Moxa PowerTrans Switch

PT-7828 User's Manual

www.moxa.com/product

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Moxa PowerTrans Switch
PT-7828 User's Manual

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1 Introduction

Welcome to the PowerTrans PT-7828, a managed redundant Gigabit Ethernet switch designed especially for connecting Ethernet-enabled devices for industrial field applications.

The following topics are covered in this chapter:

- ❑ **Overview**
- ❑ **Package Checklist**
- ❑ **Software Features**

Overview

The PowerTrans PT-7828 is certified for use in power substation automation systems (IEC 61850-3, IEEE 1613), traffic control systems (NEMA TS 2), and railway applications (EN50121-4). It can be used for Gigabit or Fast Ethernet backbones and supports redundant ring topologies. It also supports dual power inputs (24/48 VDC or 110/220 VDC/VAC) to increase the reliability of communication.

The PT-7828 has a modular design that makes network planning easy and allows greater flexibility. You can install up to 4 Gigabit Ethernet ports and 24 Fast Ethernet ports. Optional front or rear wiring makes the PT-7828 suitable for different applications.

Package Checklist

The PowerTrans PT-7828 is shipped with the following items. If any of these items is missing or damaged, please contact your customer service representative for assistance.

- 1 PowerTrans PT-7828
- Hardware installation guide
- CD-ROM with user's manual and SNMP MIB file
- Warranty statement
- RJ45-to-DB9 console port cable
- Protective caps for unused ports
- 2 rackmount attachments

Software Features

- Static routing and RIP V1/V2 supported
- Turbo Ring, Turbo Chain, and RSTP/STP (IEEE 802.1W/D)
- VRRP ensures redundant routing paths
- IEEE 1588 PTP (Precision Time Protocol) for precise time synchronization of networks
- DHCP Option 82 for IP address assignment for different policies
- Supports Modbus TCP for easy integration in HMI
- Supports LLDP (Link Layer Discovery Protocol)
- Redundant Gigabit Turbo Ring, RSTP/STP (IEEE 802.1w/D), and Turbo Chain
- IGMP snooping, GMRP to filter multicast traffic from industrial Ethernet protocols
- IEEE 802.1Q VLAN, GVRP for easier network planning
- QoS-IEEE 802.1p/1Q and TOS/DiffServ to increase determinism
- 802.3ad, LACP for bandwidth optimization
- IEEE 802.1X and https/SSL to enhance network security
- SNMP V1/V2c/V3 for differential network management
- RMON for efficient, proactive network monitoring
- Supports ABC-01 for system configuration backup
- Access restriction by MAC address
- Port mirroring for online debugging
- Automatic warnings by email, relay output
- Automatic recovery of connected device's IP addresses
- Line-swap fast recovery
- Configuration through web browser, Telnet/serial console, Windows utility, and ABC-01

2

Getting Started

This chapter explains how the initial installation process for the PT-7828. There are three ways to access PT-7828's configuration settings: the serial console, Telnet console, and web console. If you do not know the PT-7828's IP address, you can open the serial console by connecting the PT-7828 to a PC's COM port with a short serial cable. You can open the Telnet or web console over an Ethernet LAN or over the Internet.

The following topics are covered:

❑ **Serial Console Configuration (115200, None, 8, 1, VT100)**

❑ **Configuration by Telnet Console**

❑ **Configuration by Web Browser**

❑ **Disabling Telnet and Browser Access**

Serial Console Configuration (115200, None, 8, 1, VT100)

NOTE

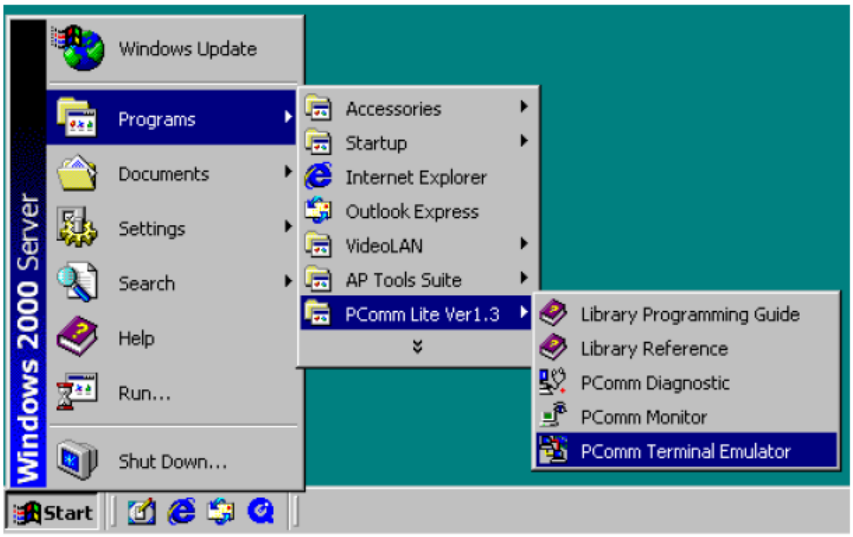
- You **cannot** connect to the serial and Telnet console at the same time.
- You **can** connect to the web console and another console (serial or Telnet) at the same time. However, it is strongly recommended that you do NOT do so. Following this advice will allow you to maintain better control over the PT-7828's configuration.

NOTE We recommend using PComm Terminal Emulator when opening the serial console. This software can be downloaded free of charge from the Moxa website.

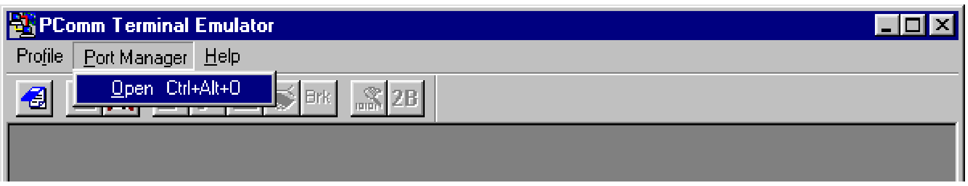
Before running PComm Terminal Emulator, use an RJ45 to DB9-F (or RJ45 to DB25-F) cable to connect the PT-7828's console port to your PC's COM port (generally COM1 or COM2, depending on how your system is set up).

After installing PComm Terminal Emulator, open the PT-7828's serial console as follows:

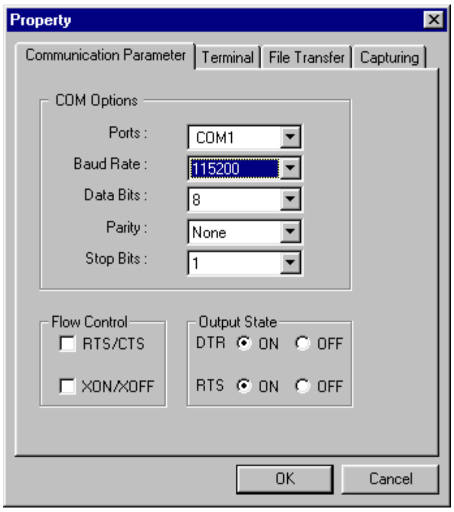
1. From the Windows desktop, click **Start → Programs → PComm Lite 1.3 → Terminal Emulator**.



2. Select **Open** under the **Port Manager** menu to open a new connection.



3. The **Property** window should open. On the **Communication Parameter** tab for **Ports**, select the COM port that is being used for the console connection. Set the other fields as follows: **115200** for **Baud Rate**, **8** for **Data Bits**, **None** for **Parity**, and **1** for **Stop Bits**.



Property

COM Options

Ports : COM1

Baud Rate : 115200

Data Bits : 8

Parity : None

Stop Bits : 1

Flow Control

□ RTS/CTS

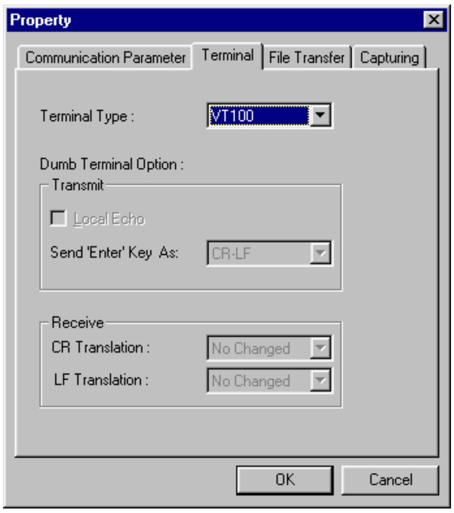
□ XON/XOFF

Output State

DTR ● ON ○ OFF

RTS ● ON ○ OFF

4. On the **Terminal** tab, select **VT100** for **Terminal Type**. Click **OK**.



Property

Terminal Type : VT100

Dumb Terminal Option :

Transmit

□ Local Echo

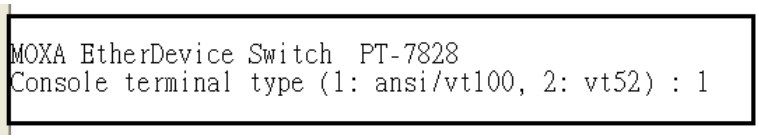
Send 'Enter' Key As: CR-LF

Receive

CR Translation : No Changed

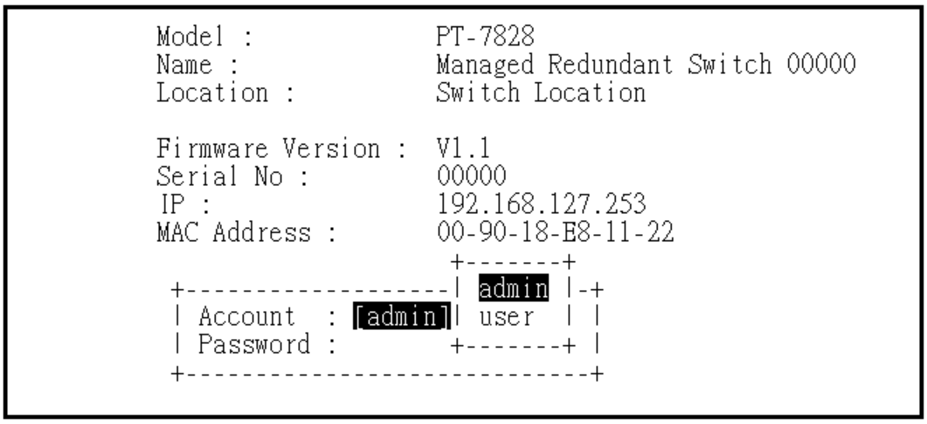
LF Translation : No Changed

5. In the terminal window, the PT-7828 will prompt you to select a terminal type. Enter **1** to select **ansi/vt100** and press **Enter**.



```
MOXA EtherDevice Switch  PT-7828
Console terminal type (1: ansi/vt100, 2: vt52) : 1
```

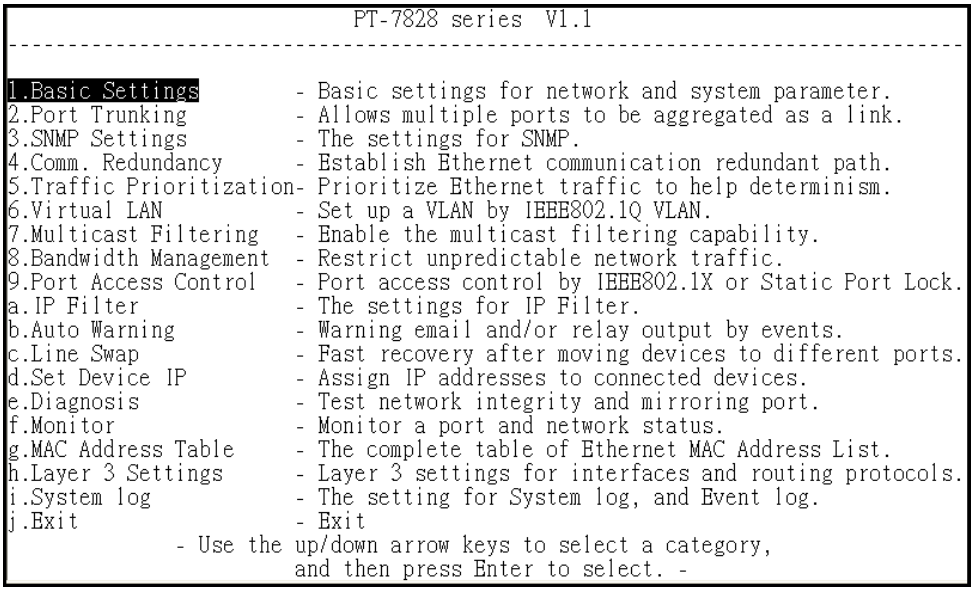
6. The serial console will prompt you to log in. Press **Enter** and select **admin** or **user**. Use the down arrow key on your keyboard to select the **Password** field and enter a password if desired. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.



```
           Model :              PT-7828
           Name :               Managed Redundant Switch 00000
           Location :           Switch Location

           Firmware Version :   V1.1
           Serial No :          00000
           IP :                 192.168.127.253
           MAC Address :        00-90-18-E8-11-22
                                 +-------+
            +-------------------| admin |-+
            | Account  : [admin]| user  | |
            | Password :         +-------+ |
            +----------------------------+
```

7. The **Main Menu** of the PT-7828's serial console should appear. (In PComm Terminal Emulator, you can adjust the font by selecting **Font…** in the **Edit** menu.)



```
                             PT-7828 series  V1.1
--------------------------------------------------------------------------------

1.Basic Settings        - Basic settings for network and system parameter.
2.Port Trunking         - Allows multiple ports to be aggregated as a link.
3.SNMP Settings         - The settings for SNMP.
4.Comm. Redundancy      - Establish Ethernet communication redundant path.
5.Traffic Prioritization- Prioritize Ethernet traffic to help determinism.
6.Virtual LAN           - Set up a VLAN by IEEE802.1Q VLAN.
7.Multicast Filtering   - Enable the multicast filtering capability.
8.Bandwidth Management  - Restrict unpredictable network traffic.
9.Port Access Control   - Port access control by IEEE802.1X or Static Port Lock.
a.IP Filter             - The settings for IP Filter.
b.Auto Warning          - Warning email and/or relay output by events.
c.Line Swap             - Fast recovery after moving devices to different ports.
d.Set Device IP         - Assign IP addresses to connected devices.
e.Diagnosis             - Test network integrity and mirroring port.
f.Monitor               - Monitor a port and network status.
g.MAC Address Table     - The complete table of Ethernet MAC Address List.
h.Layer 3 Settings      - Layer 3 settings for interfaces and routing protocols.
i.System log            - The setting for System log, and Event log.
j.Exit                  - Exit
              - Use the up/down arrow keys to select a category,
                        and then press Enter to select. -
```

8. Use the following keys on your keyboard to navigate the PT-7828's serial console:

Key	Function
Up, down, right, left arrow keys Tab	Move the onscreen cursor
Enter	Display and select options
Space	Toggle options
Esc	Previous menu

Configuration by Telnet Console

You may open the PT-7828's Telnet or web console over a network. This requires that the PC host and PT-7828 are on the same logical subnet. You may need to adjust your PC host's IP address and subnet mask. By default, the PT-7828's IP address is 192.168.127.253 and PT-7828's subnet mask is 255.255.255.0 (for a Class C network). This means that your PC's IP address must be set to 192.168.xxx.xxx for a subnet mask of 255.255.0.0, or to 192.168.127.xxx with a subnet mask of 255.255.255.0.

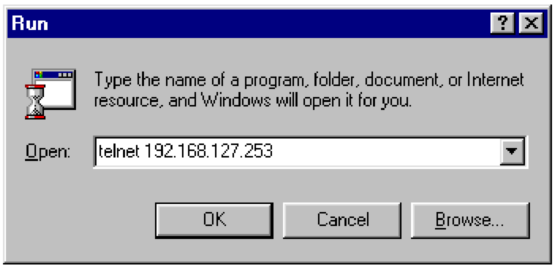
NOTE To connect to the PT-7828's Telnet or web console, your PC host and the PT-7828 must be on the same logical subnet.

NOTE When connecting to the PT-7828's Telnet or web console, first connect one of PT-7828's Ethernet ports to your Ethernet LAN or directly to your PC's Ethernet port. You may use either a straight-through or cross-over Ethernet cable.

NOTE The PT-7828's default IP address is **192.168.127.253**.

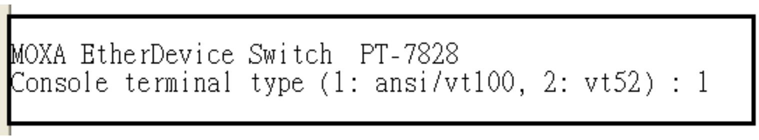
After making sure that the PT-7828 is connected to the same LAN and logical subnet as your PC, open the PT-7828's Telnet console as follows:

1. Click **Start → Run** from the Windows Start menu. Telnet to the PT-7828's IP address from the Windows **Run** window. You may also issue the Telnet command from a DOS prompt.


Run
?
Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Open:
OK
Cancel
Browse...

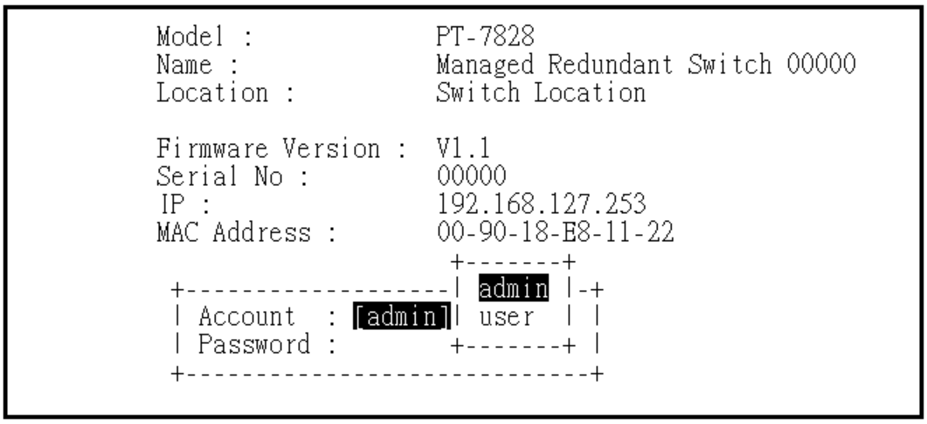
Open: telnet 192.168.127.253

2. In the terminal window, the Telnet console will prompt you to select a terminal type. Type **1** to choose **ansi/vt100**, and then press **Enter**.



```
MOXA EtherDevice Switch  PT-7828
Console terminal type (1: ansi/vt100, 2: vt52) : 1
```

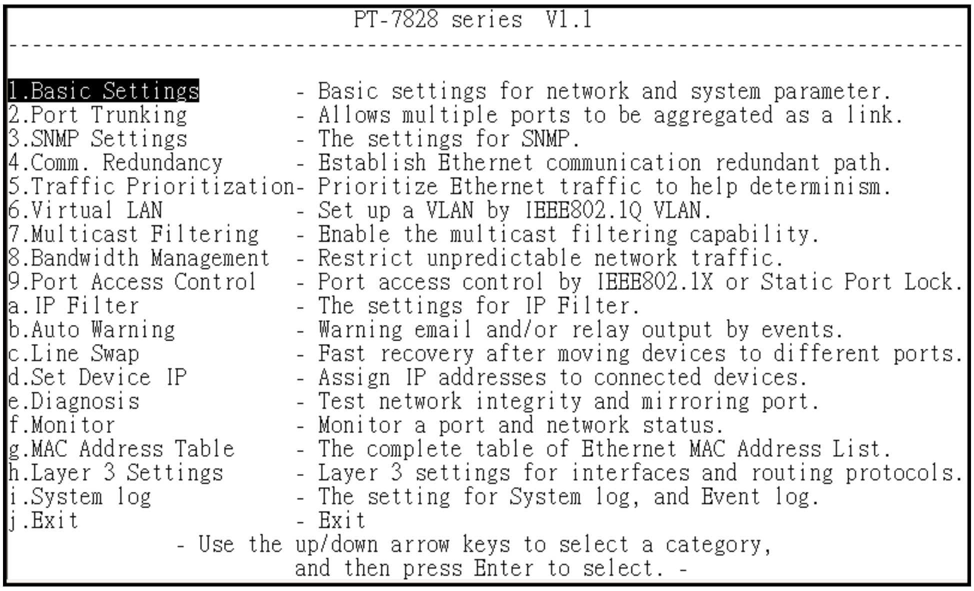
3. The Telnet console will prompt you to log in. Press **Enter** and select **admin** or **user**. Use the down arrow key on your keyboard to select the **Password** field and enter a password if desired. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.



```
Model :              PT-7828
Name :               Managed Redundant Switch 00000
Location :           Switch Location

Firmware Version :   V1.1
Serial No :          00000
IP :                 192.168.127.253
MAC Address :        00-90-18-E8-11-22
                      +-------+
 +-------------------| admin |-+
 | Account   : [admin]| user  | |
 | Password :         +-------+ |
 +-----------------------------+
```

4. The **Main Menu** of the PT-7828's Telnet console should appear.

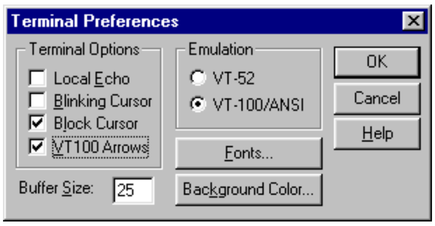


```
                              PT-7828 series  V1.1
--------------------------------------------------------------------------------

1.Basic Settings          - Basic settings for network and system parameter.
2.Port Trunking           - Allows multiple ports to be aggregated as a link.
3.SNMP Settings           - The settings for SNMP.
4.Comm. Redundancy        - Establish Ethernet communication redundant path.
5.Traffic Prioritization- Prioritize Ethernet traffic to help determinism.
6.Virtual LAN             - Set up a VLAN by IEEE802.1Q VLAN.
7.Multicast Filtering     - Enable the multicast filtering capability.
8.Bandwidth Management    - Restrict unpredictable network traffic.
9.Port Access Control     - Port access control by IEEE802.1X or Static Port Lock.
a.IP Filter               - The settings for IP Filter.
b.Auto Warning            - Warning email and/or relay output by events.
c.Line Swap               - Fast recovery after moving devices to different ports.
d.Set Device IP           - Assign IP addresses to connected devices.
e.Diagnosis               - Test network integrity and mirroring port.
f.Monitor                 - Monitor a port and network status.
g.MAC Address Table       - The complete table of Ethernet MAC Address List.
h.Layer 3 Settings        - Layer 3 settings for interfaces and routing protocols.
i.System log              - The setting for System log, and Event log.
j.Exit                    - Exit
              - Use the up/down arrow keys to select a category,
                        and then press Enter to select. -
```

5. In the terminal window, select **Preferences…** from the **Terminal** menu on the menu bar.

6. The **Terminal Preferences** window should appear. Make sure that **VT100 Arrows** is checked.



Terminal Preferences

Terminal Options
- □ Local Echo
- □ Blinking Cursor
- ☑ Block Cursor
- ☑ VT100 Arrows

Emulation
- ○ VT-52
- ● VT-100/ANSI

Buffer Size: 25

7. Use the following keys on your keyboard to navigate the PT-7828's Telnet console:

Key	Function
Up, down, right, left arrow keys Tab	Move the onscreen cursor
Enter	Display and select options
Space	Toggle options
Esc	Previous menu

NOTE The Telnet console looks and operates in precisely the same manner as the serial console.

Configuration by Web Browser

The PT-7828's web console is a convenient way to modify the configuration and access the built-in monitoring and network administration functions. You can open the PT-7828's web console using a standard web browser such as Internet Explorer or Netscape.

NOTE To connect to the PT-7828's Telnet or web console, your PC host and the PT-7828 must be on the same logical subnet.

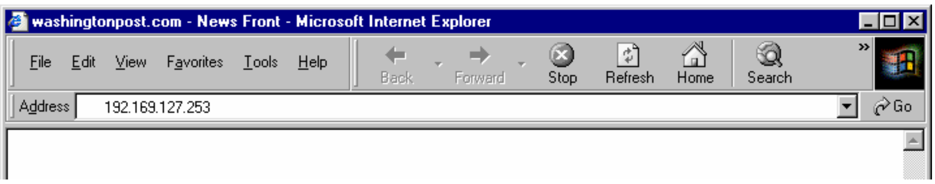
NOTE If the PT-7828 is configured for other VLAN settings, you must make sure your PC host is on the management VLAN.

NOTE When connecting to the PT-7828's Telnet or web console, first connect one of PT-7828's Ethernet ports to your Ethernet LAN or directly to your PC's Ethernet port. You may use either a straight-through or cross-over Ethernet cable.

