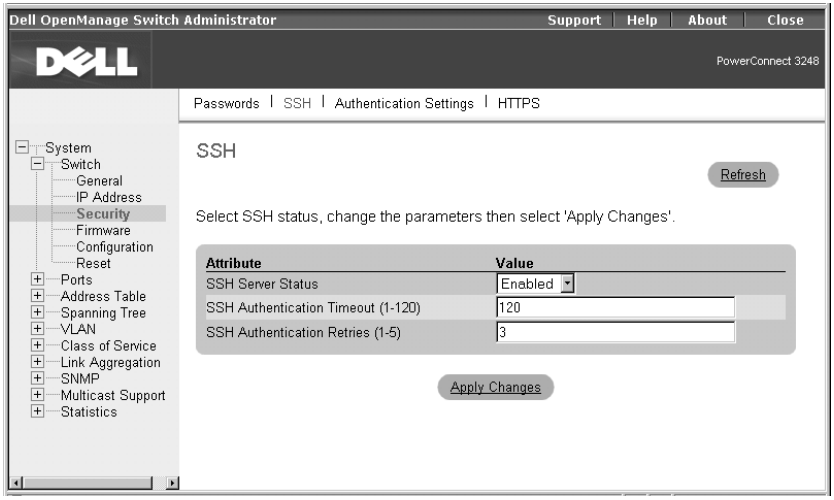
The Secure Shell (SSH) server feature provides remote management access using encrypted paths between the switch and SSH-enabled management station clients.

NOTE: There are two versions of the SSH protocol currently available: SSH v1.*x* and SSH v2.*x*. The switch supports only SSH v1.5.

- **SSH Server Status** — Allows you to enable/disable the SSH server feature on the switch. (Default: Enabled)
- **SSH authentication timeout** — Specifies the time interval in seconds that the SSH server waits for a response from a client during an authentication attempt. (Range: 1 to 120 seconds; Default: 120 seconds)
- **SSH authentication retries** — Specifies the number of authentication attempts that a client is allowed before authentication fails and the client must restart the authentication process. (Range: 1 to 5 times; Default: 3)

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Switch/Security/SSH** page.

Command	Usage
ip ssh server	Enables the SSH server on the switch. The **no** form command disables the SSH server.
ip ssh {[timeout *seconds*] | [authentication-retries *integer*]}	Specifies the authentication timeout for the SSH server and the number of retries allowed by a client. The **no** form command resets the values to the default.
disconnect ssh *connection_id*	Terminates an SSH connection. The *connection_id* is the session number displayed when using the **show ssh** command.
show ip ssh	Displays the status of the SSH server and the configured values for authentication timeout and retries.
show ssh	Displays the status of current SSH sessions.

Example

```
Console(config)#ip ssh server

Console(config)#ip ssh timeout 100

Console(config)#ip ssh authentication-retries 5

Console(config)#

Console#show ip ssh

Information of secure shell

SSH status: enable

SSH authentication timeout: 100

SSH authentication retries: 5

Console#show ssh

Information of secure shell

Session Username Version Encrypt method Negotiation
state
```

```
------- -------- ------- -------------- --------------
---

      0    admin   1.5      cipher-3des   session-
started

Console#
```

Authentication Settings

Similar to RADIUS, TACACS+ is a system that uses a central server to control authentication for access to switches on the network. The **RADIUS Settings** page was renamed "Authentication Settings" and updated to include TACACS+.

The RADIUS system uses User Datagram Protocol (UDP) while TACACS+ uses Transmission Control Protocol (TCP). UDP only offers best-effort delivery, while TCP offers a connection-oriented transport. Also, note that RADIUS encrypts only the password in the access-request packet from the client to the server, while TACACS+ encrypts the entire body of the packet.

Both RADIUS and TACACS+ authentication control management access using the console port, Web browser, or Telnet. These access options must be configured on the authentication server together with user names, passwords, and specific privilege levels for each user name/password pair.

NOTICE: If you are using only a RADIUS server for authentication, you must configure a special user name on the server for the CLI **enable** command that allows access to the Privileged Exe level from the Normal Exe level. The user name to configure on the RADIUS server for this command is `$Enable`.

NOTE: When you are setting up privilege levels on a RADIUS or TACACS+ server, level 0 allows Normal Exec access to the switch, and level 15 allows Privileged Exec access.

The **Switch/Security/Authentication Settings** page contains the following fields that can be edited:

- **Authentication Sequence**— Select the authentication, or authentication sequence, required: (Default: Local)
  - **Local** — The switch authenticates the user.
  - **RADIUS** — A RADIUS server authenticates the user.
  - **TACACS** — A TACACS+ server authenticates the user.
  - **Local, RADIUS** — The switch attempts to authenticate the user first, and then a RADIUS server attempts to authenticate the user.

- **Local, TACACS** — The switch attempts to authenticate the user first, and then a TACACS+ server attempts to authenticate the user.
- **RADIUS, Local** — A RADIUS server attempts to authenticate the user first, and then the switch attempts to authenticate the user.
- **RADIUS, TACACS** — A RADIUS server attempts to authenticate the user first, and then a TACACS+ server attempts to authenticate the user.
- **Local, RADIUS, TACACS** — The switch attempts to authenticate the user first, then a RADIUS server, and then a TACACS+ server.
- **Local, TACACS, RADIUS** — The switch attempts to authenticate the user first, then a TACACS+ server, and then a RADIUS server.
- **RADIUS, Local, TACACS** — A RADIUS server attempts to authenticate the user first, then the switch, and then a TACACS+ server.
- **RADIUS, TACACS, Local** — A RADIUS server attempts to authenticate the user first, then a TACACS+ server, and then the switch.
- **TACACS, Local, RADIUS** — A TACACS+ server attempts to authenticate the user first, then the switch, and then a RADIUS server.
- **TACACS, RADIUS, Local** — A TACACS+ server attempts to authenticate the user first, then a RADIUS server, and then the switch.

• **RADIUS Server Settings** — If using a RADIUS server, specify the following details:

- **Server IP Address** — Identifies the IP address of the RADIUS server.
- **Server Port Number** — Identifies the User Datagram Protocol (UDP) port number used by the RADIUS server.
- **Secret Text String** — Specifies the text string that is shared between the switch and the RADIUS server. Do not use blank spaces in the string.
- **Number of Server Transmits** — Specifies the number of request transmits to the RADIUS server before failure.