NOTE The PT-7828's default IP address is **192.168.127.253**.

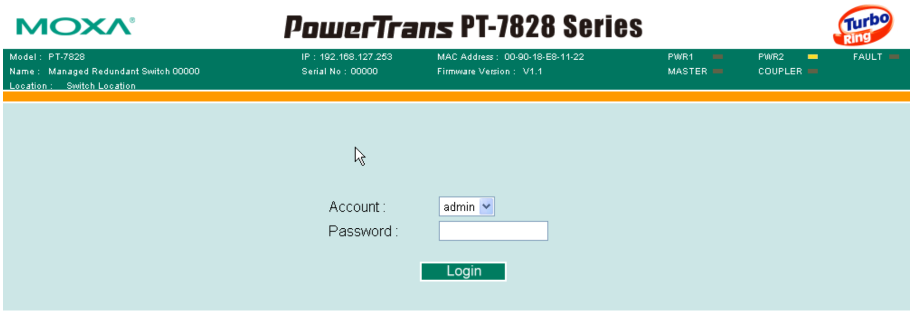
After making sure that the PT-7828 is connected to the same LAN and logical subnet as your PC, open the PT-7828's web console as follows:

1. Point your web browser to the PT-7828's IP address by entering it in the **Address** or **URL** field.



Address 192.169.127.253

2. The PT-7828's web console will open, and you will be prompted to log in. Select the login account (admin or user) and enter the **Password**. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.

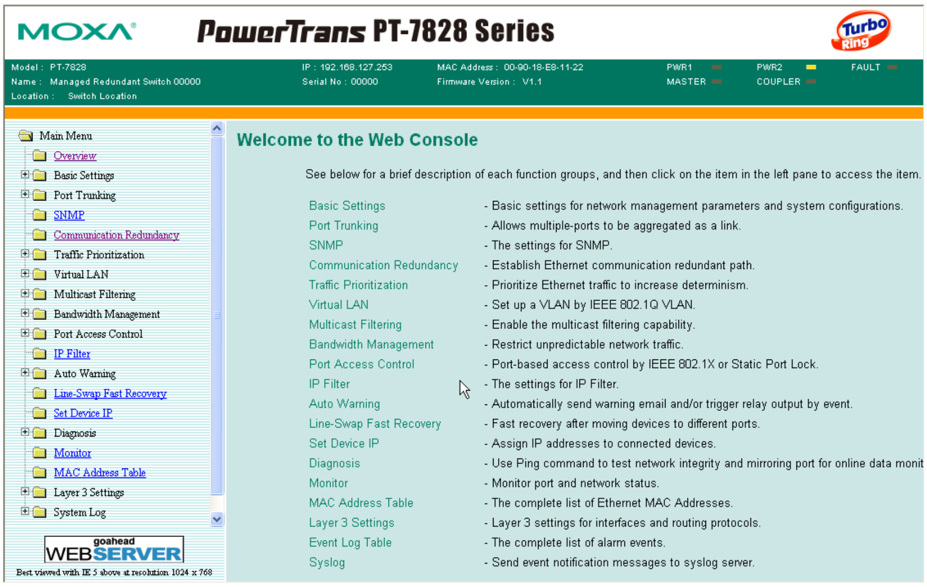


Model : PT-7828
Name : Managed Redundant Switch 00000
Location : Switch Location
IP : 192.168.127.253
Serial No : 00000
MAC Address : 00-90-18-E8-11-22
Firmware Version : V1.1

Account : admin
Password :

NOTE By default, no password is assigned to the PT-7828's web, serial, and Telnet consoles.

3. After logging in, you may need to wait a few moments for the web console to appear. Use the folders in the left navigation panel to navigate between different pages of configuration options.



Model : PT-7828
Name : Managed Redundant Switch 00000
Location : Switch Location
IP : 192.168.127.253
Serial No : 00000
MAC Address : 00-90-18-E8-11-22
Firmware Version : V1.1

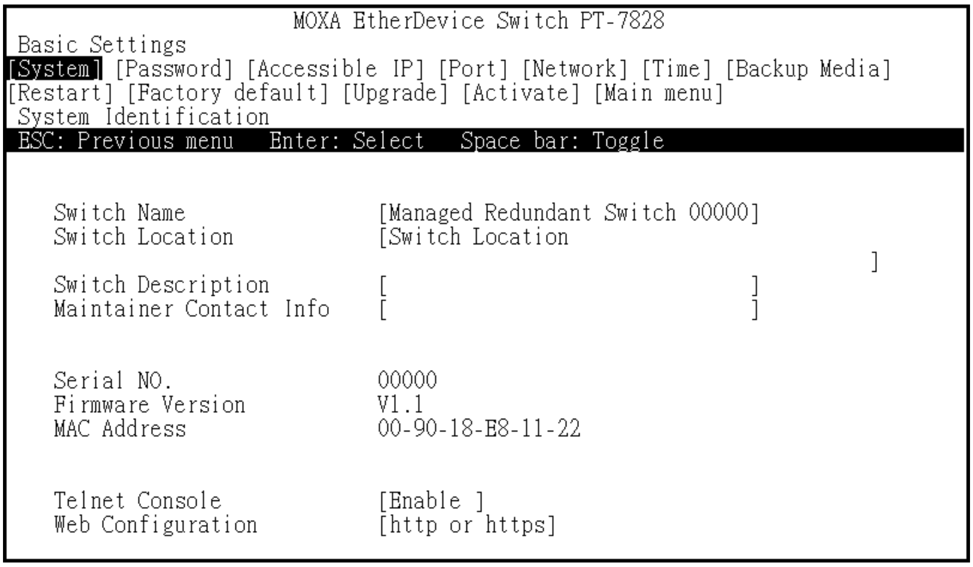
Welcome to the Web Console

See below for a brief description of each function groups, and then click on the item in the left pane to access the item.

Basic Settings	- Basic settings for network management parameters and system configurations.
Port Trunking	- Allows multiple-ports to be aggregated as a link.
SNMP	- The settings for SNMP.
Communication Redundancy	- Establish Ethernet communication redundant path.
Traffic Prioritization	- Prioritize Ethernet traffic to increase determinism.
Virtual LAN	- Set up a VLAN by IEEE 802.1Q VLAN.
Multicast Filtering	- Enable the multicast filtering capability.
Bandwidth Management	- Restrict unpredictable network traffic.
Port Access Control	- Port-based access control by IEEE 802.1X or Static Port Lock.
IP Filter	- The settings for IP Filter.
Auto Warning	- Automatically send warning email and/or trigger relay output by event.
Line-Swap Fast Recovery	- Fast recovery after moving devices to different ports.
Set Device IP	- Assign IP addresses to connected devices.
Diagnosis	- Use Ping command to test network integrity and mirroring port for online data monit
Monitor	- Monitor port and network status.
MAC Address Table	- The complete list of Ethernet MAC Addresses.
Layer 3 Settings	- Layer 3 settings for interfaces and routing protocols.
Event Log Table	- The complete list of alarm events.
Syslog	- Send event notification messages to syslog server.

Disabling Telnet and Browser Access

If you are connecting the PT-7828 to a public network but do not intend to manage it over the network, we suggest disabling both the Telnet and web consoles. This is done through the serial console, by navigating to **System Identification** under **Basic Settings**. Disable or enable the **Telnet Console** and **Web Configuration** as shown below:



```
                        MOXA EtherDevice Switch PT-7828
 Basic Settings
[System] [Password] [Accessible IP] [Port] [Network] [Time] [Backup Media]
[Restart] [Factory default] [Upgrade] [Activate] [Main menu]
 System Identification
 ESC: Previous menu   Enter: Select   Space bar: Toggle


    Switch Name                [Managed Redundant Switch 00000]
    Switch Location            [Switch Location
                                                                   ]
    Switch Description         [                               ]
    Maintainer Contact Info    [                               ]


    Serial NO.                 00000
    Firmware Version           V1.1
    MAC Address                00-90-18-E8-11-22


    Telnet Console             [Enable ]
    Web Configuration          [http or https]
```

3

Featured Functions

This chapter explains how to access PT-7828's various configuration, monitoring, and administration functions. These functions can be accessed by serial, Telnet, or web console. The serial console can be used if you do not know PT-7828's IP address and requires that you connect the PT-7828 to a PC COM port. The Telnet and web consoles can be opened over an Ethernet LAN or the Internet.

The web console is the most user-friendly way to configure PT-7828. In this chapter, we use the web console interface to introduce the functions. There are only a few differences between the web console, serial console, and Telnet console.

The following topics are covered in this chapter:

- ❑ **Configuring Basic Settings**
- ❑ **IEEE 1588 PTP**
- ❑ **How Does an Ethernet Switch Affect 1588 Synchronization?**
- ❑ **PTP Setting**
- ❑ **Using Port Trunking**
- ❑ **Configuring SNMP**
- ❑ **Using Communication Redundancy**
- ❑ **The Turbo Chain Concept**
- ❑ **Configuring "Turbo Chain"**
- ❑ **Using Traffic Prioritization**
- ❑ **Using Virtual LAN**
- ❑ **Using Multicast Filtering**
- ❑ **Using Bandwidth Management**
- ❑ **Using Port Access Control**
- ❑ **Using IP Filter**
- ❑ **Using Auto Warning**
- ❑ **Using Line-Swap-Fast-Recovery**
- ❑ **Using Set Device IP**
- ❑ **DHCP Relay Agent (Option 82)**
- ❑ **Using Diagnosis**
- ❑ **LLDP Function Overview**
- ❑ **Using Monitor**
- ❑ **Using the MAC Address Table**

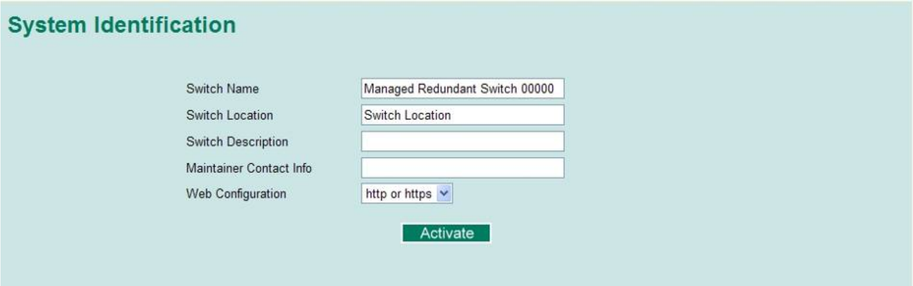
- ❑ **Using System Log**
- ❑ **Using HTTPS/SSL**
- ❑ **Using Layer 3 Settings**
- ❑ **OSPF Settings**
- ❑ **Using System Log**
- ❑ **Using HTTPS/SSL**

Configuring Basic Settings

Basic Settings includes the most common settings required by administrators to maintain and control the PT-7828.

System Identification

System Identification items are displayed at the top of the web console and will be included in alarm emails. You can set the System Identification items to make it easier to identify different switches that are connected to your network.



System Identification

Switch Name: Managed Redundant Switch 00000

Switch Location: Switch Location

Switch Description:

Maintainer Contact Info:

Web Configuration: http or https

Switch Name

Setting	Description	Factory Default
Max. 30 characters	This option is useful for differentiating between the roles or applications of different units. Example: Factory Switch 1.	Managed Redundant Switch [*Serial no. of this switch*]

Switch Location

Setting	Description	Factory Default
Max. 80 characters	This option is useful for differentiating between the locations of different units. Example: production line 1.	Switch Location

Switch Description

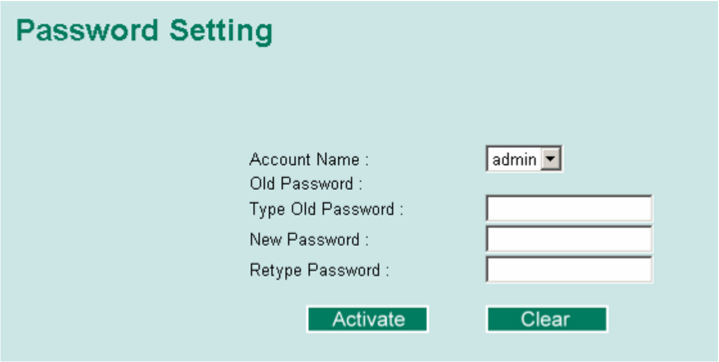
Setting	Description	Factory Default
Max. 30 characters	This option is useful for recording a more detailed description of the unit.	*None*

Maintainer Contact Info

Setting	Description	Factory Default
Max. 30 characters	This option is useful for providing information about who is responsible for maintaining this unit and how to contact this person.	*None*

Password

The PT-7828 provides two levels of configuration access. The **admin** account has read/write access of all configuration parameters, and the **user** account has read access only. The **user** account can only view the configuration, but will not be able to make modifications.



Password Setting

Account Name : admin

Old Password :

Type Old Password :

New Password :

Retype Password :

ATTENTION

By default, no password is assigned to the PT-7828's web, Telnet, and serial consoles. If a password is assigned, you will be required to enter the password when you open the serial console, Telnet console, or Web console.

Account

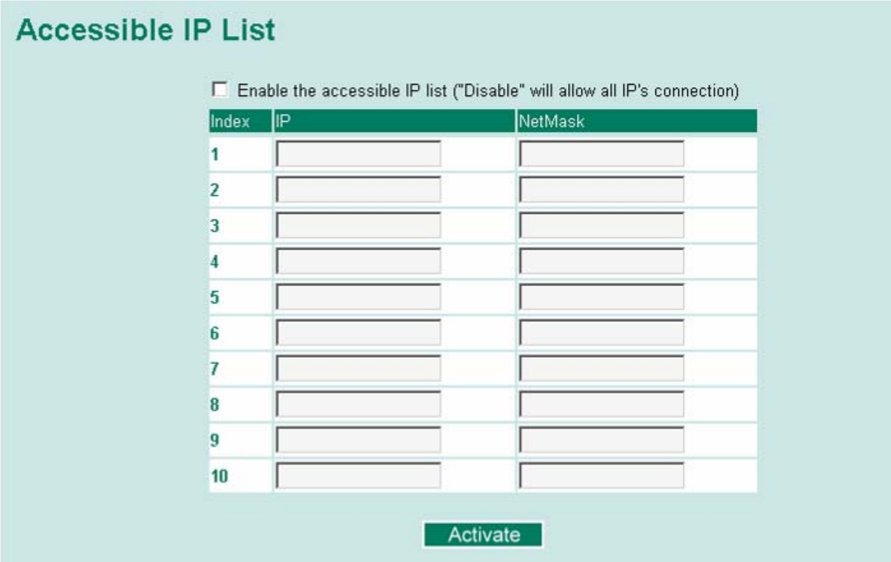
Setting	Description	Factory Default
Admin	This account can *modify* the PT-7828's configuration.	admin
User	This account can only *view* the PT-7828's configurations.	

Password

Setting	Description	Factory Default
Old password (max. 16 characters)	Enter the current password	None
New password (Max. 16 characters)	Enter the desired new password. Leave it blank if you want to remove the password.	None
Retype password (Max. 16 characters)	Enter the desired new password again. Leave it blank if you want to remove the password.	None

Accessible IP

The PT-7828 uses an IP address-based filtering method to control access.



Accessible IP List

□ Enable the accessible IP list ("Disable" will allow all IP's connection)

Index	IP	NetMask
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

You may add or remove IP addresses to limit access to the PT-7828. When the accessible IP list is enabled, only addresses on the list will be allowed access to the PT-7828. Each IP address and netmask entry can be tailored for different situations:

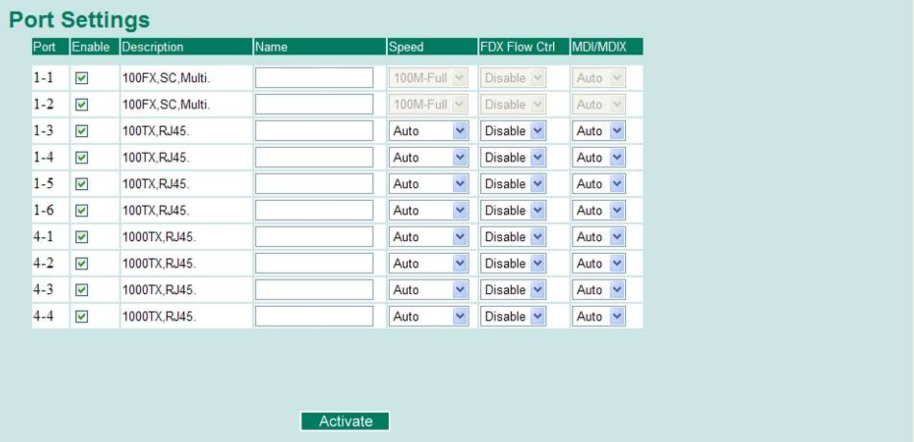
- **Grant access to one host with a specific IP address**
  For example, enter IP address 192.168.1.1 with netmask 255.255.255.255 to allow access to 192.168.1.1 only.
- **Grant access to any host on a specific subnetwork**
  For example, enter IP address 192.168.1.0 with netmask 255.255.255.0 to allow access to all IPs on the subnet defined by this IP address/subnet mask combination.
- **Grant acces to all hosts**
  Make sure the accessible IP list is not enabled. Remove the checkmark from **Enable the accessible IP list**.

The following table shows additional configuration examples:

Hosts That Need Access	Input Format
Any host	Disable
192.168.1.120	192.168.1.120 / 255.255.255.255
192.168.1.1 to 192.168.1.254	192.168.1.0 / 255.255.255.0
192.168.0.1 to 192.168.255.254	192.168.0.0 / 255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0 / 255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128 / 255.255.255.128

Port

Port settings are included to give the user control over port access, port transmission speed, flow control, and port type (MDI or MDIX).



Port Settings

Port	Enable	Description	Name	Speed	FDX Flow Ctrl	MDI/MDIX
1-1	☑	100FX,SC,Multi.		100M-Full	Disable	Auto
1-2	☑	100FX,SC,Multi.		100M-Full	Disable	Auto
1-3	☑	100TX,RJ45.		Auto	Disable	Auto
1-4	☑	100TX,RJ45.		Auto	Disable	Auto
1-5	☑	100TX,RJ45.		Auto	Disable	Auto
1-6	☑	100TX,RJ45.		Auto	Disable	Auto
4-1	☑	1000TX,RJ45.		Auto	Disable	Auto
4-2	☑	1000TX,RJ45.		Auto	Disable	Auto
4-3	☑	1000TX,RJ45.		Auto	Disable	Auto
4-4	☑	1000TX,RJ45.		Auto	Disable	Auto

Enable

Setting	Description	Factory Default
Checked	This allows data transmission through the port.	Enabled
Unchecked	This immediately shuts off port access.	

ATTENTION

If a connected device or sub-network is wreaking havoc on the rest of the network, the **Disable** option under **Advanced Settings/Port** gives the administrator a quick way to shut off access through this port immediately.

Description

Setting	Description	Factory Default
Media type	This displays the media type for each module's port	N/A

Name

Setting	Description	Factory Default
Max. 63 characters	This specifies an alias for the port to help administrators differentiate between different ports. Example: PLC 1	None

Speed

Setting	Description	Factory Default
Auto	This allows the port to use the IEEE 802.3u protocol to negotiate with connected devices. The port and connected devices will determine the best speed for that connection.	Auto
100M-Full	Choose one of these fixed speed options if the connected Ethernet device has trouble auto-negotiating for line speed.	
100M-Half		
10M-Full		
10M-Half		

FDX Flow Ctrl

This setting enables or disables flow control for the port when the port's **Speed** is set to **Auto**. The final result will be determined by the **Auto** process between the PT-7828 and connected devices.

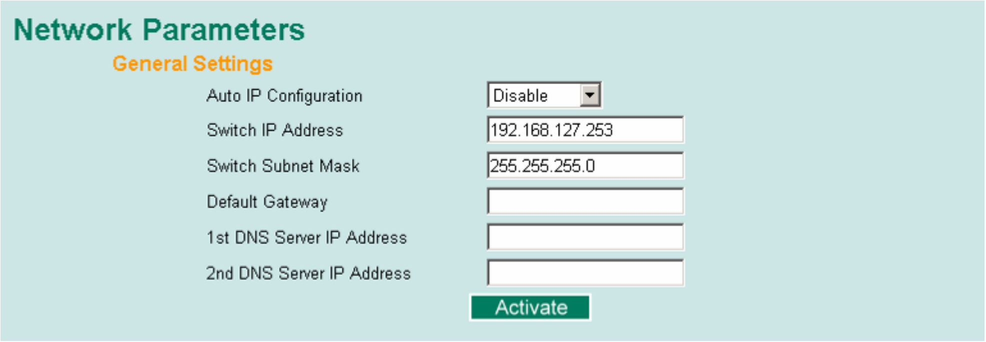
Setting	Description	Factory Default
Enable	This enables flow control for this port when the port's **Speed** is set to **Auto**.	Disable
Disable	This disables flow control for this port when the port's **Speed** is set to **Auto**.	

MDI/MDIX

Setting	Description	Factory Default
Auto	This allows the port to auto-detect the port type of the connected Ethernet device and change the port type accordingly.	Auto
MDI	Choose MDI or MDIX if the connected Ethernet device has trouble auto-negotiating for port type.	
MDIX		

Network

Network settings allow users to modify the usual TCP/IP network parameters.



Network Parameters

General Settings

Auto IP Configuration	Disable
Switch IP Address	192.168.127.253
Switch Subnet Mask	255.255.255.0
Default Gateway	
1st DNS Server IP Address	
2nd DNS Server IP Address	

Auto IP Configuration

Setting	Description	Factory Default
Disable	Select this to set the PT-7828's IP address manually.	Disable
By DHCP	The PT-7828's IP address will be assigned automatically by the network's DHCP server.	
By BootP	The PT-7828's IP address will be assigned automatically by the network's BootP server.	

Switch IP Address

Setting	Description	Factory Default
IP address for the PT-7828	This assigns the PT-7828's IP address on a TCP/IP network.	192.168.127.253

Switch Subnet Mask

Setting	Description	Factory Default
Subnet mask for the PT-7828	This identifies the type of network to which the PT-7828 is connected (e.g., 255.255.0.0 for a Class B network, or 255.255.255.0 for a Class C network).	255.255.255.0

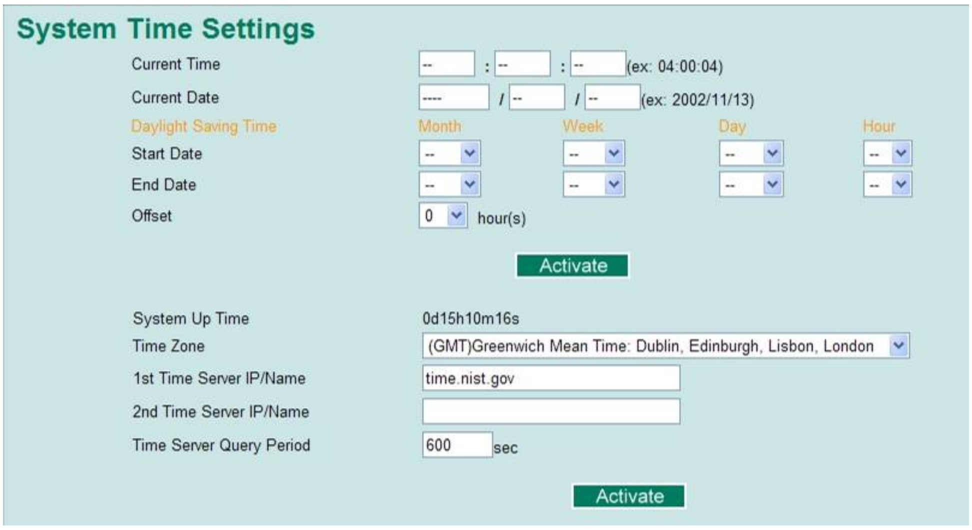
Default Gateway

Setting	Description	Factory Default
IP address for gateway	This specifies the IP address of the router that connects the LAN to an outside network.	None

DNS IP Address

Setting	Description	Factory Default
IP address for DNS server	This specifies the IP address of the DNS server used by your network. After specifying the DNS server's IP address, you can use the PT-7828's URL (e.g., www.PT.company.com) to open the web console instead of entering the IP address.	None
IP address for 2nd DNS server	This specifies the IP address of the secondary DNS server used by your network. The PT-7828 will use the secondary DNS server if the first DNS server fails to connect.	None

Time



System Time Settings

Current Time -- : -- : -- (ex: 04:00:04)

Current Date ---- / -- / -- (ex: 2002/11/13)

Daylight Saving Time	Month	Week	Day	Hour
Start Date	--	--	--	--
End Date	--	--	--	--

Offset 0 hour(s)

System Up Time 0d15h10m16s

Time Zone (GMT)Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London

1st Time Server IP/Name time.nist.gov

2nd Time Server IP/Name

Time Server Query Period 600 sec

The PT-7828 has a time calibration function based on information from an NTP server or user specified time and date. Functions such as automatic warning emails can therefore include time and date stamp.

NOTE The PT-7828 does not have a real time clock. The user must update the **Current Time** and **Current Date** to set the initial time for PT-7828 after each reboot, especially when there is no NTP server on the LAN or Internet connection.

Current Time

Setting	Description	Factory Default
User-specified time	This allows configuration of the local time in local 24-hour format.	00h:00m:00s

Current Date

Setting	Description	Factory Default
User-specified date	This allows configuration of the local date in yyyy-mm-dd format.	1970/01/01

Daylight Saving Time

The Daylight Saving Time settings are used to automatically offset the PT-7828’s time forward according to national standards.

Start Date

Setting	Description	Factory Default
User-specified date	This specifies the date that Daylight Savings Time begins.	None

End Date

Setting	Description	Factory Default
User-specified date	This specifies the date that Daylight Savings Time ends.	None

Offset

Setting	Description	Factory Default
User-specified hour	This specifies the number of hours that the time should be offset forward during Daylight Savings Time.	None

System Up Time

This indicates how long the PT-7828 remained up since the last cold start. The up time is indicated in seconds.

Time Zone

Setting	Description	Factory Default
Time zone	This specifies the time zone, which is used to determine the local time offset from GMT (Greenwich Mean Time).	GMT (Greenwich Mean Time)

NOTE Changing the time zone will automatically correct the current time. Make sure to set the time zone before setting the time.

Time Server IP/Name

Setting	Description	Factory Default
IP address or name of time server	This is the IP or domain address (e.g., 192.168.1.1, time.stdtime.gov.tw, or time.nist.gov).	None
IP address or name of secondary time server	The PT-7828 will try to locate the secondary NTP server if the first NTP server fails to connect.	

Time Server Query Period

Setting	Description	Factory Default
Query period	This parameter determines how frequently the time is updated from the NTP server.	600 seconds

IEEE 1588 PTP

The following information is taken from the NIST website at http://ieee1588.nist.gov/intro.htm:

Time measurement can be accomplished using the IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (IEEE 1588-2008) to synchronize real-time clocks incorporated within each component of the electrical power system for power automation applications.

IEEE 1588, which was published in November 2002, expands the performance capabilities of Ethernet networks to control systems that operate over a communication network. In recent years an increasing number of electrical power systems have been using a more distributed architecture with network technologies that have less stringent timing specifications. IEEE 1588 generates a master-slave relationship between the clocks, and enforces the specific timing requirements in such power systems. All devices ultimately get their time from a clock known as the grandmaster clock. In its basic form, the protocol is intended to be administration free.

How Does an Ethernet Switch Affect 1588 Synchronization?

The following content is taken from the NIST website at http://ieee1588.nist.gov/switch.htm:

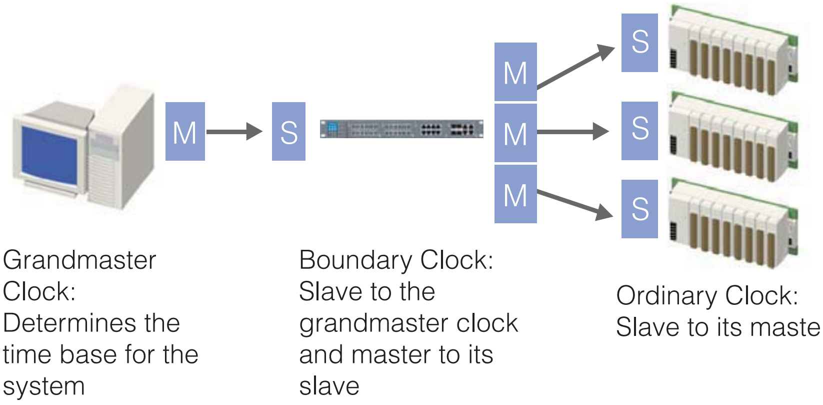
An Ethernet switch potentially introduces multi-microsecond fluctuations in the latency between the 1588 grandmaster clock and a 1588 slave clock. Uncorrected these fluctuations will cause synchronization errors. The magnitude of these fluctuations depend on the design of the Ethernet switch and the details of the communication traffic. Experiments with prototype implementations of IEEE 1588 indicate that with suitable care the effect of these fluctuations can be successfully managed. For example, use of appropriate statistics in the 1588 devices to recognized significant fluctuations and use suitable averaging techniques in the algorithms controlling the correction of the local 1588 clock will be the good design means to achieve the highest time accuracy.

Can Ethernet switches be designed to avoid the effects of these fluctuations?

A switch may be designed to support IEEE 1588 to avoide the effects of queuing. In this case two modifications to the usual design of an Ethernet switch are necessary:

- The Boundary Clock functionality defined by IEEE 1588 must be implemented in the switch
- The switch must be configured such that it does not pass IEEE 1588 message traffic using the normal communication mechanisms of the switch.

Such an Ethernet switch will synchronize clocks directly connected to one of its ports to the highest possible accuracy.


M
S
M
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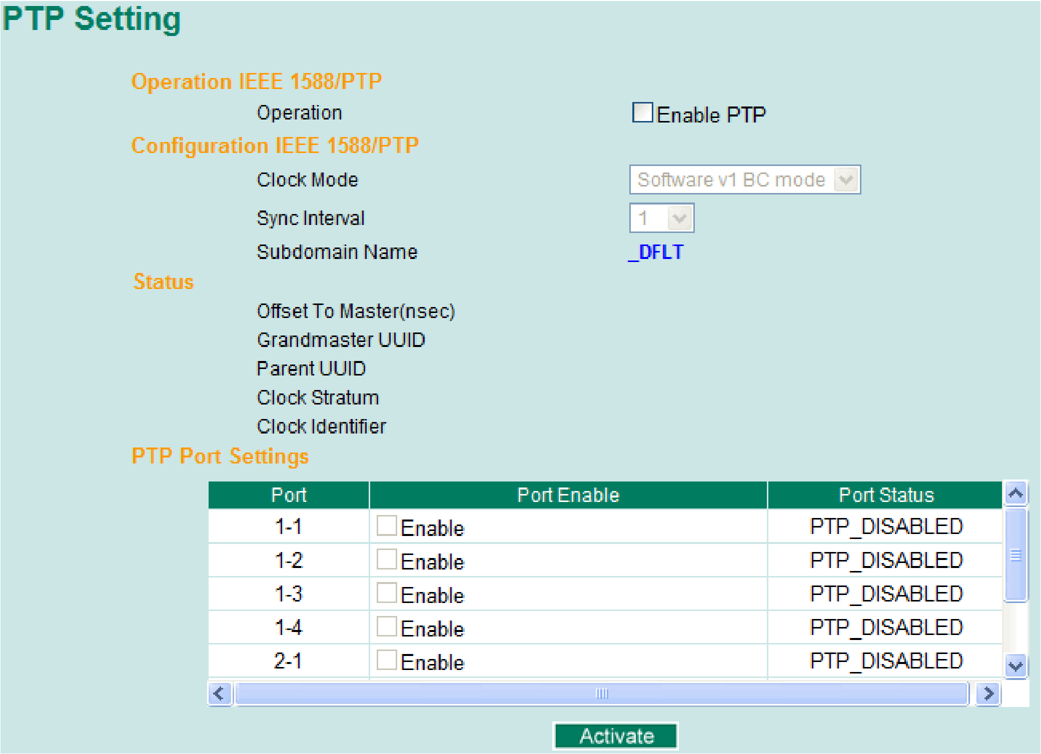
S
Grandmaster Clock: Determines the time base for the system
Boundary Clock: Slave to the grandmaster clock and master to its slave
Ordinary Clock: Slave to its master

PTP Setting



PTP Setting

Operation IEEE 1588/PTP

Operation □ Enable PTP

Configuration IEEE 1588/PTP

Clock Mode: Software v1 BC mode

Sync Interval: 1

Subdomain Name: _DFLT

Status

Offset To Master(nsec)

Grandmaster UUID

Parent UUID

Clock Stratum

Clock Identifier

PTP Port Settings

Port	Port Enable	Port Status
1-1	□ Enable	PTP_DISABLED
1-2	□ Enable	PTP_DISABLED
1-3	□ Enable	PTP_DISABLED
1-4	□ Enable	PTP_DISABLED
2-1	□ Enable	PTP_DISABLED

Operation IEEE 1588/PTP

Setting	Description	Factory Default
Operation	Disable or enable IEEE 1588(PTP) operation	Disable

Configuration IEEE 1588/PTP

Setting	Description	Factory Default
Clock Mode	Support software-based IEEE 1588(PTP) mode	Disable
Sync Interval	Period for sending synchronization message (in seconds)	Disable
Sub-domain Name	Support _DFLT(Default) domain only	_DFLT

Status

Setting	Description	Factory Default
Offset To Master (nsec)	Deviation between local time and the reference clock (in nanoseconds).	
Grandmaster UUID	When the clock has a port in PTP_SLAVE state, this member's value is the value of the grand master clock's Uuid field of the last Sync message received from the parent of the slave port.	
Parent UUID	When the clock has a port in PTP_SLAVE state, this member's value is the value of the source-Uuid field of the last Sync message received from the parent of the slave port.	

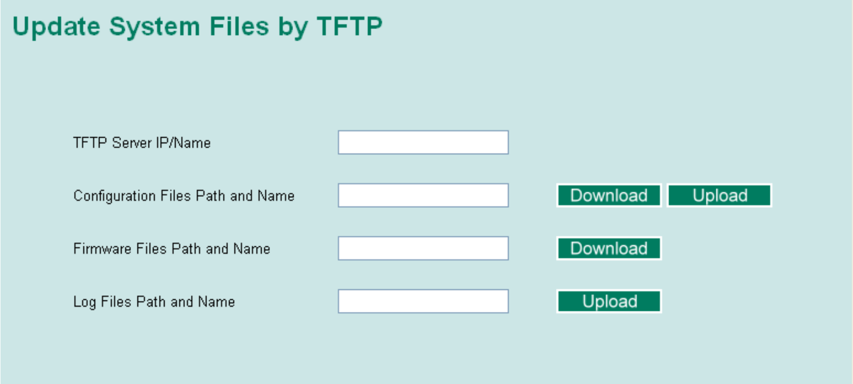
Clock Stratum	The stratum number describes one measure of the quality of a clock. Each clock is characterized by a stratum number used by the best master clock algorithm as one parameter of clock quality.	4
Clock Identifier	Properties of the clock.	DFLT

PTP Port Settings

Setting	Description	Factory Default
Port Enable	Enable or disable PTP port operation.	None
Port Status	Display PTP port real status.	PTP_DISABLED

System File Update—By Remote TFTP

The PT-7828 supports saving your configuration or log file to a remote TFTP server or local host. Other PT-7828 switches can also load the configuration at a later time. The PT-7828 also supports loading firmware or configuration files from the TFTP server or a local host.



Update System Files by TFTP

TFTP Server IP/Name

Configuration Files Path and Name

Firmware Files Path and Name

Log Files Path and Name

TFTP Server IP/Name

Setting	Description	Factory Default
IP address of TFTP server	This specifies the IP address or name of the remote TFTP server. This must be specified before downloading or uploading files.	None

Configuration Files Path and Name

Setting	Description	Factory Default
Max. 40 characters	This specifies the path and file name of the PT-7828's configuration file on the TFTP server.	None

Firmware Files Path and Name

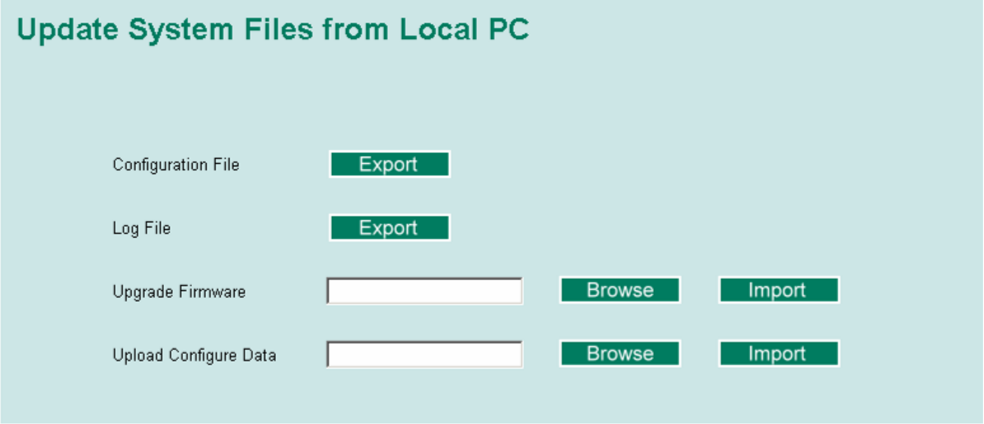
Setting	Description	Factory Default
Max. 40 characters	This specifies the path and file name of the PT-7828's firmware file.	None

Log Files Path and Name

Setting	Description	Factory Default
Max. 40 characters	This specifies the path and file name of the PT-7828's log file.	None

After setting the desired paths and file names, click **Activate** to save the setting. Click **Download** to download the prepared file from the remote TFTP server, or click **Upload** to upload the desired file to the remote TFTP server.

System File Update—By Local Import/Export



Update System Files from Local PC

Configuration File

Log File

Upgrade Firmware

Upload Configure Data

Configuration File

Click **Export** to save the PT-7828's configuration file to the local host.

Log File

Click **Export** to save the PT-7828's log file to the local host.

NOTE Some operating systems will open the configuration file and log file directly in the web page. In such cases, right click the **Export** button to save the file.

Upgrade Firmware

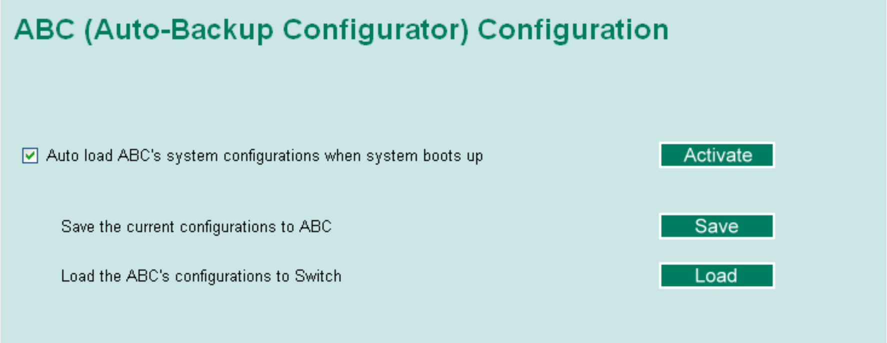
To import a new firmware file onto the PT-7828, click **Browse** to select the firmware file that is saved on your computer. The upgrade procedure will proceed automatically after clicking **Import**.

Upload Configure Data

To import a configuration file onto the PT-7828, click **Browse** to select the configuration file already saved on your computer. The upgrade procedure will proceed automatically after clicking **Import**.

System File Update - By Backup Media

User can use Moxa's Automatic Backup Configurator to save and load the configuration of PT-7828 managed switches through the switch's RS-232 console port.



ABC (Auto-Backup Configurator) Configuration

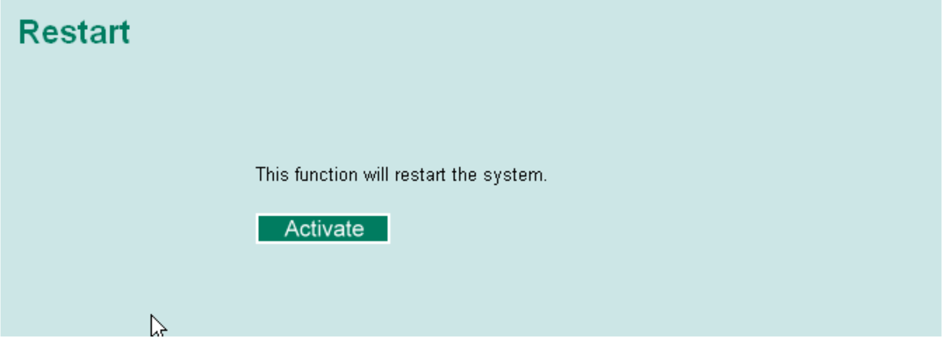
☑ Auto load ABC's system configurations when system boots up

Save the current configurations to ABC

Load the ABC's configurations to Switch

Restart

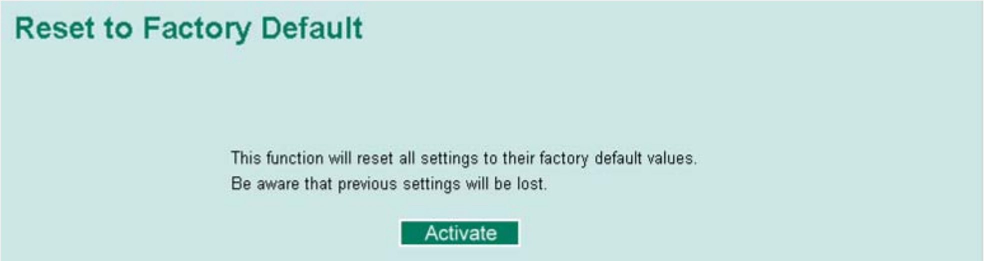
This Restart function provides users with a quick way to restart the system.



Restart

This function will restart the system.

Factory Default



Reset to Factory Default

This function will reset all settings to their factory default values.
Be aware that previous settings will be lost.

This function provides users with a quick way of restoring the PT-7828's configuration to factory defaults. This function is available in the serial, Telnet, and web consoles.

NOTE After restoring the factory default configuration, you will need to use the default network settings to re-establish the web or Telnet console connection with the PT-7828.

Using Port Trunking

Link aggregation involves grouping links to into a link aggregation group. A MAC client can treat link aggregation groups as if they were a single link.

The PT-7828's port trunking feature allows devices to communicate by aggregating up to 4 trunk groups, with a maximum of 8 ports for each group. If one of the 8 ports fails, the other seven ports will automatically provide backup and share the traffic.

Port trunking can be used to combine up to 8 ports between two PT-7828 switches. If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex, the potential bandwidth of the connection will be 1600 Mbps.

The Port Trunking Concept

Moxa has developed a proprietary port trunking protocol that provides the following benefits:

- More flexibility in setting up your network connections, since the bandwidth of a link can be doubled, tripled, or quadrupled
- Redundancy — if one link is broken, the remaining trunked ports share the traffic within this trunk group
- Load sharing — MAC client traffic may be distributed across multiple links

To avoid broadcast storms or loops in your network while configuring a trunk, first disable or disconnect all ports that you want to add to the trunk or remove from the trunk. After you finish configuring the trunk, enable or re-connect the ports.

If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex mode, the potential bandwidth of the connection will be up to 1.6 Gbps. This means that users can double, triple, or quadruple the bandwidth of the connection by port trunking between two PT series switches.

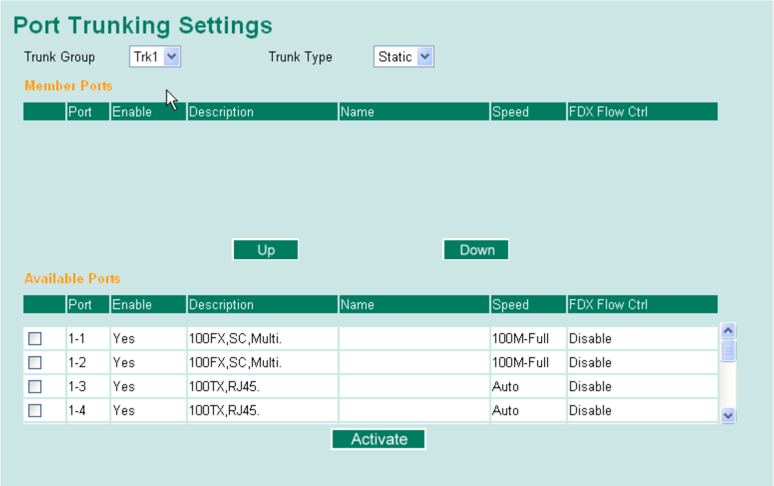
Each PT-7828 can set a maximum of 4 port trunking groups. When you activate port trunking, certain settings on each port will be reset to factory default values or disabled:

- Communication redundancy will be reset
- 802.1Q VLAN will be reset
- Multicast Filtering will be reset
- Port Lock will be reset and disabled.
- Set Device IP will be reset
- Mirror will be reset

After port trunking has been activated, you may configure these items again for each trunking ports.

Configuring Port Trunking

The **Port Trunking Settings** page is where ports are assigned to a trunk group.



Port Trunking Settings

Trunk Group: Trk1 Trunk Type: Static

Member Ports

	Port	Enable	Description	Name	Speed	FDX Flow Ctrl

Available Ports

	Port	Enable	Description	Name	Speed	FDX Flow Ctrl
□	1-1	Yes	100FX,SC,Multi.		100M-Full	Disable
□	1-2	Yes	100FX,SC,Multi.		100M-Full	Disable
□	1-3	Yes	100TX,RJ45.		Auto	Disable
□	1-4	Yes	100TX,RJ45.		Auto	Disable

Step 1: Select the desired **Trunk Group** (Trk1, Trk2, Trk3, Trk4).

Step 2: Select the **Trunk Type** (Static or LACP).

Step 3: Select the desired ports under **Available Ports** and click **Up** to add to the Trunk Group.

Step 4: Select the desired ports under **Member Ports** and click **Down** to remove from the group.

Trunk Group (Maximum of 4 trunk groups)

Setting	Description	Factory Default
Trk1, Trk2, Trk3, Trk4	This specifies the current trunk group.	Trk1

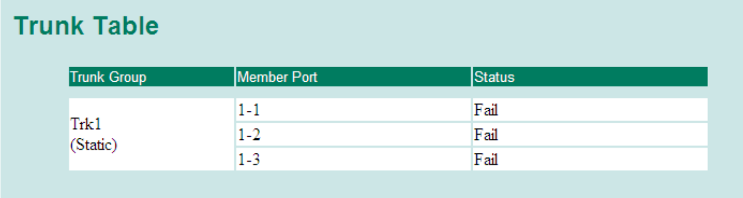
Trunk Type

Setting	Description	Factory Default
Static	This selects Moxa's proprietary trunking protocol.	Static
LACP	This selects LACP (IEEE 802.3ad, Link Aggregation Control Protocol).	Static

Available Ports/Member Ports

Setting	Description	Factory Default
Member/available ports	This lists the ports in the current trunk group and the ports that are available to be added.	N/A
Check box	This selects the port to be added or removed from the group.	Unchecked
Port	This is how each port is identified.	N/A
Port description	This displays the media type for each port.	N/A
Name	This displays the specified name for each port.	N/A
Speed	This indicates the transmission speed for each port (100M-Full, 100M-Half, 10M-Full, or 10M-Half).	N/A
FDX flow control	This indicates if the FDX flow control of this port is enabled or disabled.	N/A

Up	This is used to add selected ports into the trunk group from available ports.	N/A
Down	This is used to remove selected ports from the trunk group.	N/A



Trunk Table

Trunk Group	Member Port	Status
Trk1 (Static)	1-1	Fail
	1-2	Fail
	1-3	Fail

Trunk Table

Setting	Description
Trunk group	Displays the trunk type and trunk group.
Member port	Displays the member ports that belong to the trunk group.
Status	**Success** means port trunking is working properly. **Fail** means port trunking is not working properly. **Standby** means port trunking is working as a standby port. When there are more than eight ports trunked as a trunking group, the 9th port will be the standby port.