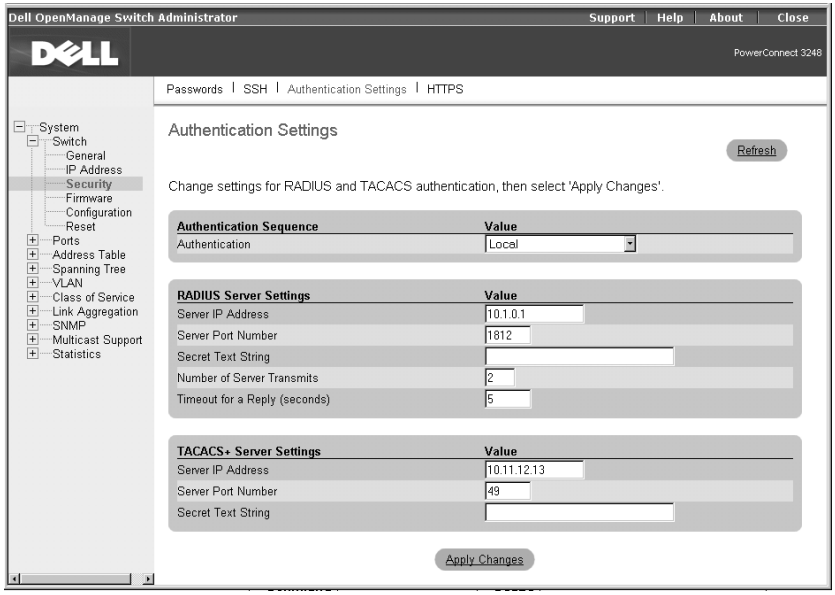
NOTE: The local switch user database must be set up through the CLI by manually entering user names and passwords.

- **Timeout for a Reply** — Specifies the number of seconds the switch waits for a reply from the RADIUS server before it resends the request.

- **TACACS+ Server Settings** — If using a TACACS+ server, specify the following details:
  - **Server IP Address** — Identifies the IP address of the TACACS+ server.
  - **Server Port Number** — Identifies the Transmission Control Protocol (TCP) port number used by the TACACS+ server.
  - **Secret Text String** — Specifies the text string that is shared between the switch and the TACACS+ server. Do not use blank spaces in the string.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Switch/Security/Authentication Settings** page.

Command	Usage
authentication login {radius | local | tacacs} [tacacs | radius | local] [local | tacacs | radius]	Defines the login authentication method and precedence.
radius-server host *host_ip_address*	Specifies the RADIUS server IP address.
radius-server port *port_number*	Sets the RADIUS server UDP port number.
radius-server key *key_string*	Sets the RADIUS encryption key (up to 20 characters).
radius-server retransmit *number_of_retries*	Sets the number of times the switch attempts to authenticate logon access through the RADIUS server. (The range is 1–30.)
radius-server timeout *number_of_seconds*	Sets the number of seconds the switch waits for a reply before resending a request. (The range is 1-65535.)
show radius-server	Displays the current configuration of the RADIUS server parameters.
tacacs-server host *host_ip_address*	Specifies the TACACS+ server IP address.
tacacs-server port *port_number*	Sets the TACACS+ server TCP port number.
tacacs-server key *key_string*	Sets the TACACS+ encryption key (up to 20 characters).
show tacacs-server	Displays the current configuration of the TACACS+ server parameters.

NOTE: The default password for the enable command is *super.* The manager must change the password.

Example

```
Console(config)#authentication login local radius
tacacs

Console(config)#radius-server host 192.168.1.25

Console(config)#radius-server port 181

Console(config)#radius-server key green

Console(config)#radius-server retransmit 5
```

```
Console(config)#radius-server timeout 10
Console(config)#tacacs-server host 192.168.1.19
Console(config)#tacacs-server port 49
Console(config)#tacacs-server key tiger
Console(config)#
Console#show tacacs-server
Remote TACACS server configuration:
 Server IP address: 192.168.1.19
 Communication key with radius server: tiger
 Server port number: 49
Console#
```

Hypertext Transfer Protocol, Secure

Use the **Switch/Security/HTTPS** page to enable the Secure Hypertext Transfer Protocol (HTTPS) over the Secure Socket Layer (SSL), providing secure access (for example, an encrypted connection) to the switch's Web interface.

Both the HTTP and HTTPS service can be enabled independently on the switch. However, you cannot configure the HTTP and HTTPS servers to use the same TCP port. If you change the HTTPS port number, clients attempting to connect to the HTTPS server must specify the port number in the URL, in this format: *https://device:port_number*.

NOTE: If you enable HTTPS, you must indicate this in the URL. For example: *https://device[:port_number]*

The following Web browsers and operating systems currently support HTTPS:

Web Browser	Operating System
Microsoft® Internet Explorer 5.0 or later	Windows® 98, Windows NT® (with service pack 6a), Windows 2000
Netscape Navigator 4.76 or later	Windows 98, Windows NT (with service pack 6a), Windows 2000, Solaris 2.6

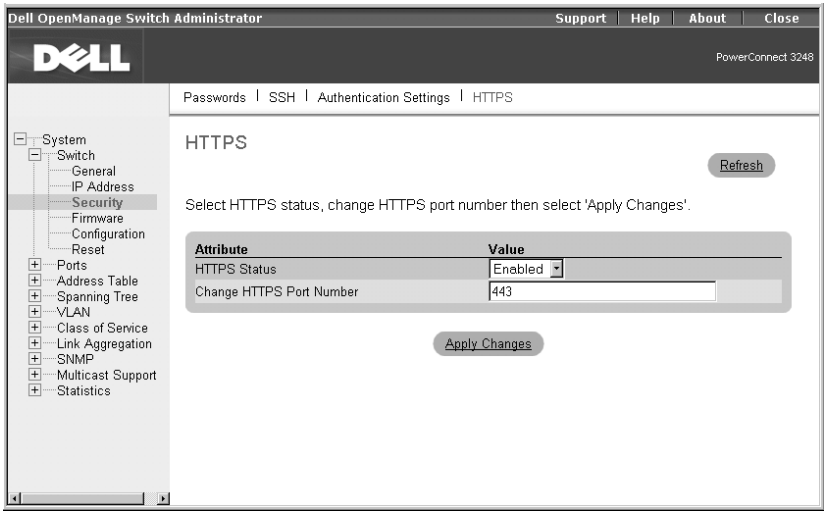
When you start HTTPS, the client and server establish a secure encrypted connection. A padlock icon should appear in the status bar for Internet Explorer 5.x and Netscape Navigator 4.x.

The **Switch/Security/HTTPS** page contains the following fields that can be edited:

- **HTTPS Status** — Allows you to enable/disable the HTTPS server feature on the switch. (Default: Enabled)
- **HTTPS Port** — Specifies the UDP port number used for HTTPS/SSL connection to the switch's Web interface. (Default: 443).

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Switch/Security/HTTPS** page.

Command	Usage
ip http secure-server	Enables the HTTPS server on the switch. The **no** form command disables the HTTPS server.
ip http secure-port *port_number*	Specifies the TCP port number used for HTTPS connection to the switch's Web interface. The **no** form command restores the default port.
copy tftp https-certificate	Copies an HTTPS certificate from an TFTP server to the switch.

Example

```
Console(config)#ip http secure-server
Console(config)#ip http secure-port 441
Console(config)#
```

Port Security

Port security is a feature that allows you to configure a switch port with one or more device Media Access Control (MAC) addresses that are authorized to access the network through that port.

When port security is enabled on a port, the switch stops learning new MAC addresses on the specified port. Only incoming traffic with source addresses already stored in the dynamic or static address table are accepted as authorized to access the network through that port. If a device with an unauthorized MAC address attempts to use the switch port, the intrusion is detected and the switch can automatically take action by disabling the port and sending a trap message.

To use port security, first allow the switch to dynamically learn the <*source MAC address*, *VLAN*> pair for frames received on a port for an initial period, and then enable port security to stop address learning. Be sure you enable the learning function long enough to ensure that all valid VLAN members are registered on the selected port.

Note that a secure port has the following restrictions:

- It should not be connected to a network interconnection device.
- It cannot be configured as a member of a static trunk.
- It can be configured as an LACP trunk port, but the switch does not allow the LACP trunk to be encabled.

NOTICE: A port that is already configured as a LACP or static trunk port cannot be enabled as a secure port.

Switch 3248: Port Security Configuration

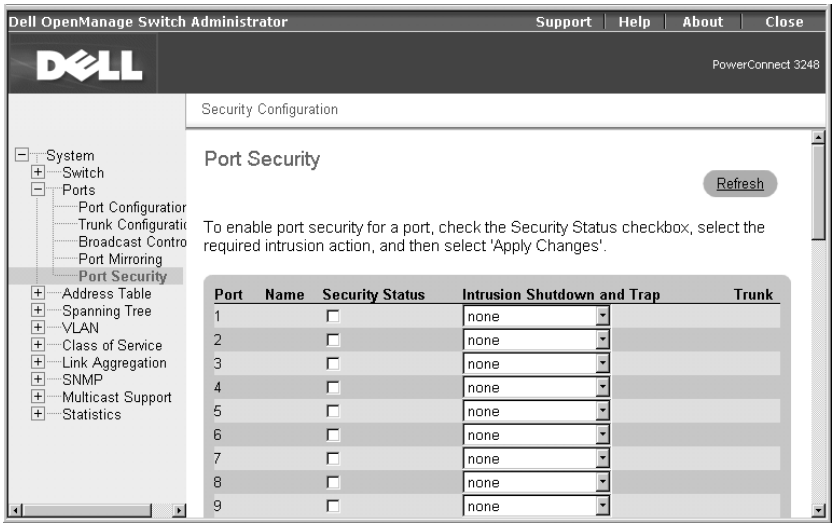
On the **Ports/Port Security** page, you can enable/disable security for any switch port. For each port number listed in the **Port** column, you can configure the following parameters listed by column name on the screen:

- **Security Status** — Enables or disables port security on the port. (Default: Disabled)
- **Intrusion Shutdown and Trap** — Indicates the action to be taken when a port security violation is detected:
  - **None**: Indicates that no action should be taken. (This is the default.)
  - **Trap**: Indicates that only an SNMP trap message be sent.
  - **Shutdown**: Indicates that only the port should be disabled.
  - **Trap and Shutdown**: Indicates that the port should be disabled and an SNMP trap message sent.

NOTICE: If a port is disabled due to a security violation, it must be manually re-enabled from the **Ports/Port Configuration** page. See "Switch 3248: Re-Enabling a Shutdown Port" on page 20.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248.



Switch 3248: Re-Enabling a Shutdown Port

If security is enabled on a port and the intrusion action set to **Shutdown** or **Trap and Shutdown**, then a security violation will cause the port to be disabled. To re-enable a shutdown port, follow these steps:

NOTE: To re-enable a port using the CLI, use the **no shutdown** command in Interface Configuration mode.

1. Click the **Ports/Port Configuration** page.
2. For the port that is disabled, click the check box in the **Admin/Oper** column.
3. Click **Apply Changes** to enable the port.

Switch 3248: CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Ports/Port Security** page.

Command	Usage
port security [action {shutdown | trap | trap-and-shutdown}]	Enables and configures port security on a port. The **no** form command resets the values to the defaults.