Configuring SNMP

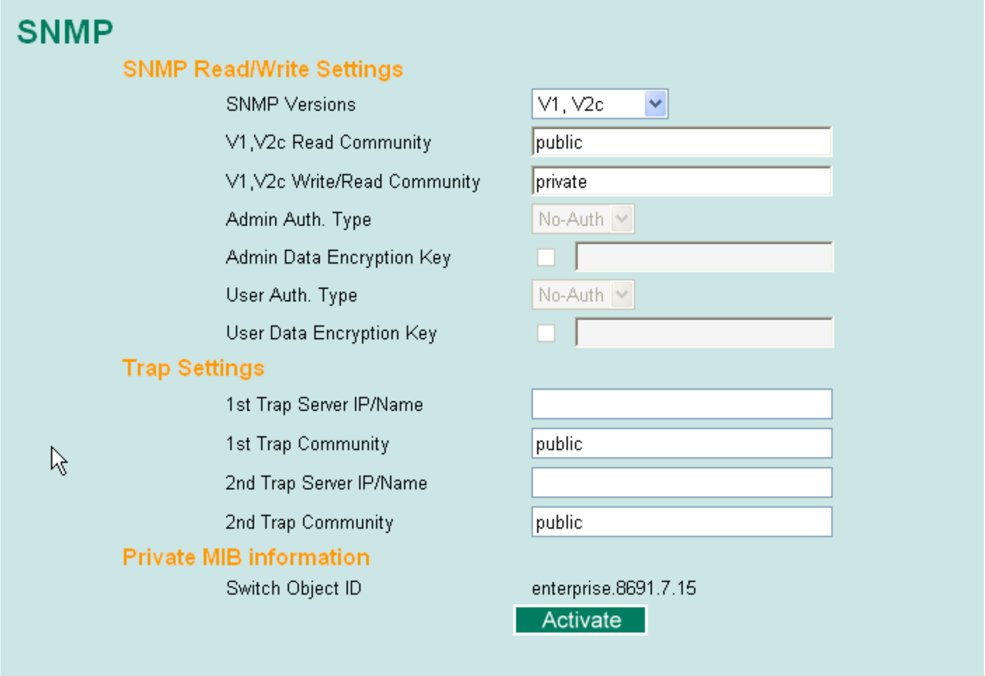
The PT-7828 supports SNMP V1, V2c, and V3. SNMP V1 and SNMP V2c use a community string match for authentication, which means that SNMP servers access all objects with read-only or read/write permissions using the community strings *public* and *private* by default. SNMP V3 requires that you select an authentication level of MD5 or SHA, and is the most secure protocol. You can also enable data encryption to enhance data security.

Supported SNMP security modes and levels are shown in the following table. Select the security mode and level that will be used to communicate between the SNMP agent and manager.

Protocol Version	UI Setting	Authentication	Encryption	Method
SNMP V1, V2c	V1, V2c Read Community	Community string	No	This uses a community string match for authentication.
	V1, V2c Write/Read Community	Community string	No	This uses a community string match for authentication.
SNMP V3	No-Auth	No	No	This uses an account with admin or user to access objects
	MD5 or SHA	Authentication based on MD5 or SHA	No	This provides authentication based on HMAC-MD5, or HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.

	MD5 or SHA	Authentication based on MD5 or SHA	Data encryption key	This provides authentication based on HMAC-MD5 or HMAC-SHA algorithms, and data encryption key. 8-character passwords and a data encryption key are the minimum requirements for authentication .and encryption.

These parameters are configured on the SNMP page. A more detailed explanation of each parameter is given below the figure.



SNMP

SNMP Read/Write Settings

- SNMP Versions: V1, V2c
- V1,V2c Read Community: public
- V1,V2c Write/Read Community: private
- Admin Auth. Type: No-Auth
- Admin Data Encryption Key: □
- User Auth. Type: No-Auth
- User Data Encryption Key: □

Trap Settings

- 1st Trap Server IP/Name:
- 1st Trap Community: public
- 2nd Trap Server IP/Name:
- 2nd Trap Community: public

Private MIB information

- Switch Object ID: enterprise.8691.7.15

SNMP Read/Write Settings

SNMP Versions

Setting	Description	Factory Default
V1, V2c, V3, or V1, V2c, or V3 only	This specifies the SNMP protocol version used to manage the switch.	V1, V2c

V1, V2c Read Community

Setting	Description	Factory Default
Max. 30 characters	This specifies the community string to authenticate the SNMP agent for read-only access. The SNMP agent will access all objects with read-only permissions using this community string.	Public

V1, V2c Write/Read Community

Setting	Description	Factory Default
Max. 30 characters	This specifies the community string to authenticate the SNMP agent for read/write access. The SNMP server will access all objects with read/write permissions using this community string.	Private

For SNMP V3, there are two levels of privilege for different accounts to access the PT-7828. **Admin** privilege provides access and authorization to read and write the MIB file. **User** privilege allows reading of the MIB file only.

Admin Auth. Type *(for SNMP V1, V2c, V3, and V3 only)*

Setting	Description	Factory Default
No-Auth	This allows the admin account to access objects without authentication.	No
MD5-Auth	Authentication will be based on the HMAC-MD5 algorithms. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Authentication will be based on the HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.	No

Admin Data Encryption Key *(for SNMP V1, V2c, V3, and V3 only)*

Setting	Description	Factory Default
Enable	This enables data encryption using the specified data encryption key (between 8 and 30 characters).	No
Disable	This specifies that data will not be encrypted.	No

User Auth. Type *(for SNMP V1, V2c, V3 and V3 only)*

Setting	Description	Factory Default
No-Auth	This allows the admin account and user account to access objects without authentication.	No
MD5-Auth	Authentication will be based on the HMAC-MD5 algorithms. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Authentication will be based on the HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.	No

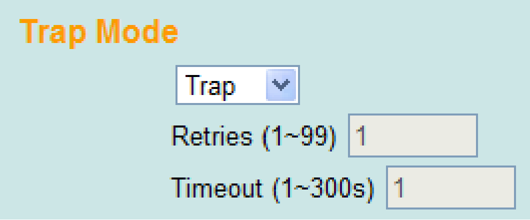
User Data Encryption Key *(for SNMP V1, V2c, V3 and V3 only)*

Setting	Description	Factory Default
Enable	This enables data encryption using the specified data encryption key (between 8 and 30 characters).	No
Disable	No data encryption	No

Trap Settings

SNMP Trap Mode

In Trap mode, the SNMP agent sends a SNMPv1 trap PDU to the NMS. No acknowledgment is sent back from the NMS so the agent has no way of knowing if the trap reached the NMS.



Trap Mode

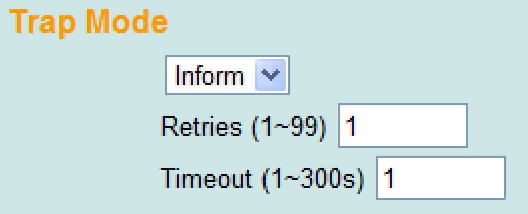
Trap

Retries (1~99) 1

Timeout (1~300s) 1

SNMP Inform Mode

SNMPv2 provides an inform mechanism. When an inform message is sent from the SNMP agent to the NMS, the receiver sends a response to the sender acknowledging receipt of the event. This behavior is similar to that of the get and set request. If the SNMP agent doesn't receive a response from the NMS for a period of time, the agent will resend the trap to the NMS agent. The maximum timeout time is 300 seconds (default is 1 second), and the maximum number of retries is 99 times (default is 1 time). When the SNMP agent receives acknowledgement from the NMS, it will stop resending the inform messages.



Trap Mode

Inform

Retries (1~99) 1

Timeout (1~300s) 1

1st Trap Server IP/Name

Setting	Description	Factory Default
IP or Name	Enter the IP address or name of the Trap Server used by your network.	None

1st Trap Community

Setting	Description	Factory Default
character string	Use a community string match for authentication (maximum of 30 characters).	public

2nd Trap Server IP/Name

Setting	Description	Factory Default
Retries	Enter Inform Retry number	1
Time out	Enter Inform Timeout window	1

Private MIB information

Switch Object ID

Setting	Description	Factory Default
8691.7.15	This indicates the PT-7828's enterprise value.	Fixed

NOTE: *The Switch Object ID cannot be changed.*

Using Communication Redundancy

Communication redundancy on your network helps protect critical links against failure, protects against network loops, and keeps network downtime at a minimum.

Communication redundancy functions allow the user to set up *redundant loops* in the network to provide a backup data transmission route in the event that a cable is inadvertently disconnected or damaged. This is a particularly important feature for industrial applications, since it could take several minutes to locate the disconnected or severed cable. For example, if the PT-7828 is used as a key communications component of a production line, several minutes of downtime can result in a big loss in production and revenue. The PT-7828 supports three different protocols for communication redundancy—**Rapid Spanning Tree Protocol (IEEE-802.1w)** and **Turbo Ring**, and **Turbo Ring V2**.

When configuring a redundant ring, all switches on the same ring must be configured using the same redundancy protocol. You cannot mix the Turbo Ring, Turbo Ring V2, and STP/RSTP protocols within a ring. The following table lists the key differences between each feature. Use this information to evaluate each the benefits of each, and then determine which features are most suitable for your network.

	Turbo Ring V2	Turbo Ring	STP	RSTP
Topology	Ring	Ring	Ring, Mesh	Ring, Mesh
Recovery Time	< 20 ms	< 300 ms	Up to 30 sec.	Up to 5 sec

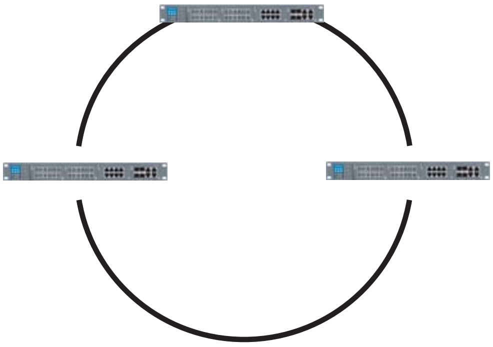
NOTE Most managed switches by Moxa support two proprietary Turbo Ring protocols:

- **Turbo Ring** refers to the original version of Moxa's proprietary redundant ring protocol, which has a recovery time of under 300 ms.
- **Turbo Ring V2** refers to the new generation Turbo Ring, which has a recovery time of under 20 ms.

The Turbo Ring Concept

Moxa developed the proprietary Turbo Ring protocol to optimize communication redundancy and achieve a faster recovery time on the network.

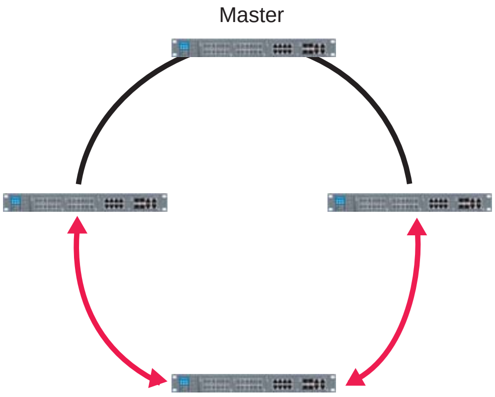
The Turbo Ring and Turbo Ring V2 protocols designate one switch as the ***master*** of the network, and then automatically block packets from traveling through any of the network's redundant loops. In the event that one branch of the ring gets disconnected from the rest of the network, the protocol automatically readjusts the ring so that the part of the network that was disconnected can reestablish contact with the rest of the network.

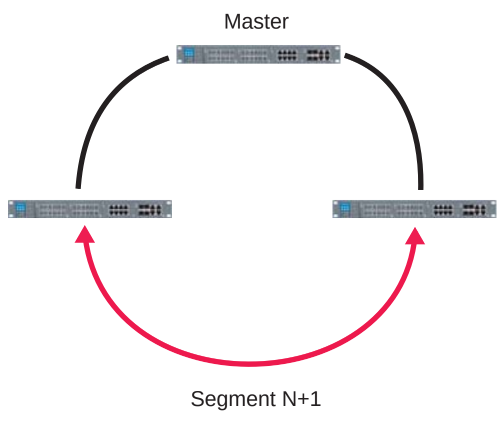
Initial setup for Turbo Ring or Turbo Ring V2	
	1. For each switch in the ring, select any two ports as the redundant ports. 2. Connect redundant ports on neighboring switches to form the redundant ring.

The user does not need to manually assign the master with Turbo Ring or Turbo Ring V2. If no switch is assigned as the master, the protocol automatically selects one of the switches to be the master. The master is only used to identify which segment in the redundant ring acts as the backup path. In the following subsections, we explain how the redundant path is selected for rings configured for Turbo Ring and Turbo Ring V2.

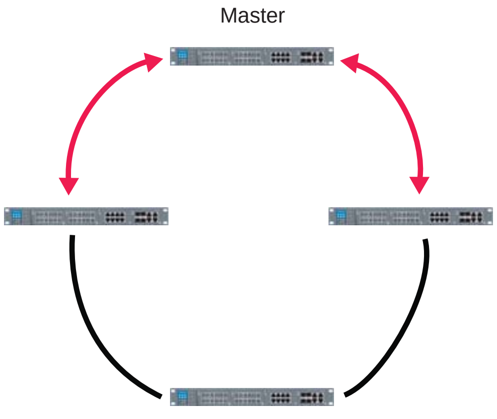
Determining the Redundant Path for Turbo Ring

In this case, the redundant segment (i.e., the segment that will be blocked during normal operation) is determined by the number of PT series Ethernet switches in the ring and by the location of the master switch.

Turbo Ring with even number of switches	
	If the number of Ethernet switches in the Turbo Ring is 2N (an even number), the backup segment is one of the two segments connected to the (N+1)st switch (i.e., the unit directly opposite the master).

Turbo Ring with odd number switches	
	If the number of Ethernet switches in the Turbo Ring is 2N+1 (an odd number), the backup segment is the (N+1)st segment counting counterclockwise. For the example shown here, N=1, so that N+1=2.

Determining the Redundant Path for Turbo Ring V2

	For **Turbo Ring V2**, the backup segment is the segment connected to the 2nd redundant port on the master. Please refer to **Configuring Turbo Ring V2** later in this chapter.

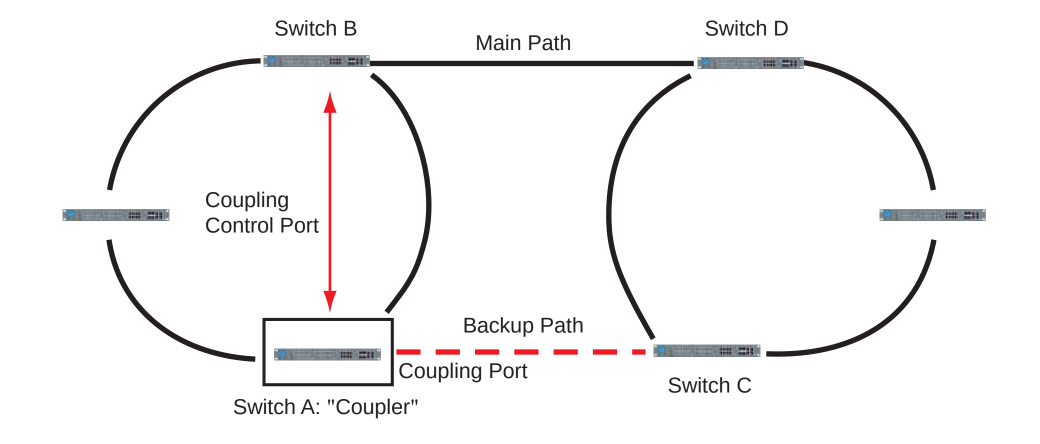
Ring Coupling Configuration

For some systems, it may not be convenient to connect all devices in the system in a single redundant ring, since some devices could be located in a remote area. For these systems, **Ring Coupling** can be used to group devices into smaller redundant rings that communicate with each other.

ATTENTION

In a VLAN environment, the user must set **Redundant Port Coupling Port** and **Coupling Control Port** to join all VLANs, since these ports act as the **backbone** to transmit all packets of different VLANs to the different PT series Ethernet switches.

Ring Coupling for Turbo Ring

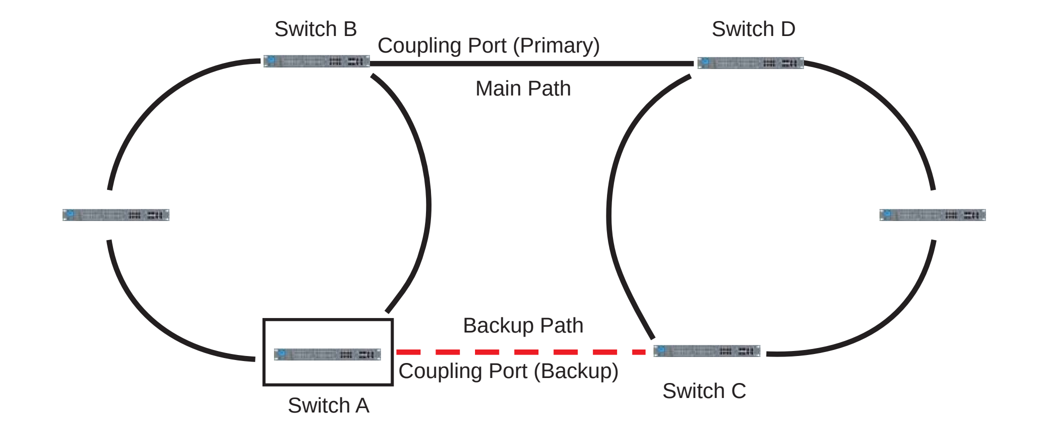


To configure the ring coupling for a **Turbo Ring**, select two PT series Ethernet switches (e.g., Switch A and B in the above figure) in the ring, and another two PT series Ethernet switches in the adjacent ring (e.g., Switch C and D).

Select two ports on each switch to be used as coupling ports and link them together. Next, assign one switch (e.g., Switch A) to be the **coupler** and connect the coupler's coupling control port with Switch B (for this example).

The coupler switch (i.e., Switch A) will monitor switch B through the coupling control port to determine whether or not the coupling port's backup path should be recovered.

Ring Coupling for Turbo Ring V2



Note that the ring coupling settings for a **Turbo Ring V2** are different from a **Turbo Ring**. For Turbo Ring V2, ring coupling is enabled by configuring the **Coupling Port (Primary)** on Switch B and the **Coupling Port (Backup)** on Switch A only. You do not need to set up a coupling control port, so **Turbo Ring V2** does not require a coupling control line.

The **Coupling Port (Backup)** on Switch A is used for the backup path and connects directly to a network port on Switch C. The **Coupling Port (Primary)** on Switch B monitors the status of the main path, and connects directly to an extra network port on Switch D. With ring coupling established, Switch A can activate the backup path as soon as it detects a problem with the main path.

ATTENTION

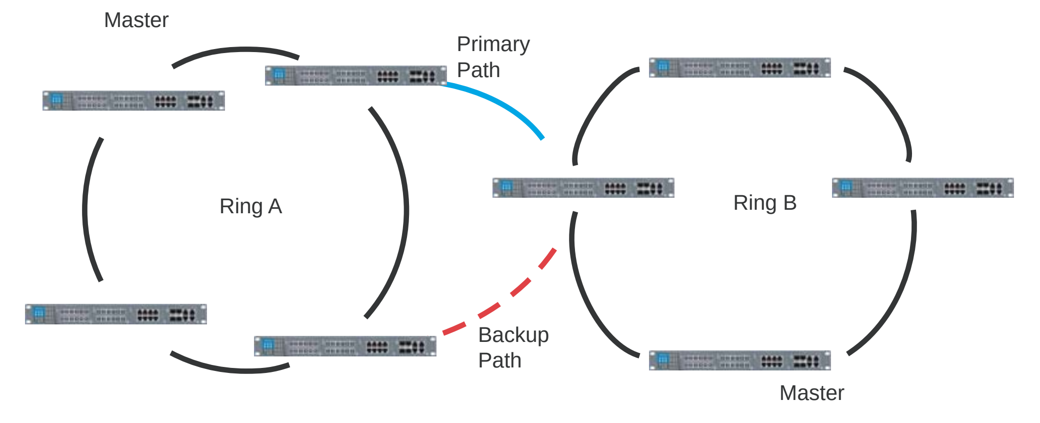
Ring coupling only needs to be enabled on one of the switches serving as the ring coupler. The coupler must assign separate ports for the two Turbo Ring ports and the coupling port.

NOTE You do not need to use the same PT series Ethernet switch for both ring coupling and ring master.

Dual-Homing Configuration for Turbo Ring V2

Dual-homing is only supported with Turbo Ring V2 and is used to connect two networks through a single Ethernet switch. The primary path is the operating connection, and the backup path is a back-up connection that is activated in the event that the primary path connection fails.

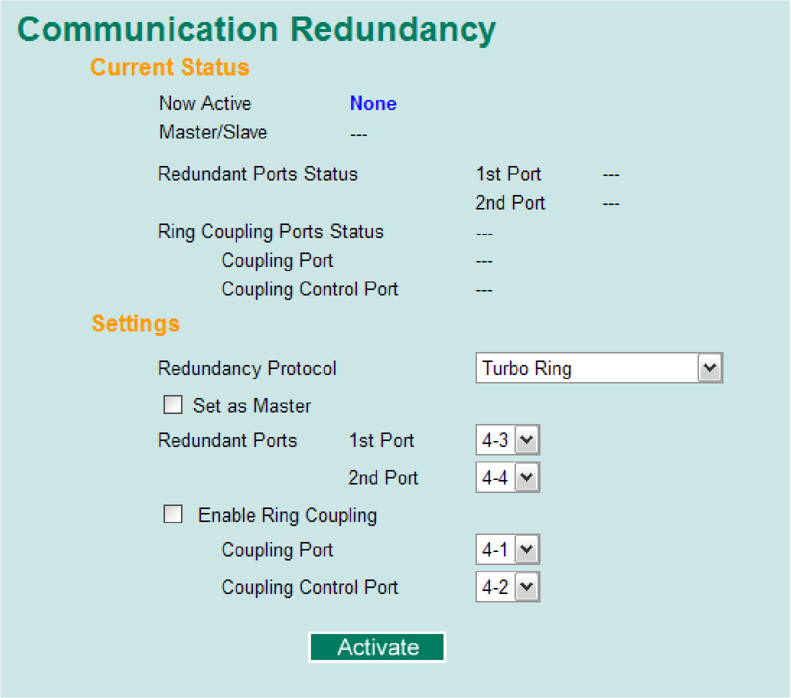
Dual-Homing for Turbo Ring V2



Configuring Turbo Ring and Turbo Ring V2

On the **Communication Redundancy** page, select **Turbo Ring** or **Turbo Ring V2** as the **Redundancy Protocol**. Note that each protocol's configuration page is different.

Configuring Turbo Ring



Communication Redundancy

Current Status

Now Active None
Master/Slave ---

Redundant Ports Status 1st Port ---
2nd Port ---

Ring Coupling Ports Status ---
Coupling Port ---
Coupling Control Port ---

Settings

Redundancy Protocol: Turbo Ring
□ Set as Master
Redundant Ports 1st Port: 4-3
2nd Port: 4-4
□ Enable Ring Coupling
Coupling Port: 4-1
Coupling Control Port: 4-2

"Current Status" Items

Now Active

This shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, or **none**.

Master/Slave

This indicates whether or not the PT-7828 is the master of the Turbo Ring. This field appears only for Turbo Ring or Turbo Ring V2.

NOTE The user does not need to assign the master to use Turbo Ring or Turbo Ring V2. If no master is assigned, the Turbo Ring protocol will automatically assign master status to one of the PT series Ethernet switches in the ring. The master is only used to determine which segment serves as the backup path.

Redundant Ports Status (1st Port, 2nd Port)
Ring Coupling Ports Status (Coupling Port, Coupling Control Port)

The **Ports Status** indicators show ***Forwarding*** for normal transmission, ***Blocking*** if the port is part of a backup path that is currently blocked, and ***Link down*** if there is no connection.

"Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	This selects the Turbo Ring protocol.	None
Turbo Ring V2	This selects the Turbo Ring V2 protocol.	
RSTP (IEEE 802.1w/1D)	This selects the RSTP protocol.	
None	This disables ring redundancy.	

Set as Master

Setting	Description	Factory Default
Enabled	The PT-7828 is manually selected as the master.	Not checked
Disabled	The Turbo Ring or Turbo Ring V2 protocol will automatically select the master.	

Redundant Ports

Setting	Description	Factory Default
1st Port	This specifies which port on the PT-7828 will be used as the first redundant port.	None
2nd Port	This specifies which port on the PT-7828 will be used as the second redundant port.	None

Enable Ring Coupling

Setting	Description	Factory Default
Enable	This specifies that this PT-7828 will be a ring coupler.	Not checked
Disable	This specifies that this PT-7828 is not a ring coupler.	

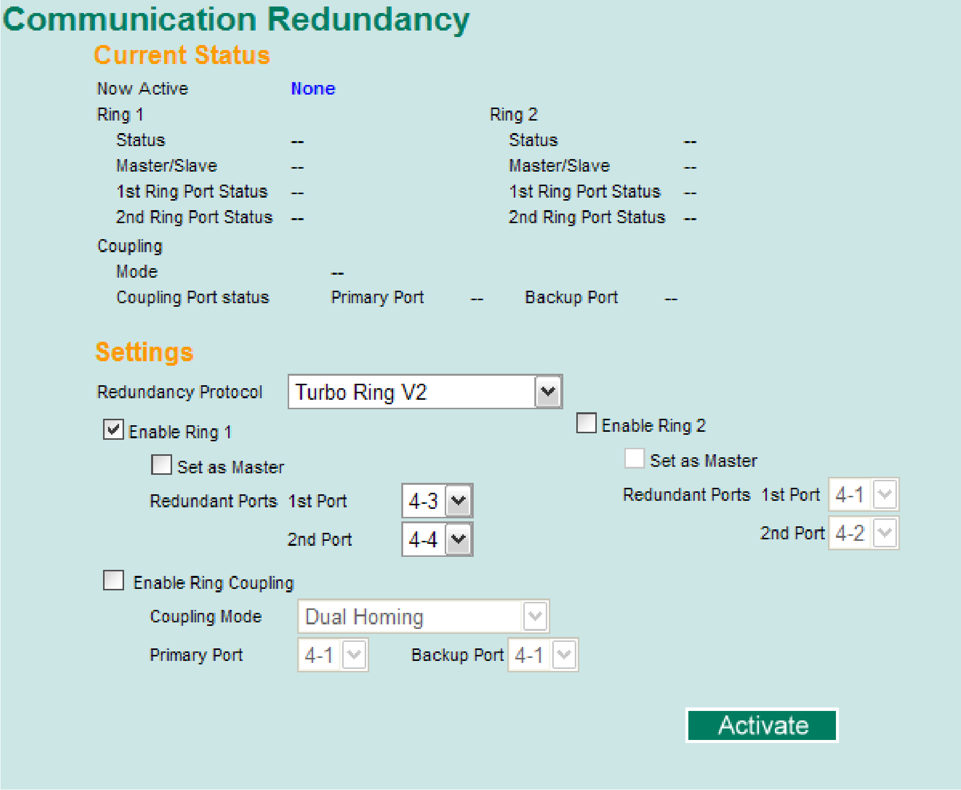
Coupling Port

Setting	Description	Factory Default
Coupling Port	This specifies which port on the PT-7828 will be used as the coupling port.	None

Coupling Control Port

Setting	Description	Factory Default
Coupling Control Port	This specifies which port on the PT-7828 will be used as the coupling control port.	None

Configuring Turbo Ring V2



Communication Redundancy

Current Status

Now Active None

Ring 1		Ring 2	
Status	--	Status	--
Master/Slave	--	Master/Slave	--
1st Ring Port Status	--	1st Ring Port Status	--
2nd Ring Port Status	--	2nd Ring Port Status	--

Coupling

Mode --

Coupling Port status Primary Port -- Backup Port --

Settings

Redundancy Protocol: Turbo Ring V2

☑ Enable Ring 1	☐ Enable Ring 2
☐ Set as Master	☐ Set as Master
Redundant Ports 1st Port: 4-3	Redundant Ports 1st Port: 4-1
2nd Port: 4-4	2nd Port: 4-2

☐ Enable Ring Coupling

Coupling Mode: Dual Homing

Primary Port: 4-1 Backup Port: 4-1

NOTE When using a dual-ring architecture, users must complete configuration for both Ring 1 and Ring 2. The status of both rings will appear under **Current Status**.

"Current Status" Items

Now Active

This shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, or **none**.

Ring 1/2—Status

This shows **Healthy** if the ring is operating normally, and shows **Break** if the ring's backup link is active.

Ring 1/2—Master/Slave

This indicates whether or not the PT-7828 is the master of the Turbo Ring. This field appears only when selected to operate in Turbo Ring or Turbo Ring V2 mode.

NOTE The user does not need to assign the master to use Turbo Ring or Turbo Ring V2. If no master is assigned, the Turbo Ring protocol will automatically assign master status to one of the PT series Ethernet switches in the ring. The master is only used to determine which segment serves as the backup path.

Ring 1/2—1st Ring Port Status

Ring 1/2—2nd Ring Port Status

The **Ports Status** indicators show ***Forwarding*** for normal transmission, ***Blocking*** if this port is connected to a backup path and the path is blocked, and ***Link down*** if there is no connection.

Coupling—Mode

This indicates either **None**, **Dual Homing**, or **Ring Coupling**.

Coupling—Coupling Port status

This indicates either **Primary**, or **Backup**.

"Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	This selects the Turbo Ring protocol.	None
Turbo Ring V2	This selects the Turbo Ring V2 protocol.	
RSTP (IEEE 802.1W/1D)	This selects the RSTP protocol.	
None	This disables ring redundancy.	

Enable Ring 1

Setting	Description	Factory Default
Enabled	This enables Ring 1.	Not checked
Disabled	This disables Ring 1.	

Enable Ring 2*

Setting	Description	Factory Default
Enabled	This enables Ring 2.	Not checked
Disabled	This disables Ring 2.	

*Both Ring 1 and Ring 2 must be enabled when using the dual-ring architecture.

Set as Master

Setting	Description	Factory Default
Enabled	The PT-7828 is manually selected as the master.	Not checked
Disabled	The Turbo Ring or Turbo Ring V2 protocol will automatically select the master.	

Redundant Ports

Setting	Description	Factory Default
1st Port	This specifies which port on the PT-7828 will be used as the first redundant port.	None
2nd Port	This specifies which port on the PT-7828 will be used as the second redundant port.	None

Enable Ring Coupling

Setting	Description	Factory Default
Enable	This specifies that this PT-7828 will be a ring coupler.	Not checked
Disable	This specifies that this PT-7828 is not a ring coupler.	

Coupling Mode

Setting	Description	Factory Default
Dual Homing	This enables dual homing through the PT-7828.	None
Ring Coupling (backup)	This specifies that the PT-7828 will be used for a ring coupling backup connection.	None
Ring Coupling (primary)	This specifies that the PT-7828 will be used for a ring coupling primary connection.	None

Primary/Backup Port

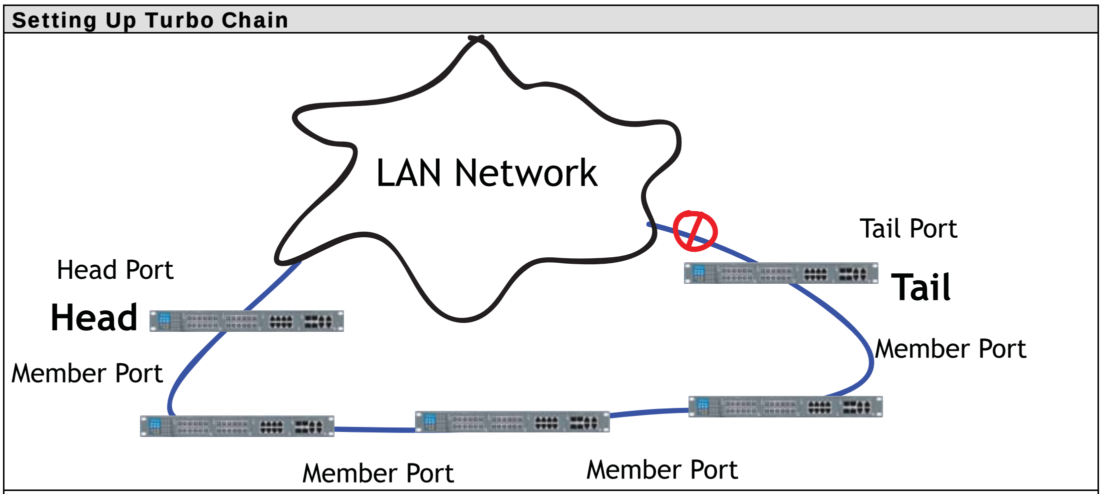
Setting	Description	Factory Default
Primary Port	This specifies which port on the PT-7828 will be used as primary port.	None
Backup Port	This specifies which port on the PT-7828 will be used as the backup port.	None

The Turbo Chain Concept

Moxa's Turbo Chain is an advanced software-technology that gives network administrators the flexibility of constructing any type of redundant network topology. When using the "chain" concept, you first connect the Ethernet switches in a chain and then simply link the two ends of the chain to an Ethernet network, as illustrated in the following figure.

Turbo Chain can be used on industrial networks that have a complex topology. If the industrial network uses a multi-ring architecture, Turbo Chain can be used to create flexible and scalable topologies with a fast media-recovery time.

Setting Up Turbo Chain

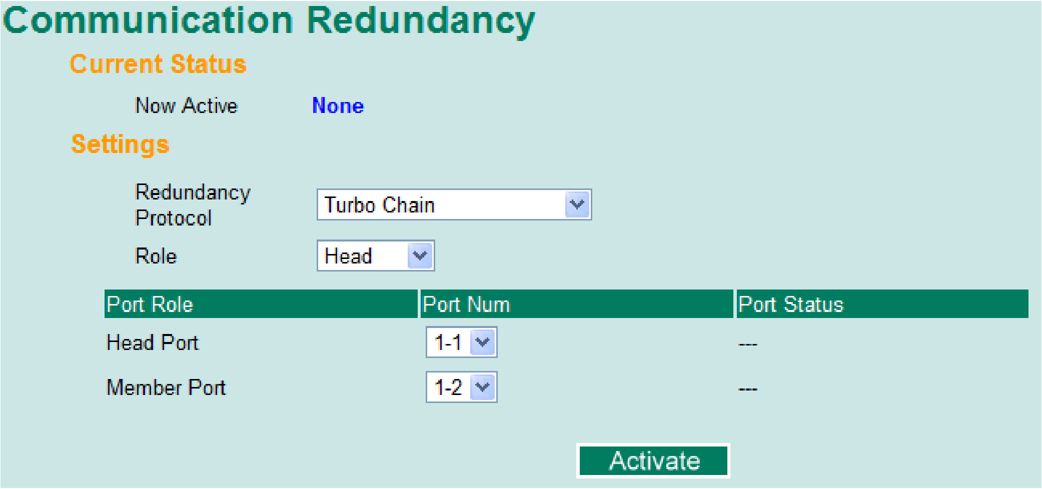


1. Select the Head switch, Tail switch, and Member switches.
2. Configure one port as the Head port and one port as the Member port in the Head switch, configure one port as the Tail port and one port as the Member port in the Tail switch, and configure two ports as Member ports in each of the Member switches.
3. Connect the Head switch, Tail switch, and Member switches as shown in the diagram.

The path connecting to the Head port is the main path, and the path connecting to the Tail port is the back up path of the Turbo Chain. Under normal conditions, packets are transmitted through the Head Port to the LAN Network. If any Turbo Chain path is disconnected, the Tail Port will be activated to continue packet transmission.

Configuring "Turbo Chain"

Head Switch Configuration



Communication Redundancy

Current Status

Now Active **None**

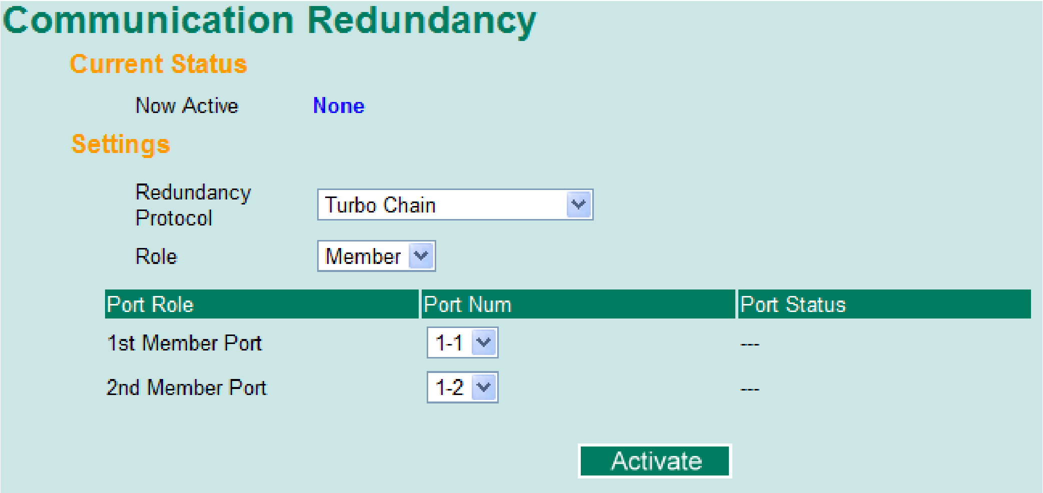
Settings

Redundancy Protocol: Turbo Chain

Role: Head

Port Role	Port Num	Port Status
Head Port	1-1	---
Member Port	1-2	---

Member Switch Configuration



Communication Redundancy

Current Status

Now Active None

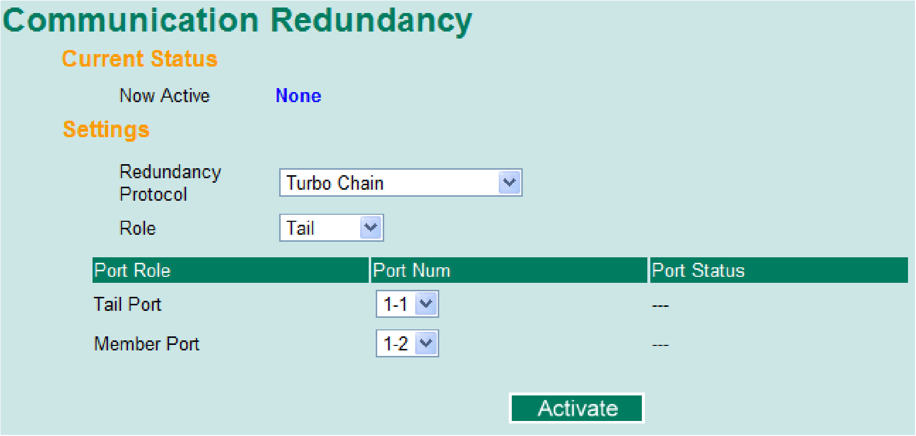
Settings

Redundancy Protocol: Turbo Chain

Role: Member

Port Role	Port Num	Port Status
1st Member Port	1-1	---
2nd Member Port	1-2	---

Tail Switch Configuration



Communication Redundancy

Current Status

Now Active None

Settings

Redundancy Protocol: Turbo Chain

Role: Tail

Port Role	Port Num	Port Status
Tail Port	1-1	---
Member Port	1-2	---

Explanation of "Current Status" Items

Now Active

Shows which communication protocol is in use: **Turbo Ring, Turbo Ring V2, RSTP, Turbo Chain** or **None**.

The "Ports Status" indicators show ***Forwarding*** for normal transmission, ***Blocked*** if this port is connected to the Tail port as a backup path and the path is blocked, and ***Link down*** if there is no connection.

Explanation of "Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Select this item to change to the Turbo Ring configuration page.	None

Turbo Ring V2	Select this item to change to the Turbo Ring V2 configuration page.	
Turbo Chain	Select this item to change to the Turbo Chain configuration page	
RSTP (IEEE 802.1W/1D)	Select this item to change to the RSTP configuration page.	
None	Ring redundancy is not active	

Enable Ring Coupling

Setting	Description	Factory Default
Head	Select this EDS as Head Switch	Member
Member	Select this EDS as Member Switch	
Tail	Select this EDS as Tail Switch	

Enable Ring Coupling

Setting	Description	Factory Default
Head Port	Select any port of the EDS to be the head port.	port 1-1
Member Port	Select any port of the EDS to be the member port.	port 1-2

Enable Ring Coupling

Setting	Description	Factory Default
1st Member port	Select any port of the EDS to be the 1st member port	port 1-1
2nd Member port	Select any port of the EDS to be the 2nd member port	port 1-2

Enable Ring Coupling

Setting	Description	Factory Default
Tail Port	Select any port of the EDS to be the tail port.	port 1-1
Member Port	Select any port of the EDS to be the member port.	port 1-2

The STP/RSTP Concept

Spanning Tree Protocol (STP) was designed to help reduce link failures in a network and provide protection from loops. Networks that have a complicated architecture are prone to broadcast storms caused by unintended loops in the network. The PT-7828's STP feature is disabled by default. To be completely effective, you must enable RSTP/STP on every PT-7828 connected to your network.

Rapid Spanning Tree Protocol (RSTP) implements the Spanning Tree Algorithm and Protocol defined by IEEE Std 802.1w-2001. RSTP provides the following benefits:

- The topology of a bridged network will be determined much more quickly compared to STP.
- RSTP is backward compatible with STP, making it relatively easy to deploy. For example:
  - ➢ It defaults to sending 802.1D style BPDUs if packets with this format are received.

- STP (802.1D) and RSTP (802.1w) can operate on different ports of the same PT-7828. This feature is particularly helpful when PT-7828 ports connect to older equipment, such as legacy switches.

You get essentially the same functionality with RSTP and STP. To see how the two systems different, please refer to *Differences between RSTP and STP* later in this chapter.

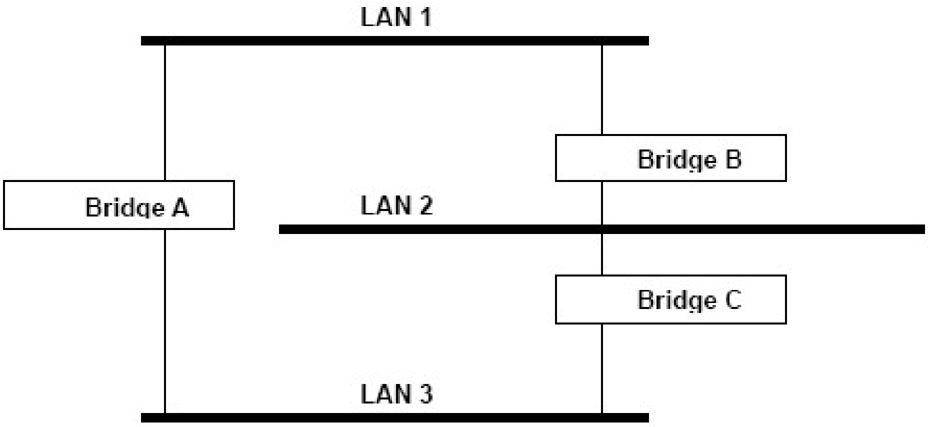
NOTE The STP protocol is part of the IEEE Std 802.1D, 1998 Edition bridge specification. The explanation given below uses bridge instead of switch.

What is STP?

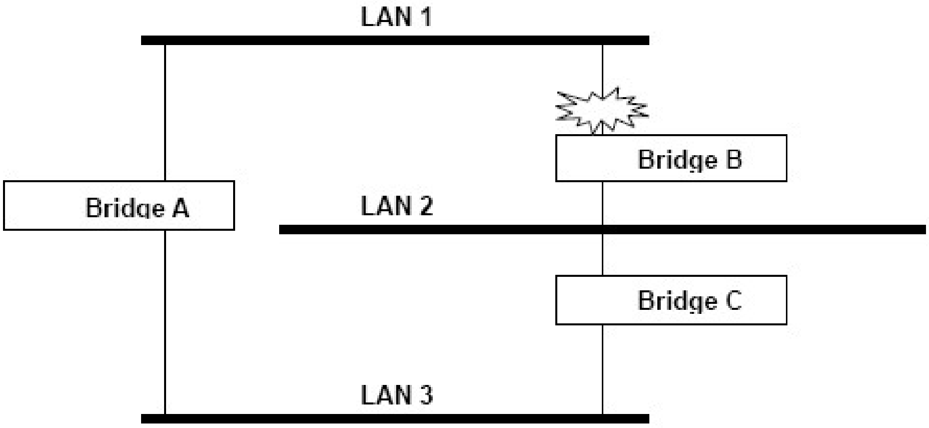
STP (802.1D) is a bridge-based system that is used to implement parallel paths for network traffic. STP uses a loop-detection process to:

- Locate and then disable less efficient paths (i.e., paths that have a lower bandwidth)
- Enable one of the less efficient paths if the most efficient path fails

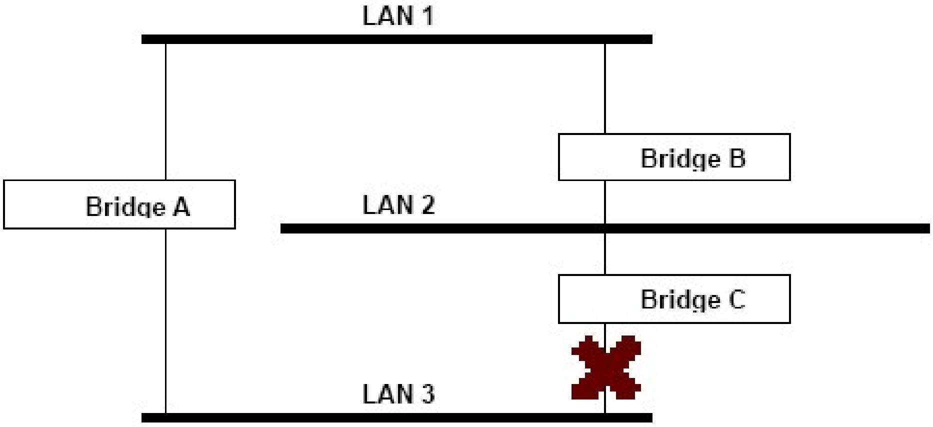
The figure below shows a network made up of three LANs separated by three bridges. Each segment uses at most two paths to communicate with the other segments. Since this configuration can give rise to loops, the network will overload if STP is not enabled.



If STP is enabled, it will detect duplicate paths and prevent, or block, one of them from forwarding traffic. In the following example, STP determined that traffic from LAN segment 2 to LAN segment 1 should flow through Bridges C and A because this path has a greater bandwidth and is therefore more efficient.



What happens if a link failure is detected? As shown in next figure, the STP process reconfigures the network so that traffic from LAN segment 2 flows through Bridge B.



STP will determine which path between each bridged segment is most efficient, and then assign a specific reference point on the network. When the most efficient path has been identified, the other paths are blocked. In the above 3 figures, STP first determined that the path through Bridge C was the most efficient, and as a result, blocked the path through Bridge B. After the failure of Bridge C, STP re-evaluated the situation and opened the path through Bridge B.

How STP Works

When enabled, STP determines the most appropriate path for traffic through a network. The method is described below:

STP Requirements

Before STP can configure the network, the system must satisfy the following requirements:

- Communication must be established between all bridges. This communication is carried out using Bridge Protocol Data Units (BPDUs), which are transmitted in packets with a known multicast address.

- Each bridge must have a Bridge Identifier that specifies which bridge acts as the central reference point, or Root Bridge, for the STP system. Bridges with a lower Bridge Identifier are more likely to be designated as the Root Bridge. The Bridge Identifier is calculated using the MAC address of the bridge and a priority defined for the bridge. The default priority of PT-7828 is 32768.
- Each port has a cost that specifies the efficiency of each link. The efficiency cost is usually determined by the bandwidth of the link, with less efficient links assigned a higher cost. The following table shows the default port costs for a switch:

Port Speed	**Path Cost 802.1D, 1998 Edition**	**Path Cost 802.1w-2001**
10 Mbps	100	2,000,000
100 Mbps	19	200,000
1000 Mbps	4	20,000

STP Calculation

The first step of the STP process is to perform calculations. During this stage, each bridge on the network transmits BPDUs. The following items will then be calculated:

- The bridge that will act as the Root Bridge. The Root Bridge is the central reference point from which the network is configured.
- The Root Path Costs for each bridge. This is the cost of the paths from each bridge to the Root Bridge.
- The identity of each bridge's Root Port. The Root Port is the port on the bridge that connects to the Root Bridge via the most efficient path. In other words, this port connects to the Root Bridge via the path with the lowest Root Path Cost. The Root Bridge itself does not have a Root Port.
- The identity of the Designated Bridge for each LAN segment. The Designated Bridge is the bridge with the lowest Root Path Cost from that segment. If several bridges have the same Root Path Cost, the one with the lowest Bridge Identifier becomes the Designated Bridge. Traffic transmitted in the direction of the Root Bridge will flow through the Designated Bridge. The port on this bridge that connects to the segment is called the Designated Bridge Port.

STP Configuration

After all the bridges on the network agree on the identity of the Root Bridge and all relevant parameters have been established, each bridge is configured to forward traffic only between its Root Port and the Designated Bridge Ports for their respective network segments. All other ports are blocked, which means that they will not be allowed to receive or forward traffic.