Example

```
Console(config)#interface ethernet 1/5
Console(config-if)#port security action shutdown
Console(config-if)#port security
Console(config-if)#
```

Switch 5224: Port Security

The **Ports/Port Security** page contains links to the following pages:

- **Global Configuration**
- **Port Security Configuration**

Switch 5224: Global Configuration

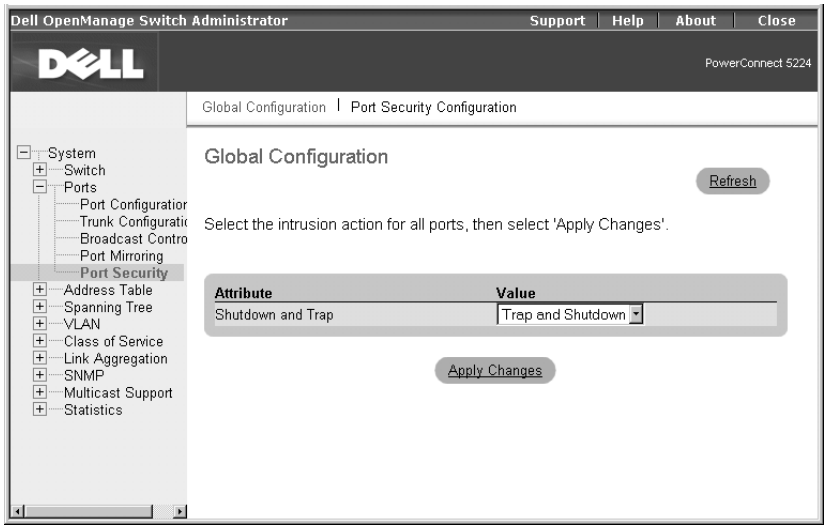
On the **Ports/Port Security/Global Configuration** page, you can set the security action to be taken when a port intrusion is detected. This setting applies to all ports on the switch.

The page provides one parameter to configure:

- **Shutdown and Trap** — Indicates the action to be taken when a port security violation is detected:
  - **None**: Indicates that no action should be taken. (This is the default.)
  - **Trap and Shutdown**: Indicates that the port should be disabled and an SNMP trap message sent.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 5224.



Switch 5224: Port Security Configuration

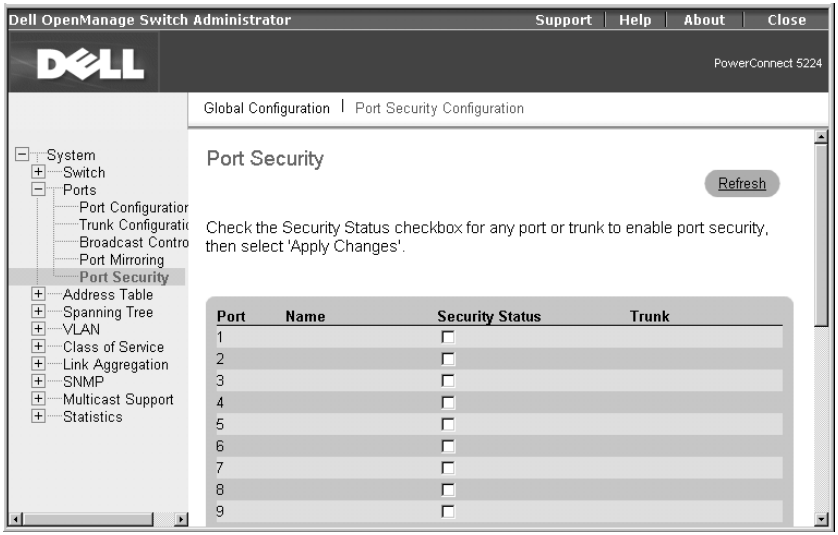
On the **Ports/Port Security/Port Security Configuration** page, you can enable/disable security for any switch port. For each port number listed in the **Port** column, you can configure the following parameter:

- **Security Status** — Enables or disables port security on the port. (Default: Disabled)

NOTICE: If a port is disabled due to a security violation, it must be manually re-enabled from the **Ports/Port Configuration** page. See "Switch 5224: Re-Enabling a Shutdown Port" on page 23.

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 5224.



Switch 5224: Re-Enabling a Shutdown Port

If security is enabled on a port and you set the intrusion action to **Trap and Shutdown**, a security violation causes the port to be disabled. To re-enable a shutdown port, follow these steps:

1. Click the **Ports/Port Configuration** page.
2. For the port that is disabled, click the check box in the **Admin/Oper** column.
3. Click **Apply Changes** to enable the port.

NOTE: To re-enable a port using the CLI, use the **no shutdown** command in Interface Configuration mode.

Switch 5224: CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Ports/Port Security** pages.

Command	Usage
port security	Enables port security on an interface. The **no** form command disables port security.

Command	Usage
port security action {trap-and-shutdown}	Configures the port security action for all switch ports. The **no** form command restores the default.

NOTICE: Although the **port security action** command is an interface-level CLI command, it applies globally to all switch ports.

Example

```
Console(config)#interface ethernet 1/5

Console(config-if)#port security action trap-and-
shutdown

Console(config-if)#port security

Console(config-if)#
```

Spanning Tree Protocol

The Spanning Tree Protocol (STP) can be used to detect and disable network loops, and to provide backup links between switches, bridges or routers. STP allows the switch to interact with other bridging devices in your network such as an STP-compliant switch, bridge or route. STP ensures that only one route exists between any two stations on the network and provides backup links that automatically take over when a primary link goes down.

The switch supports the following STPs:

- **STP** – Spanning Tree Protocol (IEEE 802.1D).
- **RSTP** – Rapid Spanning Tree Protocol (IEEE 802.1w).

RSTP is designed as a general replacement for the slower, legacy STP. RSTP achieves much faster reconfiguration (around one tenth of that required by STP) by reducing the number of state changes before active ports start learning, predefining an alternate route that can be used when a node or port fails, and retaining the forwarding database for ports insensitive to changes in the tree structure when reconfiguration occurs.

The **Spanning Tree** page contains links to pages that allow you to specify the parameters of the Spanning Tree Protocol:

- **Bridge Settings**
- **Advanced Bridge Settings**
- **Port Settings**
- **Trunk Settings**

Bridge Settings

The **Bridge Settings** page contains the following information:

- **Bridge ID** — Identifies a unique identifier for the switch in the Spanning Tree. The ID is calculated using the defined Spanning Tree priority of the switch and its MAC address. The lower the Bridge ID, the more likely the switch acts as the root.
- **Max Age** — The maximum time, in seconds, that the switch can wait without receiving a configuration message before attempting to reconfigure. All device ports, except for designated ports, should receive configuration messages at regular intervals. If the root port ages out STP information (provided in the last configuration message), a new root port is selected from among the device ports attached to the network. References to "ports" in this section means "interfaces," which includes both ports and trunks.
- **Hello Time** — Specifies the time interval, in seconds, at which the root device transmits a configuration message.
- **Forward Delay** — The maximum time, in seconds, that the switch waits before changing states (such as, discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a discarding state; otherwise, temporary data loops might result.
- **Designated Root** — Identifies the priority and MAC address of the device in the Spanning Tree that the switch has accepted as the root device.