STP Reconfiguration

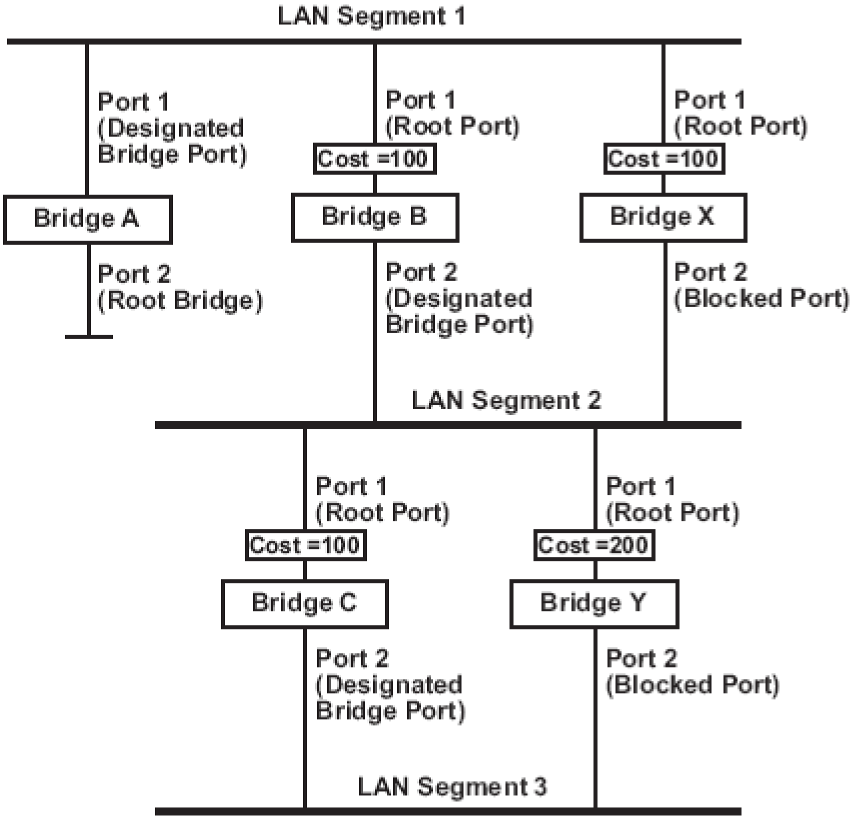
Once the network topology has stabilized, each bridge listens for "Hello" BPDUs that are transmitted from the Root Bridge at regular intervals. If a bridge does not receive a "Hello" BPDU after a certain interval (the Max Age time), the bridge assumes that the Root Bridge, or a link between itself and the Root Bridge, has gone down. This will trigger the bridge to reconfigure the network to account for the change. If you have configured an SNMP trap destination, the first bridge to detect a topology change in your network sends out an SNMP trap.

Differences between RSTP and STP

RSTP is similar to STP, but includes additional information in the BPDUs that allow each bridge to confirm that it has taken action to prevent loops from forming when it decides to enable a link to a neighboring bridge. Adjacent bridges connected via point-to-point links will be able to enable a link without waiting to ensure that all other bridges in the network have had time to react to the change. The main benefit of RSTP is that the configuration decision is made locally rather than network-wide, allowing RSTP can carry out automatic configuration and restore a link faster than STP.

STP Example

The LAN shown below has three segments, with adjacent segments connected using two possible links. The various STP factors, such as Cost, Root Port, Designated Bridge Port, and Blocked Port are shown in the figure.

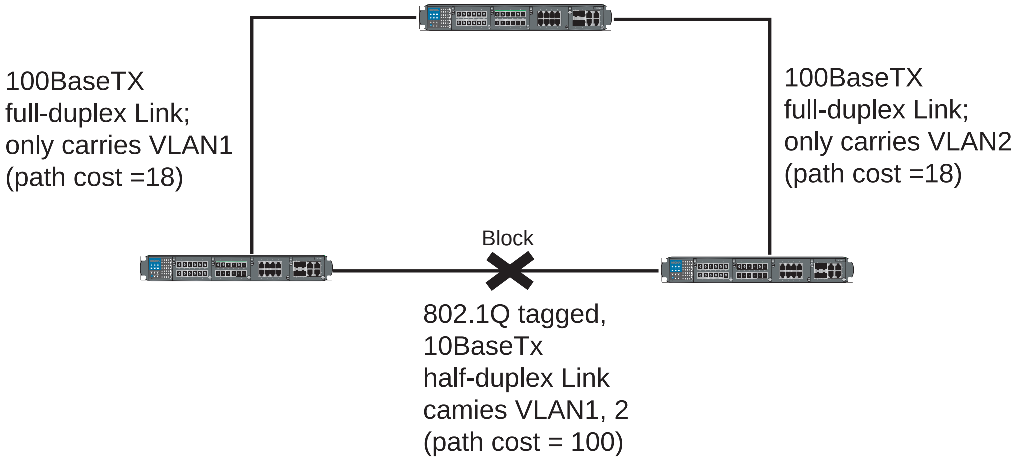


- Bridge A has been selected as the Root Bridge, since it was determined to have the lowest Bridge Identifier on the network.
- Since Bridge A is the Root Bridge, it is also the Designated Bridge for LAN segment 1. Port 1 on Bridge A is selected as the Designated Bridge Port for LAN Segment 1.
- Ports 1 of Bridges B, C, X, and Y are all Root Ports sine they are nearest to the Root Bridge, and therefore have the most efficient path.
- Bridges B and X offer the same Root Path Cost for LAN segment 2. However, Bridge B was selected as the Designated Bridge for that segment since it has a lower Bridge Identifier. Port 2 on Bridge B is selected as the Designated Bridge Port for LAN Segment 2.
- Bridge C is the Designated Bridge for LAN segment 3, because it has the lowest Root Path Cost for LAN Segment 3:
  - The route through Bridges C and B costs 200 (C to B=100, B to A=100)
  - The route through Bridges Y and B costs 300 (Y to B=200, B to A=100)
- The Designated Bridge Port for LAN Segment 3 is Port 2 on Bridge C.

Using STP on a Network with Multiple VLANs

IEEE Std 802.1D, 1998 Edition, does not take into account VLANs when calculating STP information—the calculations only depend on the physical connections. Consequently, some network configurations will result in VLANs being subdivided into a number of isolated sections by the STP system. You must ensure that every VLAN configuration on your network takes into account the expected STP topology and alternative topologies that may result from link failures.

The following figure shows an example of a network that contains VLANs 1 and 2. The VLANs are connected using the 802.1Q-tagged link between Switch B and Switch C. By default, this link has a port cost of 100 and is automatically blocked because the other Switch-to-Switch connections have a port cost of 36 (18+18). This means that both VLANs are now subdivided—VLAN 1 on Switch units A and B cannot communicate with VLAN 1 on Switch C, and VLAN 2 on Switch units A and C cannot communicate with VLAN 2 on Switch B.

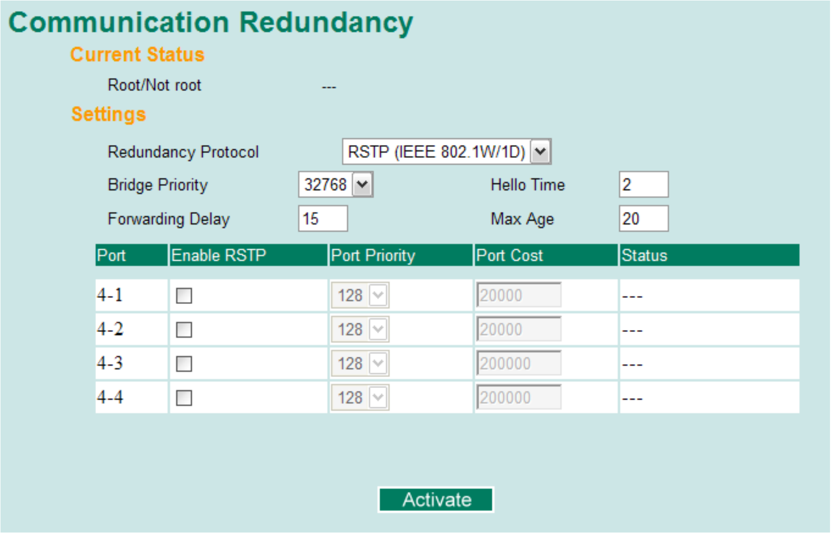


To avoid subdividing VLANs, all inter-switch connections should be made members of all available 802.1Q VLANs. This will ensure connectivity at all times. For example, the connections between Switches A and B, and between Switches A and C should be 802.1Q tagged and carrying VLANs 1 and 2 to ensure connectivity.

See the **Configuring Virtual LANs** section for more information about VLAN Tagging.

Configuring STP/RSTP

The following figures indicate which Spanning Tree Protocol parameters can be configured. A more detailed explanation of each parameter is given below the figure.



Communication Redundancy

Current Status

Root/Not root ---

Settings

Redundancy Protocol: RSTP (IEEE 802.1W/1D)

Bridge Priority: 32768

Hello Time: 2

Forwarding Delay: 15

Max Age: 20

Port	Enable RSTP	Port Priority	Port Cost	Status
4-1	□	128	20000	---
4-2	□	128	20000	---
4-3	□	128	200000	---
4-4	□	128	200000	---

At the top of this page, the user can check the **Current Status** of this function. For RSTP, you will see:

Now Active:

This field shows which communication protocol is being used—Turbo Ring, RSTP, or neither.

Root/Not Root

This field appears only for RSTP mode. It indicates whether or not this PT-7828 is the Root of the Spanning Tree (the root is determined automatically).

At the bottom of this page, the user can configure the **Settings** for the selected protocol. For RSTP, you can configure:

Protocol of Redundancy

Setting	Description	Factory Default
Turbo Ring	This selects the Turbo Ring protocol.	None
RSTP (IEEE 802.1W/1D)	This selects the RSTP protocol.	None

Bridge Priority

Setting	Description	Factory Default
Numerical value selected by user	This specifies the PT-7828's bridge priority. A lower number means a higher priority, which means a greater chance of being established as the root of the Spanning Tree topology.	32768

Forwarding Delay

Setting	Description	Factory Default
Numerical value input by user	This specifies the amount of time this device will wait before checking to see if it should change to a different state.	15 (sec.)

Hello Time (sec.)

Setting	Description	Factory Default
Numerical value input by user	This specifies the time interval between "hello" messages broadcast by the root of the Spanning Tree topology. The "hello" message is used to check if the topology is healthy.	2

Max. Age (sec.)

Setting	Description	Factory Default
Numerical value input by user	This specifies the amount of time to wait for a "hello" message from the root before the PT-7828 will reconfigure itself as a root. When two or more devices on the network are recognized as a root, the devices will renegotiate to set up a new Spanning Tree topology.	20

Enable STP per Port

Setting	Description	Factory Default
Enable/Disable	This includes the selected port as a node on the Spanning Tree topology.	Disabled

NOTE We suggest that you disable the Spanning Tree Protocol for ports that are connected directly to a device (PLC, RTU, etc.) as opposed to network equipment. This will prevent unnecessary negotiation.

Port Priority

Setting	Description	Factory Default
Numerical value selected by user	This specifies the port's priority as a node on the Spanning Tree topology. Lower values correspond to higher priority.	128

Port Cost

Setting	Description	Factory Default
Numerical value input by user	This specifies the port cost. Higher costs correspond to lower suitability as a node for the Spanning Tree topology.	200000

Port Status

Indicates the current Spanning Tree status of this port. **Forwarding** indicates normal transmission and **Blocking** indicates blocked transmission.

Configuration Limits of RSTP/STP

The Spanning Tree Algorithm places limits on three of the configuration items:

[Eq. 1]: 1 sec ≦ Hello Time ≦ 10 sec

[Eq. 2]: 6 sec ≦ Max. Age ≦ 40 sec

[Eq. 3]: 4 sec ≦ Forwarding Delay ≦ 30 sec

These three variables are further restricted by the following two inequalities:

[Eq. 4]: 2 * (Hello Time + 1 sec) ≦ Max. Age ≦ 2 * (Forwarding Delay – 1 sec)

The PT-7828's firmware will alert you immediately if any of these restrictions are violated. For example, suppose Hello Time = 5 sec, Max. Age = 20 sec, and Forwarding Delay = 4 sec. This does not violate Eqs. 1 through 3, but it violates Eq. 4:

2 * (Hello Time + 1 sec) = 12 sec, and 2 * (Forwarding Delay – 1 sec) = 6 sec.

You can remedy the situation in any number of ways. One solution is simply to increase the Forwarding Delay value to at least 11 seconds.

HINT: Take the following steps to avoid guessing:

Step 1: Assign a value to **"Hello Time"** and then calculate the left most part of Eq. 4 to get the lower limit of **Max. Age**.

Step 2: Assign a value to **"Forwarding Delay"** and then calculate the right most part of Eq. 4 to get the upper limit for **Max. Age**.

Step 3: Assign a value to **Forwarding Delay** that satisfies the conditions in Eq. 3 and Eq. 4.

Using Traffic Prioritization

The PT-7828's traffic prioritization capability provides Quality of Service (QoS) to your network by making data delivery more reliable. You can prioritize traffic on your network to ensure that high priority data is transmitted with minimum delay. Traffic can be controlled by a set of rules to obtain the required Quality of Service for your network. The rules define different types of traffic and specify how each type should be treated as it passes through the switch. The PT-7828 can inspect both IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information to provide consistent classification of the entire network. The PT-7828's QoS capability improves the performance and determinism of industrial networks for mission critical applications.

The Traffic Prioritization Concept

What is Traffic Prioritization?

Traffic prioritization allows you to prioritize data so that time-sensitive and system-critical data can be transferred smoothly and with minimal delay over a network. The benefits of using traffic prioritization are:

- Improve network performance by controlling a wide variety of traffic and managing congestion.
- Assign priorities to different categories of traffic. For example, set higher priorities for time-critical or business-critical applications.
- Provide predictable throughput for multimedia applications, such as video conferencing or voice over IP, and minimize traffic delay and jitter.
- Improve network performance as the amount of traffic grows. This will save cost by reducing the need to keep adding bandwidth to the network.

How Traffic Prioritization Works

Traffic prioritization uses the four traffic queues that are present in your PT-7828 to ensure that high priority traffic is forwarded on a different queue from lower priority traffic. This is what provides Quality of Service (QoS) to your network.

The PT-7828 traffic prioritization depends on two industry-standard methods:

- **IEEE 802.1D**—a layer 2 marking scheme.

- **Differentiated Services (DiffServ)**—a layer 3 marking scheme.

IEEE 802.1D Traffic Marking

The IEEE Std 802.1D, 1998 Edition marking scheme, which is an enhancement to IEEE Std 802.1D, enables Quality of Service on the LAN. Traffic service levels are defined in the IEEE 802.1Q 4-byte tag, which is used to carry VLAN identification as well as IEEE 802.1p priority information. The 4-byte tag immediately follows the destination MAC address and Source MAC address.

The IEEE Std 802.1D, 1998 Edition priority marking scheme assigns an IEEE 802.1p priority level between 0 and 7 to each frame. This determines the level of service that that type of traffic should receive. Refer to the table below for an example of how different traffic types can be mapped to the eight IEEE 802.1p priority levels.

IEEE 802.1p Priority Level	IEEE 802.1D Traffic Type
0	Best Effort (default)
1	Background
2	Standard (spare)
3	Excellent Effort (business critical)
4	Controlled Load (streaming multimedia)
5	Video (interactive media); less than 100 milliseconds of latency and jitter
6	Voice (interactive voice); less than 10 milliseconds of latency and jitter
7	Network Control Reserved traffic

Even though the IEEE 802.1D standard is the most widely used prioritization scheme in the LAN environment, it still has some restrictions:

- It requires an additional 4-byte tag in the frame, which is normally optional in Ethernet networks. Without this tag, the scheme cannot work.
- The tag is part of the IEEE 802.1Q header, so to implement QoS at layer 2, the entire network must implement IEEE 802.1Q VLAN tagging.

It is only supported on a LAN and not across routed WAN links, since the IEEE 802.1Q tags are removed when the packets pass through a router.

Differentiated Services (DiffServ) Traffic Marking

DiffServ is a Layer 3 marking scheme that uses the DiffServ Code Point (DSCP) field in the IP header to store the packet priority information. DSCP is an advanced intelligent method of traffic marking because you can choose how your network prioritizes different types of traffic. DSCP uses 64 values that map to user-defined service levels, allowing you to establish more control over network traffic.

Advantages of DiffServ over IEEE 802.1D are:

- Configure how you want your switch to treat selected applications and types of traffic by assigning various grades of network service to them.
- No extra tags are required in the packet.
- DSCP uses the IP header of a packet and therefore priority is preserved across the Internet.
- DSCP is backward compatible with IPV4 TOS, which allows operation with existing devices that use a layer 3 TOS enabled prioritization scheme.

Traffic Prioritization

The PT-7828 classifies traffic based on layer 2 of the OSI 7 layer model, and the switch prioritizes received traffic according to the priority information defined in the received packet. Incoming traffic is classified based upon the IEEE 802.1D frame and is assigned to the appropriate priority queue based on the IEEE 802.1p service level value defined in that packet. Service level markings (values) are defined in the IEEE 802.1Q 4-byte tag, and consequently traffic will only contain 802.1p priority markings if the network is configured with VLANs and VLAN tagging. The traffic flow through the switch is as follows:

- A packet received by the PT-7828 may or may not have an 802.1p tag associated with it. If it does not, then it is given a default 802.1p tag (which is usually 0). Alternatively, the packet may be marked with a new 802.1p value, which will result in all knowledge of the old 802.1p tag being lost.
- Because the 802.1p priority levels are fixed to the traffic queues, the packet will be placed in the appropriate priority queue, ready for transmission through the appropriate egress port. When the packet reaches the head of its queue and is about to be transmitted, the device determines whether or not the egress port is tagged for that VLAN. If it is, then the new 802.1p tag is used in the extended 802.1D header.

The PT-7828 will check a packet received at the ingress port for IEEE 802.1D traffic classification, and then prioritize it based upon the IEEE 802.1p value (service levels) in that tag. It is this 802.1p value that determines which traffic queue the packet is mapped to.

Traffic Queues

The PT-7828 hardware has multiple traffic queues that allow packet prioritization to occur. Higher priority traffic can pass through the PT-7828 without being delayed by lower priority traffic. As each packet arrives in the PT-7828, it passes through any ingress processing (which includes classification, marking/re-marking), and is then sorted into the appropriate queue. The switch then forwards packets from each queue.

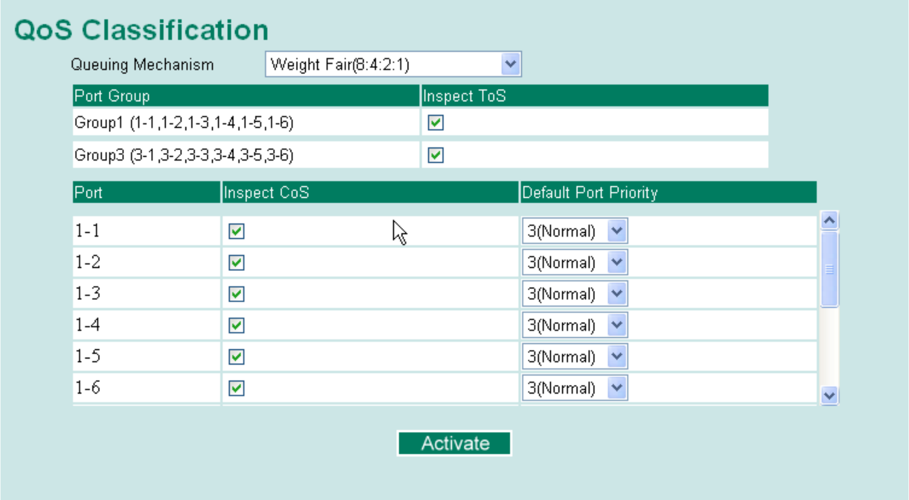
The PT-7828 supports two different queuing mechanisms:

- Weight Fair: This method services all the traffic queues, giving priority to the higher priority queues. Under most circumstances, this method gives high priority precedence over low-priority, but in the event that high-priority traffic except the link capacity, lower priority traffic is not blocked.
- Strict: This method services high traffic queues first; low priority queues are delayed until no more high priority data nePT to be sent. This method always gives precedence to high priority over low-priority.

Configuring Traffic Prioritization

Quality of Service (QoS) provides a traffic prioritization capability to ensure that important data is delivered consistently and predictably. The PT-7828 can inspect IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information, to provide a consistent classification of the entire network. The PT-7828' QoS capability improves your industrial network's performance and determinism for mission critical applications.

QoS Classification



QoS Classification

Queuing Mechanism: Weight Fair(8:4:2:1)

Port Group	Inspect ToS
Group1 (1-1,1-2,1-3,1-4,1-5,1-6)	☑
Group3 (3-1,3-2,3-3,3-4,3-5,3-6)	☑

Port	Inspect CoS	Default Port Priority
1-1	☑	3(Normal)
1-2	☑	3(Normal)
1-3	☑	3(Normal)
1-4	☑	3(Normal)
1-5	☑	3(Normal)
1-6	☑	3(Normal)

The PT-7828 supports inspection of layer 3 TOS and/or layer 2 CoS tag information to determine how to classify traffic packets.

Queuing Mechanism

Setting	Description	Factory Default
Weight Fair	PT-7828 has 4 priority queues. In the weight fair scheme, an 8, 4, 2, 1 weighting is applied to the four priorities. This approach prevents the lower priority frames from being starved of opportunity for transmission with only a slight delay to the higher priority frames.	Weight Fair
Strict	In the Strict-priority scheme, all top-priority frames egress a port until that priority's queue is empty, and then the next lower priority queue's frames egress. This approach can cause the lower priorities to be starved of opportunity for transmitting any frames but ensures all high priority frames to egress the switch as soon as possible.	

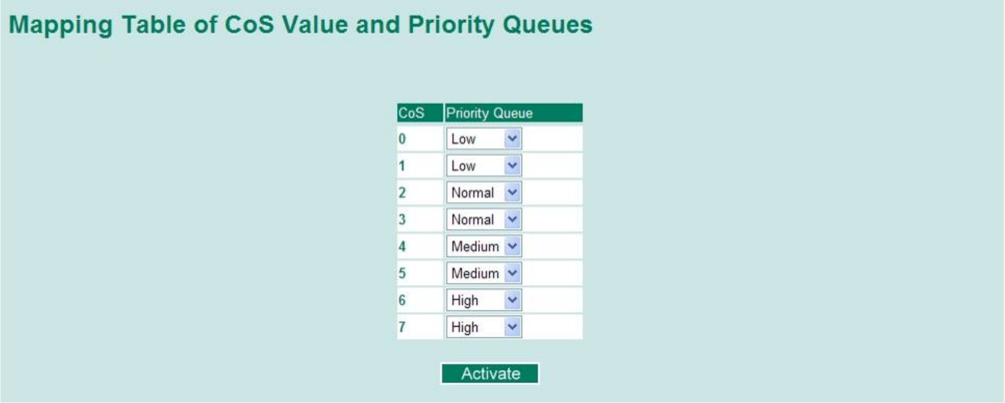
Inspect TOS

Setting	Description	Factory Default
Enable/Disable	This enables or disables the PT-7828 to inspect the Type of Service (TOS) bits in IPV4 frame to determine the priority of each frame.	Enable

Inspect COS

Setting	Description	Factory Default
Enable/Disable	This enables or disables the PT-7828 to inspect the 802.1p COS tag in the MAC frame to determine the priority of each frame.	Enable

CoS Mapping

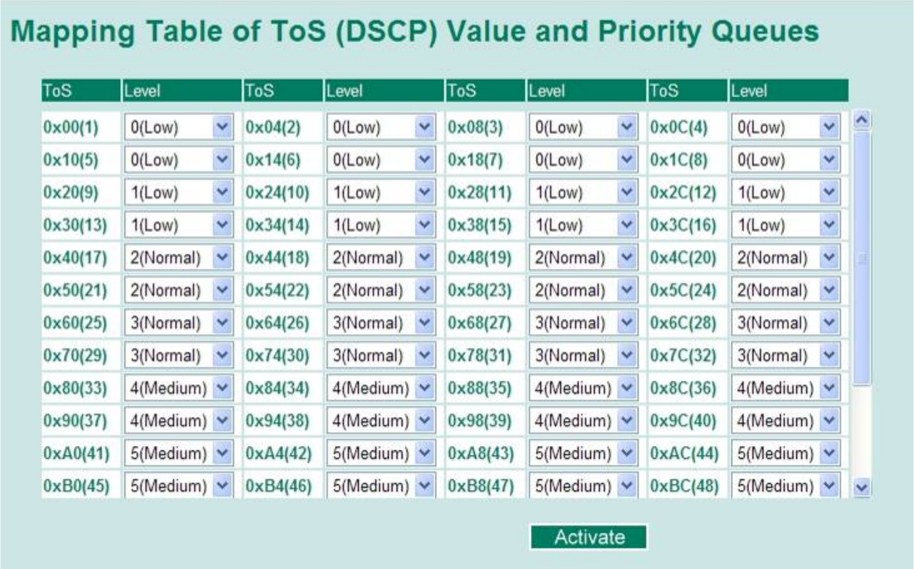


Mapping Table of CoS Value and Priority Queues

CoS	Priority Queue
0	Low
1	Low
2	Normal
3	Normal
4	Medium
5	Medium
6	High
7	High

Setting	Description	Factory
Low/Normal/ Medium/High	This maps different CoS values to 4 different egress queues.	0: Low 1: Low 2: Normal 3: Normal 4: Medium 5: Medium 6: High 7: High

TOS/DiffServ Mapping



Mapping Table of ToS (DSCP) Value and Priority Queues

ToS	Level	ToS	Level	ToS	Level	ToS	Level
0x00(1)	0(Low)	0x04(2)	0(Low)	0x08(3)	0(Low)	0x0C(4)	0(Low)
0x10(5)	0(Low)	0x14(6)	0(Low)	0x18(7)	0(Low)	0x1C(8)	0(Low)
0x20(9)	1(Low)	0x24(10)	1(Low)	0x28(11)	1(Low)	0x2C(12)	1(Low)
0x30(13)	1(Low)	0x34(14)	1(Low)	0x38(15)	1(Low)	0x3C(16)	1(Low)
0x40(17)	2(Normal)	0x44(18)	2(Normal)	0x48(19)	2(Normal)	0x4C(20)	2(Normal)
0x50(21)	2(Normal)	0x54(22)	2(Normal)	0x58(23)	2(Normal)	0x5C(24)	2(Normal)
0x60(25)	3(Normal)	0x64(26)	3(Normal)	0x68(27)	3(Normal)	0x6C(28)	3(Normal)
0x70(29)	3(Normal)	0x74(30)	3(Normal)	0x78(31)	3(Normal)	0x7C(32)	3(Normal)
0x80(33)	4(Medium)	0x84(34)	4(Medium)	0x88(35)	4(Medium)	0x8C(36)	4(Medium)
0x90(37)	4(Medium)	0x94(38)	4(Medium)	0x98(39)	4(Medium)	0x9C(40)	4(Medium)
0xA0(41)	5(Medium)	0xA4(42)	5(Medium)	0xA8(43)	5(Medium)	0xAC(44)	5(Medium)
0xB0(45)	5(Medium)	0xB4(46)	5(Medium)	0xB8(47)	5(Medium)	0xBC(48)	5(Medium)

Setting	Description	Factory Default
Low/Normal/ Medium/High	This maps different TOS values to 4 different egress queues.	1 to 16: Low 17 to 32: Normal 33 to 48: Medium 49 to 64: High

Using Virtual LAN

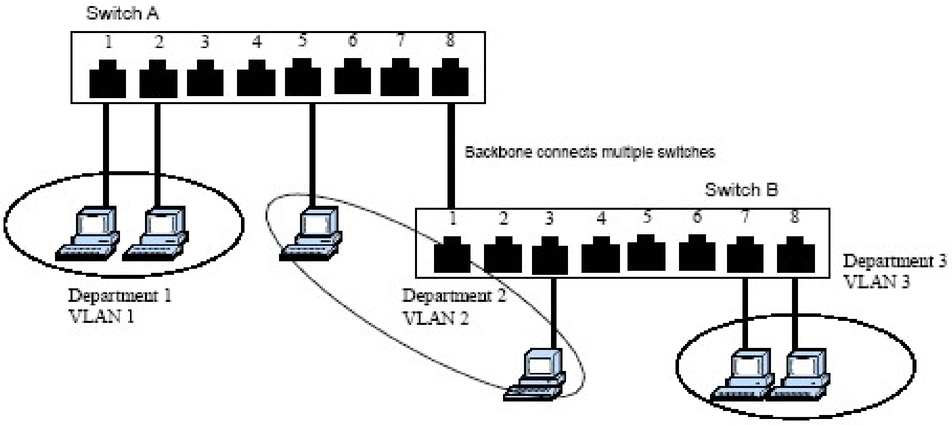
Setting up Virtual LANs (VLANs) on your PT-7828 increases the efficiency of your network by dividing the LAN into logical segments, as opposed to physical segments. In general, VLANs are easier to manage.