- **Root Port** — Specifies the port number on the switch that is closest to the root. The switch communicates with the root device through this port. If there is no root port, the switch was accepted as the root device of the Spanning Tree network.
- **Root Path Cost** — Identifies the path cost from the root port on the switch to the root device.
- **Configuration Changes** — Specifies the number of times the Spanning Tree has been reconfigured.
- **Last Topology Change** — Identifies the time since the Spanning Tree was last reconfigured.

From the **Bridge Settings** page, under **Attributes**, you can configure the following Spanning Tree parameters:

- **Spanning Tree State** — Enables or disables the Spanning Tree. If you enable the Spanning Tree, you must complete the other fields. (Default: Enabled)
- **Spanning Tree Type** — Specifies the type of Spanning Tree Protocol used on the switch: (Default: RSTP)
  - **STP**: Spanning Tree Protocol (IEEE 802.1D).
    STP creates one Spanning Tree instance for the entire network. If multiple VLANs are implemented on a network, the path between specific VLAN members may be inadvertently disabled to prevent network loops, thus isolating group members.

NOTICE: When the STP option is selected, the switch uses RSTP set to STP forced-compatibility mode.

  - **RSTP**: Rapid Spanning Tree (IEEE 802.1w).
    RSTP supports connections to either STP or RSTP nodes by monitoring the incoming protocol messages and dynamically adjusting the type of protocol messages the RSTP node transmits, as described below:
    - STP Mode – If the switch receives an 802.1D BPDU (such as, STP BPDU) after a port's migration delay timer expires, the switch assumes it is connected to an 802.1D bridge and starts using only 802.1D BPDUs.

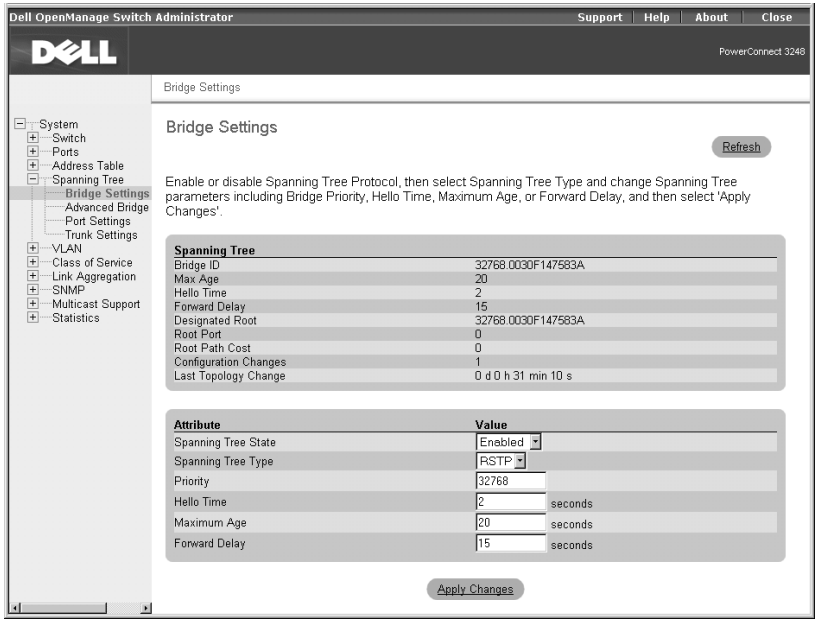
  - RSTP Mode – If RSTP is using 802.1D BPDUs on a port and receives an RSTP BPDU after the migration delay expires, RSTP restarts the migration delay timer and begins using RSTP BPDUs on that port.

- **Priority** — Bridge priority is used in selecting the root device, root port, and designated port. The device with the highest priority becomes the STP root device. However, if all devices have the same priority, the device with the lowest MAC address becomes the root device.
  - Default: 32768
  - Range: 0-61440, in steps of 4096
  - Options: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440
- **Hello Time** — Interval, in seconds, at which the switch transmits a configuration message.
  - Default: 2
  - Minimum: 1
  - Maximum: The lower of 10 or [(Max. Message Age / 2) -1]
- **Maximum Age** — The maximum time, in seconds, the switch can wait without receiving a configuration message before attempting to reconfigure. All device ports, except for designated ports, should receive configuration messages at regular intervals. Any port that ages out STP information (provided in the last configuration message) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the device ports attached to the network. References to "ports" in this section means "interfaces," which includes both ports and trunks.
  - Default: 20
  - Minimum: The higher of 6 or [2 x (Hello Time + 1)].
  - Maximum: The lower of 40 or [2 x (Forward Delay - 1)]

- **Forward Delay** — The maximum time, in seconds, the switch waits before changing states (such as, discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a discarding state; otherwise, temporary data loops might result.
  - Default: 15
  - Minimum: The higher of 4 or [(Max. Message Age / 2) + 1]
  - Maximum: 30

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Spanning Tree/Bridge Settings** page.

Command	Usage
spanning-tree	Enables the Spanning Tree algorithm globally for the switch. The **no** form command disables STP.
spanning-tree mode {stp | rstp}	Selects the Spanning Tree mode for the switch. The **no** form command restores the default (STP).
spanning-tree forward-time *seconds*	Configures the Spanning Tree bridge forward time globally for the switch.
spanning-tree hello-time *time*	Configures the Spanning Tree bridge hello time globally for the switch.
spanning-tree max-age *seconds*	Configures the Spanning Tree bridge maximum age globally for the switch.
spanning-tree priority *priority*	Configures the Spanning Tree priority globally for the switch.
show spanning-tree [*interface*]	Shows the Spanning Tree configuration.