The Virtual LAN (VLAN) Concept

What is a VLAN?

A VLAN is a group of devices that can be located anywhere on a network, but which communicate as if they are on the same physical segment. With VLANs, you can segment your network without being restricted by physical connections—a limitation of traditional network design. As an example, with VLANs you can segment your network according to:

- **Departmental groups**—You could have one VLAN for the marketing department, another for the finance department, and another for the product development department.
- **Hierarchical groups**—You could have one VLAN for directors, another for managers, and another for general staff.
- **Usage groups**—You could have one VLAN for email users and another for multimedia users.



Benefits of VLANs

The main benefit of VLANs is that they provide a network segmentation system that is far more flexible than traditional networks. Using VLANs also provides you with three other benefits:

- **VLANs ease the relocation of devices on networks.** With traditional networks, network administrators spend much of their time dealing with moves and changes. If users move to a different subnetwork, the addresses of each host must be updated manually. With a VLAN setup, if a host on VLAN *Marketing,* for example, is moved to a port in another part of the network, and retains its original subnet membership, you only need to specify that the new port is on VLAN *Marketing*. You do not need to carry out any re-cabling.

- **VLANs provide extra security.** Devices within each VLAN can only communicate with other devices on the same VLAN. If a device on VLAN *Marketing* nePT to communicate with devices on VLAN *Financ*e, the traffic must pass through a routing device or Layer 3 switch.
- **VLANs help control traffic.** With traditional networks, congestion can be caused by broadcast traffic that is directed to all network devices, regardless of whether or not they need it. VLANs increase the efficiency of your network because each VLAN can be set up to contain only those devices that need to communicate with each other.

VLANs and the PowerTrans

Your PT-7828 provides support for VLANs using IEEE Std 802.1Q-1998. This standard allows traffic from multiple VLANs to be carried across one physical link. The IEEE Std 802.1Q-1998 standard allows each port on your PT-7828 to be placed as follows:

- In a single VLAN defined on the PT-7828
- In several VLANs simultaneously using 802.1Q tagging

The standard requires that you define the *802.1Q VLAN ID* about each VLAN on your PT-7828 before the switch can use it to forward traffic:

Managing a VLAN

A new or initialized PT-7828 contains a single VLAN—the Default VLAN. This VLAN has the following definition:

- *VLAN Name*—Management VLAN
- *802.1Q VLAN ID*—1 (if tagging is required)

All the ports are initially placed in this VLAN, and it is the only VLAN that allows you to access the management software of the PT-7828 over the network.

Communication between VLANs

If devices connected to a VLAN need to communicate to devices on a different VLAN, a router or Layer 3 switching device with connections to both VLANs needs to be installed. Communication between VLANs can only take place if they are all connected to a routing or Layer 3 switching device.

VLANs: Tagged and Untagged Membership

The PT-7828 supports 802.1Q VLAN tagging, a system that allows traffic for multiple VLANs to be carried on a single physical (backbone, trunk) link. When setting up VLANs you need to understand when to use untagged and tagged membership of VLANs. Simply put, if a port is on a single VLAN it can be an untagged member, but if the port needs to be a member of multiple VLANs, tagged membership must be defined.

A typical host (e.g., clients) will be untagged members of one VLAN, defined as **Access Port** in PT-7828, while inter-switch connections will be tagged members of all VLANs, defined as Trunk Port in PT-7828.

The IEEE Std 802.1Q-1998 defines how VLANs operate within an open packet-switched network. An 802.1Q compliant packet carries additional information that allows a switch to determine which VLAN the port belongs to. If a frame is carrying the additional information, it is known as a *tagged* frame.

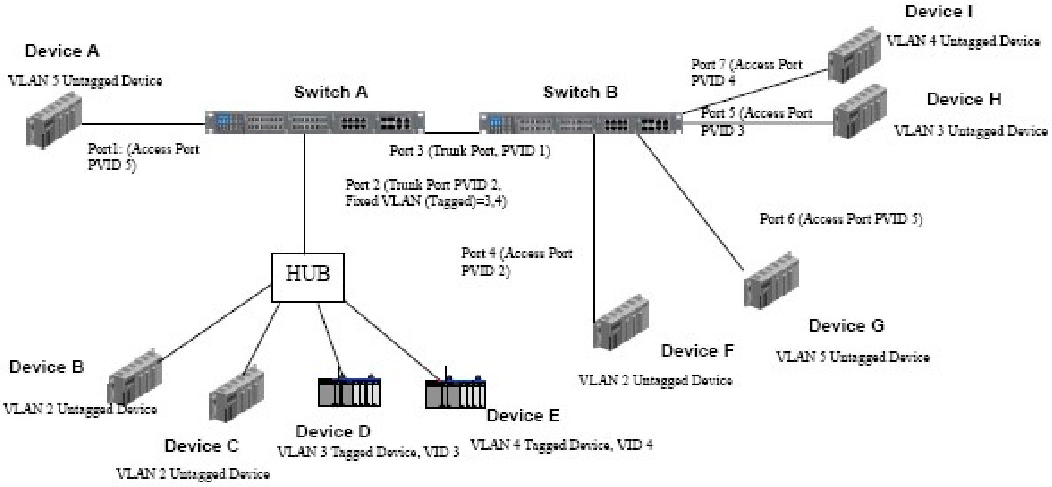
To carry multiple VLANs across a single physical (backbone, trunk) link, each packet must be tagged with a VLAN identifier so that the switches can identify which packets belong in which VLAN. To communicate between VLANs, a router must be used.

The PT-7828 supports two types of VLAN port settings:

- **Access Port:** The port connects to a single device that is not tagged. The user must define the default port PVID that assigns which VLAN the device belongs to. Once the ingress packet of this Access Port egresses to another Trunk Port (the port nePT all packets to carry tag information), PT-7828 will insert this PVID into this packet to help the next 802.1Q VLAN switch recognize it.
- **Trunk Port:** The port connects to a LAN that consists of untagged devices/tagged devices and/or switches and hubs. In general, the traffic of the Trunk Port must have a Tag. Users can also assign PVID to a Trunk Port. The untagged packet on the Trunk Port will be assigned the port default PVID as its VID.

The following section illustrates how to use these ports to set up different applications.

Sample Applications of VLANs using PT-7828


Device A
VLAN 5 Untagged Device
Port1: (Access Port PVID 5)
Switch A
Switch B
Port 3 (Trunk Port, PVID 1)
Port 2 (Trunk Port PVID 2, Fixed VLAN (Tagged)=3,4)
Port 4 (Access Port PVID 2)
HUB
Device B
VLAN 2 Untagged Device
Device C
VLAN 2 Untagged Device
Device D
VLAN 3 Tagged Device, VID 3
Device E
VLAN 4 Tagged Device, VID 4
Device F
VLAN 2 Untagged Device
Device G
VLAN 5 Untagged Device
Port 6 (Access Port PVID 5)
Port 5 (Access Port PVID 3
Device H
VLAN 3 Untagged Device
Port 7 (Access Port PVID 4
Device I
VLAN 4 Untagged Device

In this application,

- Port 1 connects a single untagged device and assigns it to VLAN 5; it should be configured as **Access Port** with PVID 5.
- Port 2 connects a LAN with two untagged devices belonging to VLAN 2. One tagged device with VID 3 and one tagged device with VID 4. It should be configured as **Trunk Port** with PVID 2 for untagged device and Fixed VLAN (Tagged) with 3 and 4 for tagged device. Since each port can only have one unique PVID, all untagged devices on the same port can only belong to the same VLAN.

- Port 3 connects with another switch. It should be configured as **Trunk Port** GVRP protocol will be used through the Trunk Port.
- Port 4 connects a single untagged device and assigns it to VLAN 2; it should be configured as **Access Port** with PVID 2.
- Port 5 connects a single untagged device and assigns it to VLAN 3; it should be configured as **Access Port** with PVID 3.
- Port 6 connect a single untagged device and assigns it to VLAN 5; it should be configured as

Access Port with PVID 5.

- Port 7 connects a single untagged device and assigns it to VLAN 4; it should be configured as **Access Port** with PVID 4.

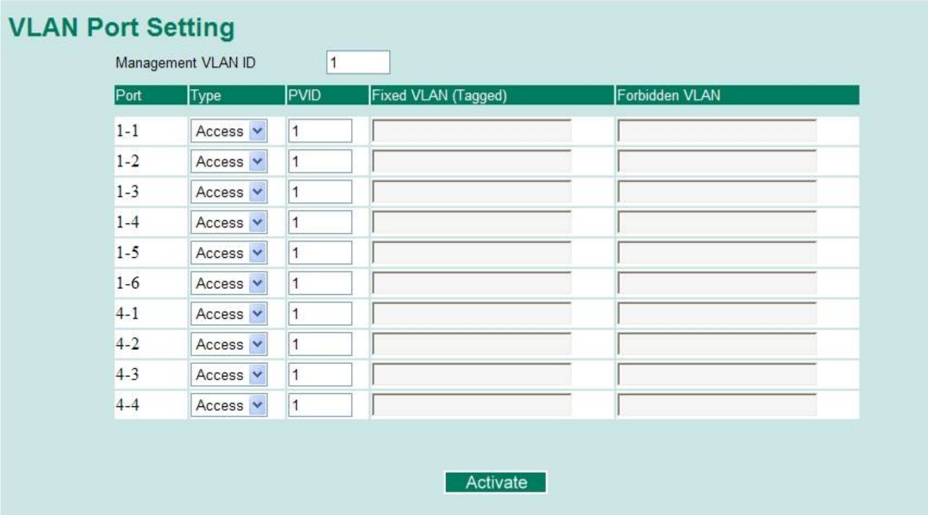
After proper configuration:

- Packets from Device A will travel through **Trunk Port 3** with tagged VID 5. Switch B will recognize its VLAN, pass it to port 6, and then remove tags received successfully by Device G, and vice versa.
- Packets from Devices B and C will travel through **Trunk Port 3** with tagged VID 2. Switch B recognizes its VLAN, passes it to port 4, and then removes tags received successfully by Device F, and vice versa.
- Packets from Device D will travel through **Trunk Port 3** with tagged VID 3. Switch B will recognize its VLAN, pass to port 5, and then remove tags received successfully by Device H. Packets from Device H will travel through **Trunk Port 3** with PVID 3. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device D.
- Packets from Device E will travel through **Trunk Port 3** with tagged VID 4. Switch B will recognize its VLAN, pass it to port 7, and then remove tags received successfully by Device I. Packets from Device I will travel through **Trunk Port 3** with tagged VID 4. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device E.

Configuring Virtual LAN

VLAN Settings

To configure **802.1Q VLAN** on the PT-7828, use the VLAN Setting page to configure the ports.



VLAN Port Setting

Management VLAN ID: 1

Port	Type	PVID	Fixed VLAN (Tagged)	Forbidden VLAN
1-1	Access ▾	1		
1-2	Access ▾	1		
1-3	Access ▾	1		
1-4	Access ▾	1		
1-5	Access ▾	1		
1-6	Access ▾	1		
4-1	Access ▾	1		
4-2	Access ▾	1		
4-3	Access ▾	1		
4-4	Access ▾	1		

Management VLAN ID

Setting	Description	Factory Default
VLAN ID from 1 to 4094	This assigns the VLAN ID of this PT-7828.	1

Port Type

Setting	Description	Factory Default
Access	This port type is used to connect single devices without tags.	Access
Trunk	Select **Trunk** port type to connect another 802.1Q VLAN aware switch or another LAN that combines tagged and/or untagged devices and/or other switches/hubs.	

ATTENTION

For communication redundancy in the VLAN environment, set **Redundant Port Coupling Port** and **Coupling Control Port** as **Trunk Port** since these ports act as the **backbone** to transmit all packets of different VLANs to different PT-7828 units.

Port PVID

Setting	Description	Factory Default
VID range from 1 to 4094	This sets the default VLAN ID for untagged devices that connect to the port.	1

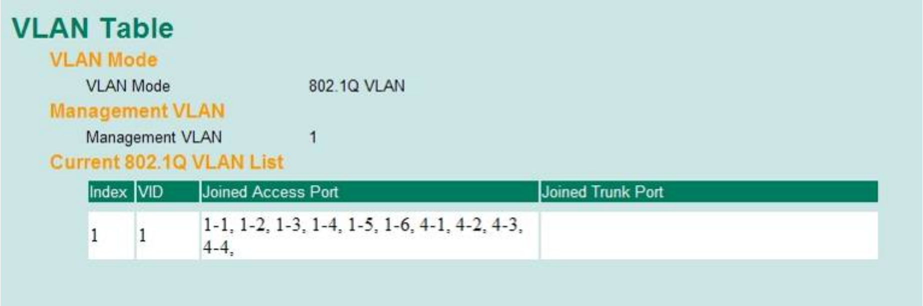
Fixed VLAN List (Tagged)

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the **Trunk** port type. Set the other VLAN ID for tagged devices that connect to the Trunk port. Use commas to separate different VIDs.	None

Forbidden VLAN List

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the **Trunk** port type. Set the VLAN IDs that will not be supported by this trunk port. Use commas to separate different VIDs.	None

VLAN Table



VLAN Table

VLAN Mode

VLAN Mode 802.1Q VLAN

Management VLAN

Management VLAN 1

Current 802.1Q VLAN List

Index	VID	Joined Access Port	Joined Trunk Port
1	1	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 4-1, 4-2, 4-3, 4-4,	

In 802.1Q VLAN table, you can review the VLAN groups that were created, Joined Access Ports, and Trunk Ports, and in Port-based VLAN table, you can review the VLAN group and Joined port.

NOTE The physical network can have a maximum of 64 VLAN settings.

Using Multicast Filtering

Multicast filtering improves the performance of networks that carry multicast traffic. This section explains multicasts, multicast filtering, and how multicast filtering can be implemented on your PT-7828.

The Concept of Multicast Filtering

What is an IP Multicast?

A *multicast* is a packet sent by one host to multiple hosts. Only those hosts that belong to a specific multicast group will receive the multicast. If the network is set up correctly, a multicast can only be sent to an end-station or a subset of end-stations on a LAN or VLAN that belong to the multicast group. Multicast group members can be distributed across multiple subnets, so that multicast transmissions can occur within a campus LAN or over a WAN. In addition, networks that support IP multicast send only *one* copy of the desired information across the network until the delivery path that reaches group members diverges. To make more efficient use of network bandwidth, it is only at these points that multicast packets are duplicated and forwarded. A multicast packet has a multicast group address in the destination address field of the packet's IP header.

Benefits of Multicast

The benefits of using IP multicast are that it:

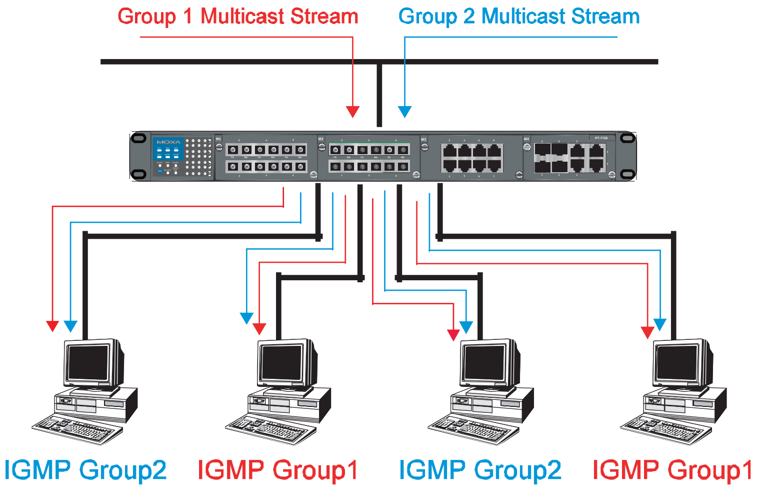
- Uses the most efficient, sensible method to deliver the same information to many receivers with only one transmission.
- Reduces the load on the source (for example, a server) since it will not need to produce several copies of the same data.
- Makes efficient use of network bandwidth and scales well as the number of multicast group members increases.
- Works with other IP protocols and services, such as Quality of Service (QoS).

Multicast transmission makes more sense and is more efficient than unicast transmission for some applications. For example, multicasts are often used for video-conferencing, since high volumes of traffic must be sent to several end-stations at the same time, but where broadcasting the traffic to all end-stations would cause a substantial reduction in network performance. Furthermore, several industrial automation protocols, such as Allen-Bradley, EtherNet/IP, Siemens Profibus, and Foundation Fieldbus HSE (High Speed Ethernet), use multicast. These industrial Ethernet protocols use publisher/subscriber communications models by multicasting packets that could flood a network with heavy traffic. IGMP Snooping is used to prune multicast traffic so that it travels only to those end destinations that require the traffic, reducing the amount of traffic on the Ethernet LAN.

Multicast Filtering

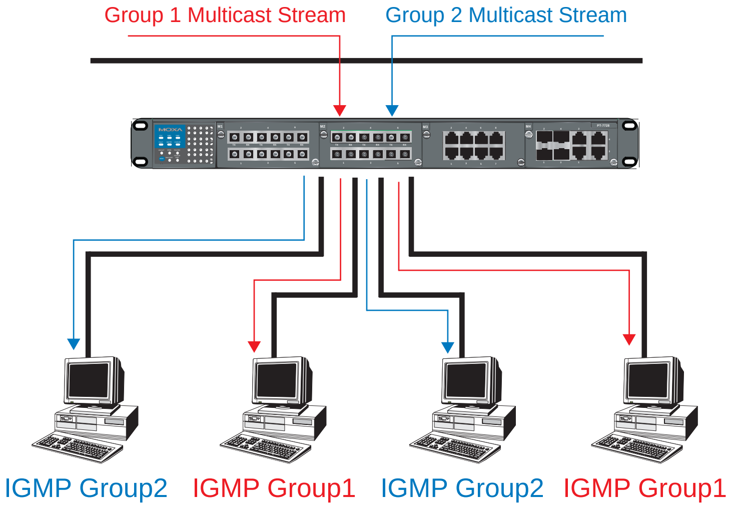
Multicast filtering ensures that only end-stations that have joined certain groups receive multicast traffic. With multicast filtering, network devices only forward multicast traffic to the ports that are connected to registered end-stations. The following two figures illustrate how a network behaves without multicast filtering, and with multicast filtering.

Network without multicast filtering



All hosts receive the multicast traffic, even if they don't need it.

Network with multicast filtering



Hosts only receive dedicated traffic from other hosts belonging to the same group.

Multicast Filtering and Moxa PowerTrans Switch

The PT-7828 has three ways to achieve multicast filtering: IGMP (Internet Group Management Protocol) Snooping, GMRP (GARP Multicast Registration Protocol), and adding a static multicast MAC manually to filter multicast traffic automatically.

IGMP (Internet Group Management Protocol)

Snooping Mode

Snooping Mode allows your switch to forward multicast packets only to the appropriate ports. The switch **snoops** on exchanges between hosts and an IGMP device, such as a router, to find those ports that want to join a multicast group, and then configures its filters accordingly.

Query Mode

Query mode allows the PT-7828 to work as the Querier if it has the lowest IP address on the subnetwork to which it belongs. IGMP querying is enabled by default on the PT-7828 to help prevent interoperability issues with some multicast routers that may not follow the lowest IP address election method. Enable query mode to run multicast sessions on a network that does not contain IGMP routers (or queriers).

NOTE PT-7828 is compatible with any device that conforms to the IGMP v2 and IGMP v3 device protocol.

IGMP Multicast Filtering

IGMP is used by IP-supporting network devices to register hosts with multicast groups. It can be used on all LANs and VLANs that contain a multicast capable IP router, and on other network devices that support multicast filtering. IGMP works as follows:

1. The IP router (or querier) periodically sends *query* packets to all end-stations on the LANs or VLANs that are connected to it. For networks with more than one IP router, the router with the lowest IP address is the querier. A switch with IP address lower than the IP address of any other IGMP queriers connected to the LAN or VLAN can become the IGMP querier.
2. When an IP host receives a query packet, it sends a *report* packet back that identifies the multicast group that the end-station would like to join.
3. When the report packet arrives at a port on a switch with *IGMP Snooping* enabled, the switch knows that the port should forward traffic for the multicast group, and then proceeds to forward the packet to the router.
4. When the router receives the report packet, it registers that the LAN or VLAN requires traffic for the multicast groups.
5. When the router forwards traffic for the multicast group to the LAN or VLAN, the switches only forward the traffic to ports that received a report packet.

GMRP (GARP Multicast Registration Protocol)

The PT-7828 supports IEEE 802.1D-1998 GMRP (GARP Multicast Registration Protocol), which differs from IGMP (Internet Group Management Protocol). GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or de-register Group membership information dynamically. GMRP functions similarly to GVRP, except that GMRP registers multicast addresses on ports. When a port receives a ***GMRP-join*** message, it will register the multicast address to its database if the multicast address is not registered, and all the multicast packets with that multicast address are able to be forwarded from this port. When a port receives a ***GMRP-leave*** message, it will de-register the multicast address from its database, and all the multicast packets with this multicast address are not able to be forwarded from this port.