Example

```
Console(config)#spanning-tree mode rstp
Console(config)#spanning-tree
Console(config)#spanning-tree forward-time 15
Console(config)#spanning-tree hello-time 2
Console(config)#spanning-tree max-age 20
Console(config)#spanning-tree priority 40000
```

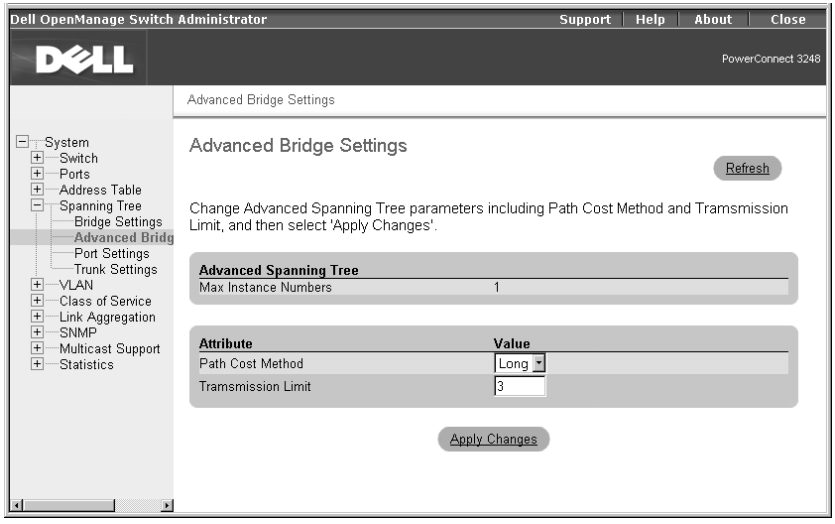
Advanced Bridge Settings

From the **Advanced Bridge Settings** page, under **Attributes**, you can configure the following parameters:

- **Path Cost Method** — The path cost is used to determine the best path between devices. The path cost method is used to determine the range of values that can be assigned to each interface.
  - **Long**: Specifies 32-bit based values that range from 1-200,000,000.
  - **Short**: Specifies 16-bit based values that range from 1-65535. (This is the default.)
- **Transmission Limit** — The maximum transmission rate for BPDUs is specified by setting the minimum interval between the transmission of consecutive protocol messages. (Range: 1-10; Default: 3)

To save any changes you make in this page, click **Apply Changes**. If you do not want to save the changes, click **Refresh**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Spanning Tree/Advanced Bridge Settings** page.

Command	Usage
spanning-tree pathcost method {long | short}	Configures the path cost method used for Rapid Spanning Tree. The **no** form command restores the default.
spanning-tree transmission-limit *count*	Sets the minimum interval between the transmission of consecutive RSTP BPDUs. The **no** form command restores the default.

Example

```
Console(config)#spanning-tree pathcost method long
Console(config)#spanning-tree transmission-limit 4
Console(config)#
```

Port and Trunk Settings

You can configure RSTP attributes for specific interfaces, including port priority, path cost, link type, and edge port. You may use a different priority or path cost for ports of same media type to indicate the preferred path, link type to indicate a point-to-point connection or shared-media connection, and edge port to indicate if the attached device can support fast forwarding. References to "ports" in this section means "interfaces," which includes both ports and trunks.

In the **Port Settings** page, you can specify Spanning Tree parameters for each port. For each port number listed in the **Port** column, the following information is available:

- **State** — Displays current state of this port within the Spanning Tree:
  - **Discarding** — Port receives STA configuration messages, but does not forward packets.
  - **Learning** — Port has transmitted configuration messages for an interval set by the Forward Delay parameter without receiving contradictory information. Port address table is cleared, and the port begins learning addresses.

  - **Forwarding** — Port forwards packets, and continues learning addresses.

- **Designated Cost** — The cost for a packet to travel from this port to the root in the current Spanning Tree configuration. The slower the media, the higher the cost.
- **Designated Bridge** — The priority and MAC address of the device through which this port must communicate to reach the root of the Spanning Tree.
- **Designated Port** — The priority and number of the port on the designated bridging device through which this switch must communicate with the root of the Spanning Tree.
- **Trunk** — Indicates whether the port is configured as a trunk member

The **Port Settings** page also contains the following fields that can be edited:

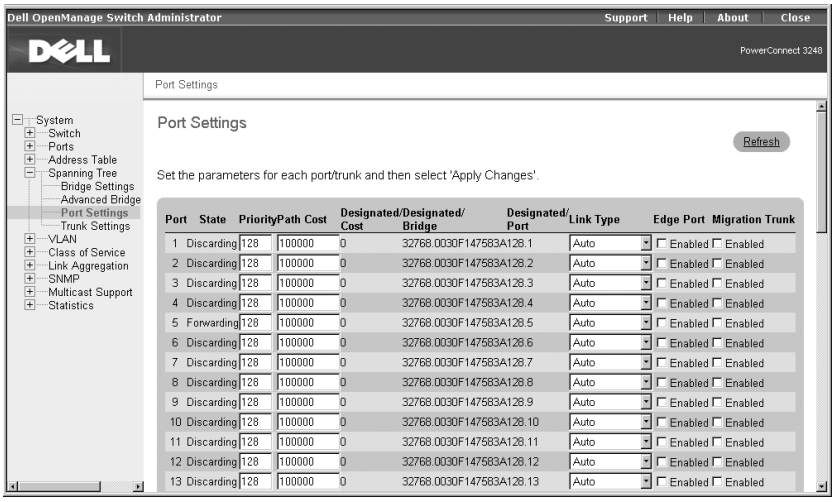
- **Priority** — Defines the priority used for this port in the Spanning Tree Protocol. If the path cost for all ports on a switch is the same, the port with the highest priority (such as, lowest value) is configured as an active link in the Spanning Tree. This makes a port with higher priority less likely to be blocked if the Spanning Tree Protocol is detecting network loops. Where more than one port is assigned the highest priority, the port with lowest numeric identifier is enabled. (Range: 0-240, in steps of 16; Default: 128.)
- **Path Cost** — This parameter is used by the STP to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media. Path cost takes precedence over port priority.
  - Range —
    Ethernet: 200,000-20,000,000
    Fast Ethernet: 20,000-2,000,000
    Gigabit Ethernet: 2,000-200,000
  - Defaults —
    Ethernet — half duplex: 2,000,000; full duplex: 1,000,000; trunk: 500,000
    Fast Ethernet — half duplex: 200,000; full duplex: 100,000; trunk: 50,000
    Gigabit Ethernet — full duplex: 10,000; trunk: 5,000

NOTICE: When the Path Cost Method is set to short, the maximum path cost is 65,535.

- **Link Type** — The link type attached to this interface. (Default: Auto)
  - **Point-to-Point** — A connection to exactly one other bridge.
  - **Shared** — A connection to two or more bridges.
  - **Auto** — The switch automatically determines if the interface is attached to a point-to-point link or to shared media.
- **Edge Port** — You can enable this option if an interface is attached to a LAN segment that is at the end of a bridged LAN or to an end node. Because end nodes cannot cause forwarding loops, they can pass directly through to the spanning tree forwarding state. Specifying Edge Ports provides:
  - Quicker convergence for devices such as workstations or servers
  - Retains the current forwarding database to reduce the amount of frame flooding required to rebuild address tables during reconfiguration events
  - Does not cause the Spanning Tree to initiate reconfiguration when the interface changes state,
  - Overcomes other STP-related timeout problems.

  Edge Port should only be enabled for ports connected to an end-node device.
- **Migration** — Re-checks the appropriate BPDU format to send on the selected interface. If, at any time, the switch detects STP BPDUs, including Configuration or Topology Change Notification BPDUs, it automatically sets the selected interface to forced STP-compatible mode. You can also check this Migration check box to manually re-check the appropriate BPDU format (RSTP or STP-compatible) to send on the selected interfaces.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Spanning Tree/Port Settings** page.

Command	Usage
spanning-tree port-priority *priority*	Configures the priority for the specified interface. The **no** form command restores the default.
spanning-tree cost *cost*	Configures the Spanning Tree path cost for the specified interface. The **no** form command restores the default.
spanning-tree link-type {auto | point-to-point | shared}	Configures the link type for the Rapid Spanning Tree. The **no** form command restores the default.
spanning-tree edge-port	Specifies an interface as an edge port. The **no** form command restores the default.
spanning-tree protocol-migration *interface*	Re-checks the appropriate BPDU format to send on the selected interface.

Example

```
Console(config)#interface ethernet 1/5
Console(config-if)#spanning-tree port-priority 128
Console(config-if)#spanning-tree cost 19
Console(config-if)#spanning-tree link-type auto
Console(config-if)#no spanning-tree edge-port
Console#spanning-tree protocol-migration ethernet 1/5
```

Simple Network Management Protocol

The **Simple Network Management Protocol (SNMP)** page contains a new link to the following page:

- **IP Filtering**

IP Filtering

On the **SNMP/IP Filtering** page, you can create a list of up to 16 IP addresses or IP address groups that are allowed access to the switch using SNMP management software.

IP addresses that are permitted SNMP access are specified by an IP address and a subnet mask that identifies the range of valid addresses. For example:

IP address 192.168.1.1 and mask 255.255.255.0 — Specifies a valid IP address group from 192.168.1.0 to 192.168.1.255.

IP address 192.168.1.1 and mask 255.255.255.255 — Specifies a valid IP address of 192.168.1.1 only.

The following options are available:

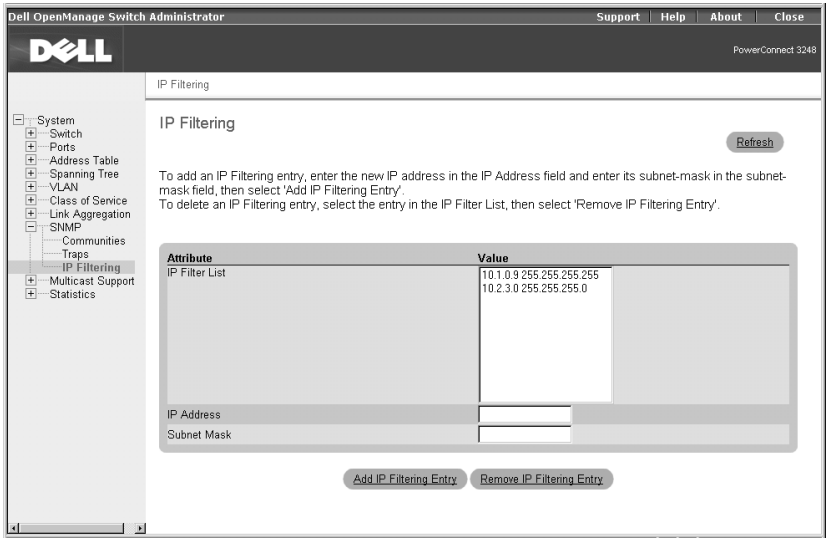
- **IP Filter List** — Displays a list of the IP address/subnet mask entries currently configured for SNMP access.
- **IP address** — Specifies a new IP address to add to the **IP Filter List**.
- **Subnet Mask** — Specifies a single IP address or group of addresses. If the IP is the address of a single management station, the mask should be set to 255.255.255.255. Otherwise, the IP address group is specified by the mask.

NOTE: IP filtering does not affect management access to the switch using the Web interface or Telnet.

NOTICE: The default setting is null, which allows all IP groups SNMP access to the switch. If one IP address is configured, the IP filtering is enabled and only addresses in the IP group will have SNMP access.

To add an IP address, type the new IP address in the **IP Address** box, type the appropriate subnet mask in the **Subnet Mask** box, and click **Add IP Filtering Entry**. To delete an IP address, click the entry in the **IP Filter List**, and then click **Remove IP Filtering Entry**.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **SNMP/IP Filtering** page.

Command	Usage
snmp ip filter *ip_address subnet_mask*	Sets IP addresses of clients allowed to management access to the switch using SNMP. The **no** form command removes an IP address.

Example

```
Console(config)#snmp ip filter 10.1.2.3
255.255.255.255

Console(config)#
```

Statistics

The **Statistics** page has two new links to the following pages:

- **Utilization Summary**
- **Counter Summary**

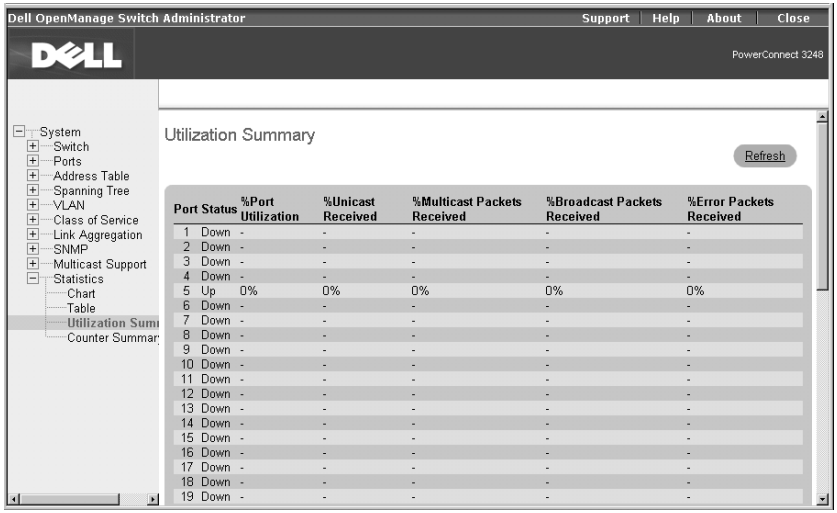
Utilization Summary

The **Statistics/Utilization Summary** page provides a per-port summary of traffic types and bandwidth utilization as a percentage of total traffic.

This page displays the following information:

- **%Port Utilization** — Displays the percentage of bandwidth used by all traffic types on the port.
- **%Unicast Received** — Displays the percentage of traffic received on the port that are unicast packets.
- **%Multicast Packets Received** — Displays the percentage of traffic received on the port that are multicast packets.
- **%Broadcast Packets Received** — Displays the percentage of traffic received on the port that are broadcast packets.
- **%Error Packets Received** — Displays the percentage of traffic received on the port that are packets with errors.

The following figure is representative of PowerConnect 3248 and 5224.



Counter Summary

The **Statistics/Counter Summary** page provides a per-port summary of traffic-type counters.

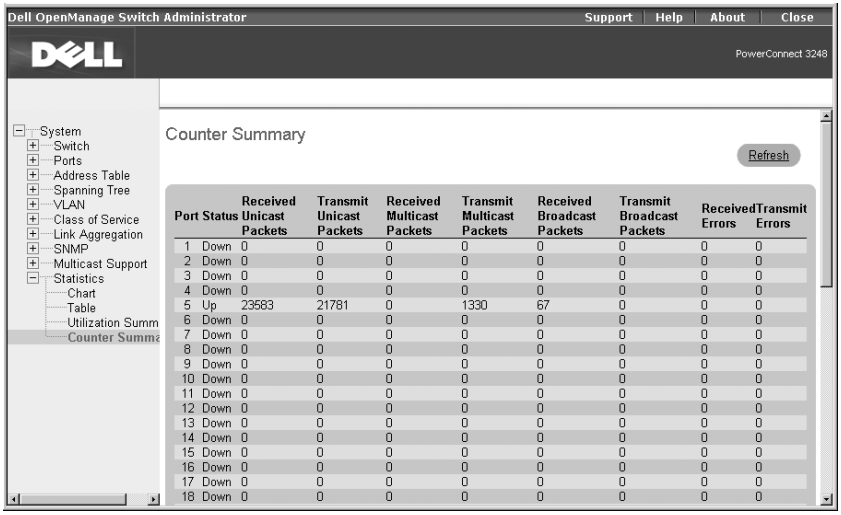
NOTE: Counters are cumulative from the last time the system was booted.

This page displays the following information:

- **Received Unicast Packets** — Total number of unicast packets received on the port.
- **Transmit Unicast Packets** — Total number of unicast packets transmitted on the port.
- **Received Multicast Packets** — Total number of multicast packets received on the port.
- **Transmit Multicast Packets** — Total number of multicast packets transmitted on the port.
- **Received Broadcast Packets** — Total number of broadcast packets received on the port.
- **Transmit Broadcast Packets** — Total number of broadcast packets transmitted on the port.

- **Received Errors** — Total number of error packets received on the port.
- **Transmit Errors** — Total number of error packets transmitted on the port.

The following figure is representative of PowerConnect 3248 and 5224.



CLI Commands

The following table summarizes the equivalent CLI commands for items in the **Statistics/Counter Summary** page.

Command	Usage
show interfaces counters *interface*	Displays statistics counters for an interface.
clear counters *interface*	Clears statistics counters on an interface.

Example

```
Console#show interfaces counters ethernet 1/17
Ethernet 1/17
  Iftable stats:
    Octets input: 91248, Octets output: 343887
    Unitcast input: 680, Unitcast output: 593
    Discard input: 0, Discard output: 0
```

NOTE: You can also clear the counters for a port by clicking the **Reset Counter** button at the bottom of the **Statistics/Table** page.

```
    Error input: 0, Error output: 0
    Unknown protos input: 0, QLen output: 0
  Extended iftable stats:
    Multi-cast input: 0, Multi-cast output: 1854
    Broadcast input: 138, Broadcast output: 165
  Ether-like stats:
    Alignment errors: 0, FCS errors: 0
    Single Collision frames: 0, Multiple collision frames: 0
    SQE Test errors: 0, Deferred transmissions: 0
    Late collisions: 0, Excessive collisions: 0
    Internal mac transmit errors: 0, Internal mac receive errors:
0
    Frame too longs: 0, Carrier sense errors: 0
  RMON stats:
    Drop events: 0, Octets: 435135, Packets: 3430
    Broadcast pkts: 303, Multi-cast pkts: 1854
    Undersize pkts: 0, Oversize pkts: 0
    Fragments: 0, Jabbers: 0
    CRC align errors: 0, Collisions: 997976404
    Packet size <= 64 octets: 2584, Packet size 65 to 127 octets:
211
    Packet size 128 to 255 octets: 198, Packet size 256 to 511
octets: 317
    Packet size 512 to 1023 octets: 95, Packet size 1024 to 1518
octets: 25
Console#
Console#configure
Console(config)#clear counters ethernet 1/17
```