Static Multicast MAC

Some devices may only support multicast packets, but not support either IGMP Snooping or GMRP. The PT-7828 supports adding multicast groups manually to enable multicast filtering.

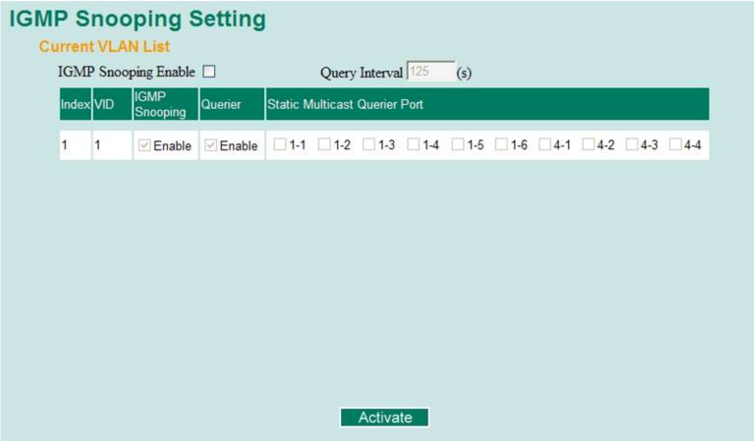
Enabling Multicast Filtering

Use the serial console or Web interface to enable or disable IGMP Snooping and IGMP querying. If IGMP Snooping is not enabled, then IP multicast traffic is always forwarded, flooding the network.

Configuring IGMP Snooping

IGMP Snooping provides the ability to prune multicast traffic so that it travels only to those end destinations that require that traffic, thereby reducing the amount of traffic on the Ethernet LAN.

IGMP Snooping Settings



IGMP Snooping Setting

Current VLAN List

IGMP Snooping Enable □ Query Interval 125 (s)

Index	VID	IGMP Snooping	Querier	Static Multicast Querier Port
1	1	☑ Enable	☑ Enable	□ 1-1 □ 1-2 □ 1-3 □ 1-4 □ 1-5 □ 1-6 □ 4-1 □ 4-2 □ 4-3 □ 4-4

IGMP Snooping Enable

Setting	Description	Factory Default
Enable/Disable	Click the checkbox to enable the IGMP Snooping function **globally**.	Disabled

Query Interval

Setting	Description	Factory Default
Numerical value input by user	This sets the query interval of the Querier function globally. Valid settings are from 20 to 600 seconds.	125 seconds

IGMP Snooping

Setting	Description	Factory Default
Enable/Disable	This enables or disables the IGMP Snooping function per VLAN.	Enabled if IGMP Snooping Enabled Globally

Querier

Setting	Description	Factory Default
Enable/Disable	This enables or disables the PT-7828's querier function.	Enabled if IGMP Snooping is Enabled Globally

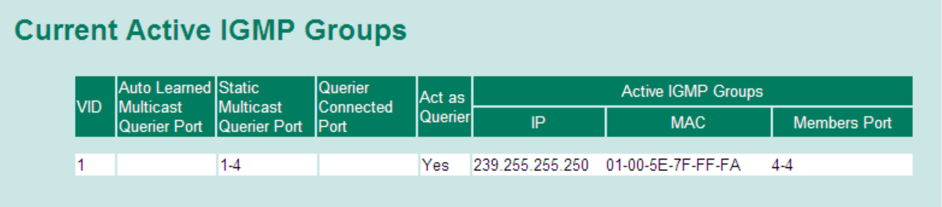
Static Multicast Router Port

Setting	Description	Factory Default
Select/Deselect	This selects the ports that will connect to the multicast routers. It is active only when IGMP Snooping is enabled.	Disabled

NOTE At least one switch must be designated the Querier or enable IGMP snooping and GMRP when enabling Turbo Ring and IGMP snooping simultaneously.

IGMP Table

The PT-7828 displays the current active IGMP groups that were detected.



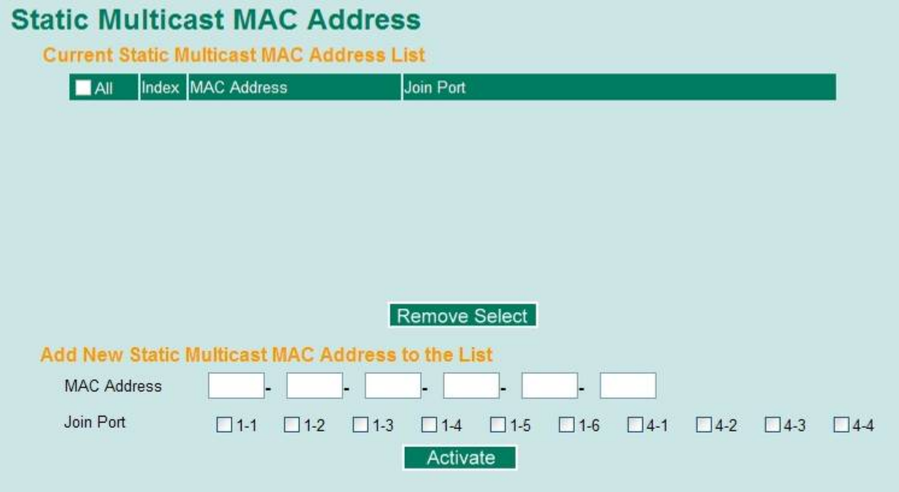
Current Active IGMP Groups

VID	Auto Learned Multicast Querier Port	Static Multicast Querier Port	Querier Connected Port	Act as Querier	Active IGMP Groups		
					IP	MAC	Members Port
1		1-4		Yes	239.255.255.250	01-00-5E-7F-FF-FA	4-4

The information includes **VID**, **Auto-learned Multicast Router Port**, **Static Multicast Router Port**, **Querier Connected Port**, and the **IP** and **MAC** addresses of active IGMP groups.

Add Static Multicast MAC

If required, the PT-7828 also supports adding multicast groups manually.



Static Multicast MAC Address

Current Static Multicast MAC Address List

□ All	Index	MAC Address	Join Port

Remove Select

Add New Static Multicast MAC Address to the List

MAC Address ____ - ____ - ____ - ____ - ____ - ____

Join Port □ 1-1 □ 1-2 □ 1-3 □ 1-4 □ 1-5 □ 1-6 □ 4-1 □ 4-2 □ 4-3 □ 4-4

Activate

Add New Static Multicast Address to the List

Setting	Description	Factory Default
MAC Address	Input the multicast MAC address of this host.	*None*

MAC Address

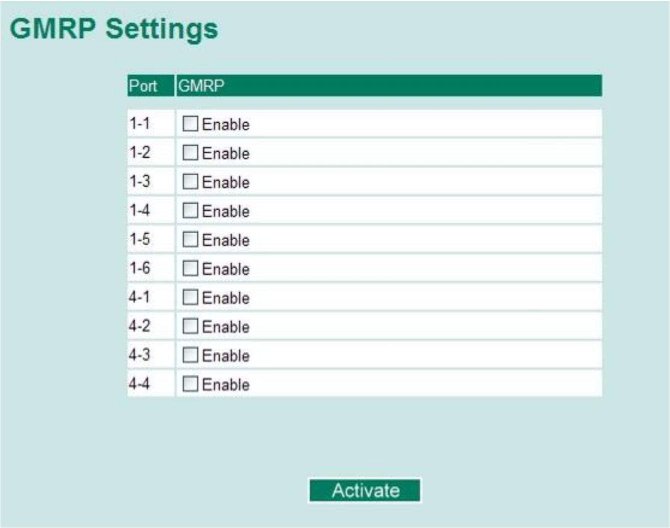
Setting	Description	Factory Default
Integer	Input the number of the VLAN that the host with this MAC address belongs to.	*None*

Join Port

Setting	Description	Factory Default
Select/Deselect	Checkmark the appropriate check boxes to select the join ports for this multicast group.	*None*

Configuring GMRP

GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or un-register Group membership information dynamically.



GMRP Settings

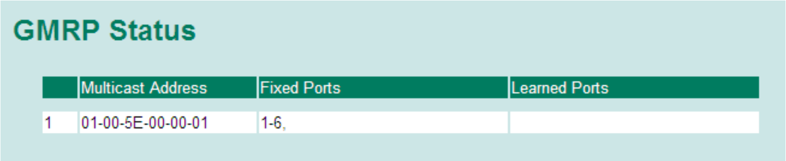
Port	GMRP
1-1	□ Enable
1-2	□ Enable
1-3	□ Enable
1-4	□ Enable
1-5	□ Enable
1-6	□ Enable
4-1	□ Enable
4-2	□ Enable
4-3	□ Enable
4-4	□ Enable

GMRP enable

Setting	Description	Factory Default
Enable/Disable	This enables or disables the GMRP function for the port listed in the Port column	Disable

GMRP Table

The PT-7828 displays the current active GMRP groups that were detected



GMRP Status

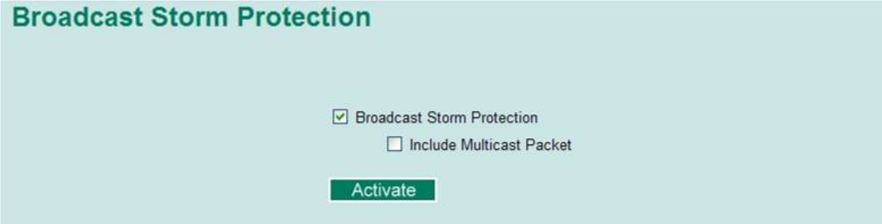
	Multicast Address	Fixed Ports	Learned Ports
1	01-00-5E-00-00-01	1-6,	

Setting	Description
Fixed Ports	This multicast address is defined by static multicast.
Learned Ports	This multicast address is learned by GMRP.

Using Bandwidth Management

In general, one host should not be allowed to occupy unlimited bandwidth, particularly when the device malfunctions. For example, so-called "broadcast storms" could be caused by an incorrectly configured topology, or a malfunctioning device. The PT-7828 not only prevents broadcast storms, but can also be configured to a different ingress rate for all packets, giving administrators full control of their limited bandwidth to prevent undesirable effects caused by unpredictable faults.

Broadcast Storm Protection



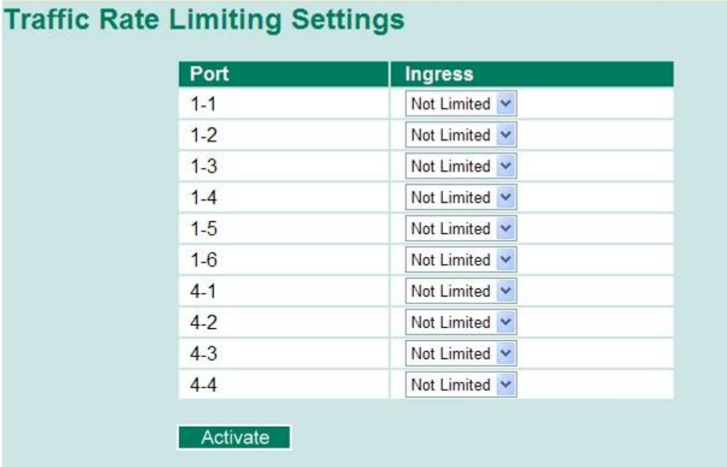
Broadcast Storm Protection

☑ Broadcast Storm Protection

□ Include Multicast Packet

Setting	Description	Factory Default
Enable/Disable	This enables or disables Broadcast Storm Protection for unknown broadcast packet globally.	Enable
	This enables or disables Broadcast Storm Protection for unknown multicast packets globally.	Disable

Traffic Rate Limiting Settings



Traffic Rate Limiting Settings

Port	Ingress
1-1	Not Limited
1-2	Not Limited
1-3	Not Limited
1-4	Not Limited
1-5	Not Limited
1-6	Not Limited
4-1	Not Limited
4-2	Not Limited
4-3	Not Limited
4-4	Not Limited

Ingress

Setting	Description	Factory Default
Ingress rate	Select the ingress rate for all packets from the following options: not limited, 3%, 5%, 10%, 15%, 25%, 35%, 50%, 65%, 85%	N/A

Using Port Access Control

The PT-7828 provides two kinds of Port-Base Access Control. One is Static Port Lock and the other is IEEE 802.1X.

Static Port Lock

The PT-7828 can also be configured to protect static MAC addresses for a specific port. With the Port Lock function, these locked ports will not learn any additional addresses, but only allow traffic from preset static MAC addresses, helping to block hackers and careless usage.

IEEE 802.1X

The IEEE 802.1X standard defines a protocol for client/server-based access control and authentication. The protocol restricts unauthorized clients from connecting to a LAN through ports that are open to the Internet, and which otherwise would be readily accessible. The purpose of the authentication server is to check each client that requests access to the port. The client is only allowed access to the port if the client's permission is authenticated.

The IEEE 802.1X Concept

Three components are used to create an authentication mechanism based on 802.1X standards: Client/Supplicant, Authentication Server, and Authenticator.

Supplicant: The end station that requests access to the LAN and switch services and responds to the requests from the switch.

Authentication server: The server that performs the actual authentication of the supplicant.

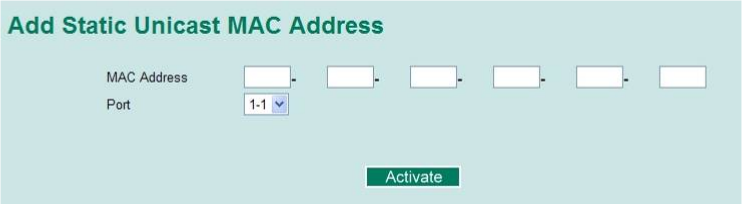
Authenticator: Edge switch or wireless access point that acts as a proxy between the supplicant and the authentication server, requesting identity information from the supplicant, verifying the information with the authentication server, and relaying a response to the supplicant.

The PT-7828 acts as an authenticator in the 802.1X environment. A supplicant and an authenticator exchange EAPOL (Extensible Authentication Protocol over LAN) frames with each other. We can either use an external RADIUS server as the authentication server, or implement the authentication server in PT-7828 by using a Local User Database as the authentication look-up table. When we use an external RADIUS server as the authentication server, the authenticator and the authentication server exchange EAP frames between each other.

Authentication can be initiated either by the supplicant or the authenticator. When the supplicant initiates the authentication process, it sends an **EAPOL-Start** frame to the authenticator. When the authenticator initiates the authentication process or when it receives an **EAPOL Start** frame, it sends an **EAP Request/Identity** frame to ask for the username of the supplicant.

Configuring Static Port Lock

The PT-7828 supports adding unicast groups manually if required.



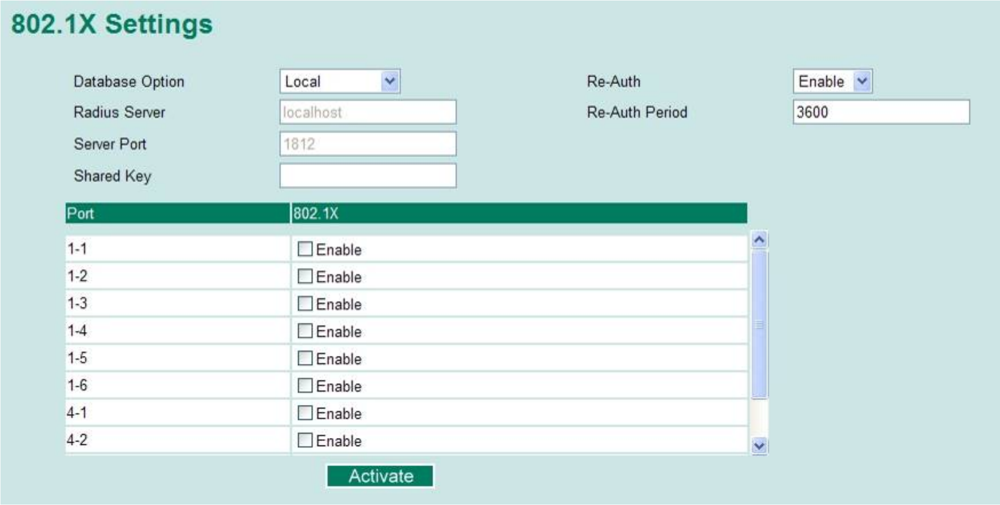
Add Static Unicast MAC Address

MAC Address: ____ - ____ - ____ - ____ - ____ - ____

Port: 1-1

Setting	Description	Factory Default
MAC Address	Add the static unicast MAC address into the address table.	*None*
Port	Fix the static address with a dedicated port.	1-1

Configuring IEEE 802.1X



802.1X Settings

Database Option: Local

Radius Server: localhost

Server Port: 1812

Shared Key:

Re-Auth: Enable

Re-Auth Period: 3600

Port	802.1X
1-1	☐ Enable
1-2	☐ Enable
1-3	☐ Enable
1-4	☐ Enable
1-5	☐ Enable
1-6	☐ Enable
4-1	☐ Enable
4-2	☐ Enable

Database Option

Setting	Description	Factory Default
Local (Max. 32 users)	Select this option when setting the Local User Database as the authentication database.	Local
Radius	Select this option to set an external RADIUS server as the authentication database. The authentication mechanism is **EAP-MD5**.	Local
Radius, Local	Select this option to make using an external RADIUS server as the authentication database the second priority. The authentication mechanism is **EAP-MD5** The first priority is to set the Local User Database as the authentication database.	Local

Radius Server

Setting	Description	Factory Default
IP address or domain name	The IP address or domain name of the RADIUS server	local host

Server Port

Setting	Description	Factory Default
Numerical	The UDP port of the RADIUS server	1812

Shared Key

Setting	Description	Factory Default
alphanumeric (Max. 40 characters)	A key to be shared between the external RADIUS server and PT-7828. Both ends must be configured to use the same key.	None

Re-Auth

Setting	Description	Factory Default
Enable/Disable	Select to require re-authentication of the client after a preset time period of no activity has elapsed.	Disable

Re-Auth Period

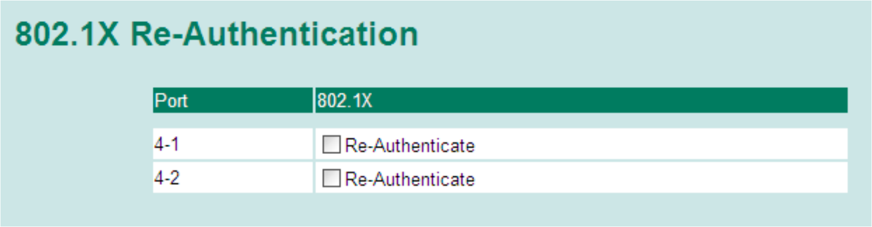
Setting	Description	Factory Default
Numerical (60 to 65535 sec.)	Specify how frequently the end stations need to reenter usernames and passwords in order to stay connected.	3600

802.1X

Setting	Description	Factory Default
Enable/Disable	Click the checkbox under the 802.1X column to enable IEEE 802.1X for one or more ports. All end stations must enter usernames and passwords before access to these ports is allowed.	Disable

802.1X Re-Authentication

The PT-7828 can force connected devices to be re-authorized manually.



802.1X Re-Authentication

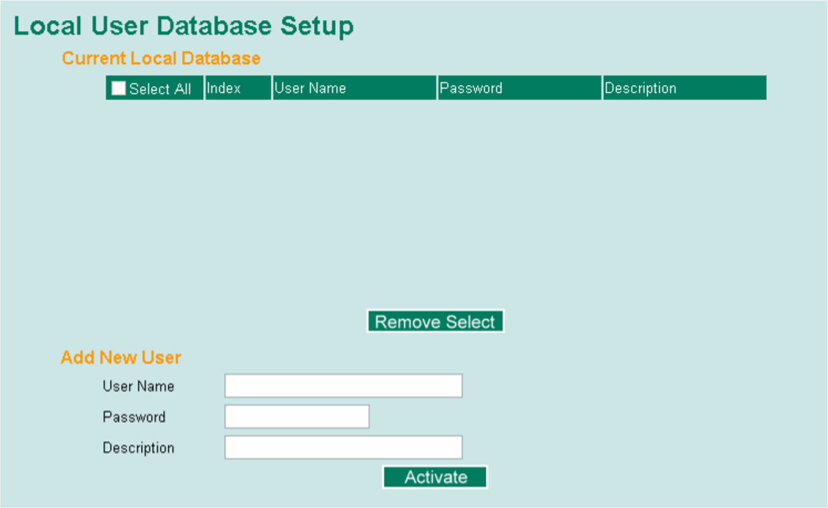
Port	802.1X
4-1	□ Re-Authenticate
4-2	□ Re-Authenticate

802.1X Re-Authentication

Setting	Description	Factory Default
Enable/Disable	This enables or disables 802.1X Re-Authentication	Disable

Local User Database Setup

When setting the Local User Database as the authentication database, set the database first.

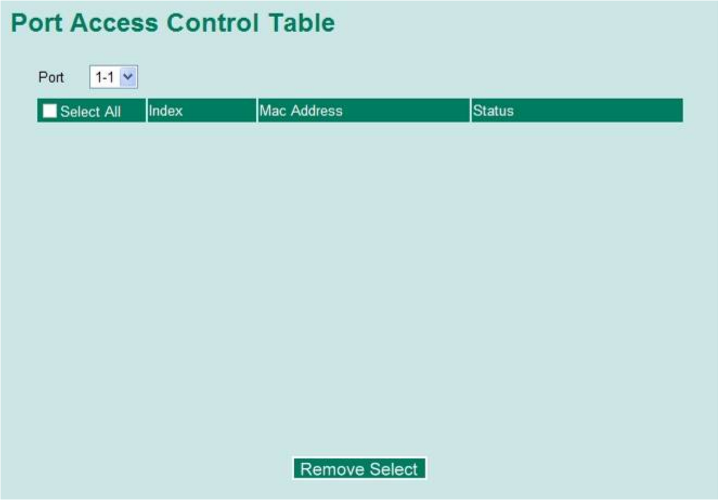


Local User Database Setup

Setting	Description	Factory Default
User Name (Max. 30 characters)	User Name for Local User Database	*None*
Password (Max. 16 characters)	Password for Local User Database	*None*
Description (Max. 30 characters)	Description for Local User Database	*None*

NOTE The user name for the Local User Database is case-insensitive.

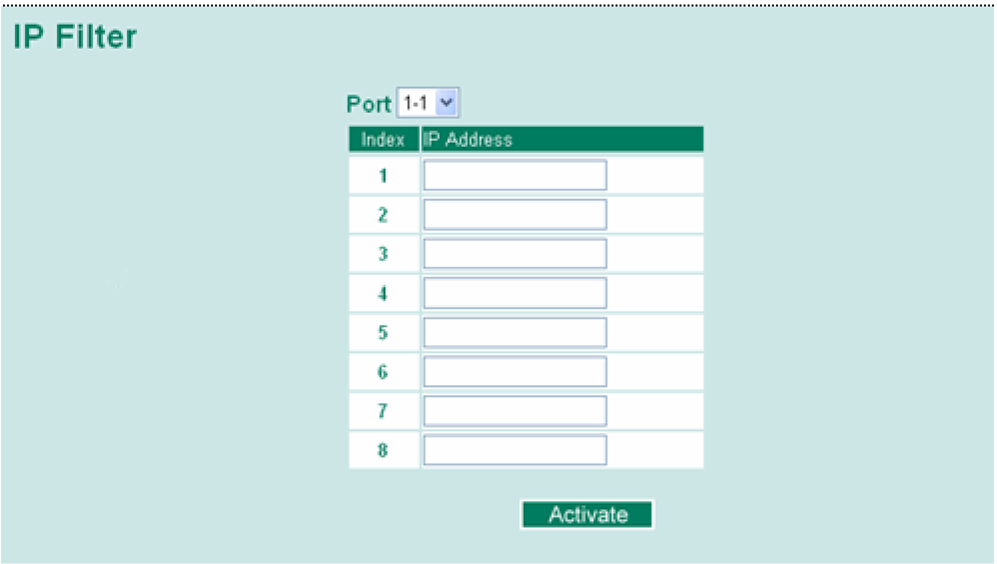
Port Access Control Table



The port status will show authorized or unauthorized.

Using IP Filter

IP filtering lets users control which IP addresses are allowed to access the port.



IP Filter

Port 1-1

Index	IP Address
1	
2	
3	
4	
5	
6	
7	
8	

Using Auto Warning

Since industrial Ethernet devices are often located at the endpoints of a system, these devices will not always know what is happening elsewhere on the network. This means that an industrial Ethernet switch that connects to these devices must provide system maintainers with real-time alarm messages. Even when control engineers are out of the control room for an extended period of time, they can still be informed of the status of devices almost instantaneously when exceptions occur. The PT-7828 supports different approaches to warn engineers automatically, such as email and relay output. It also supports two digital inputs to integrate sensors into your system to automate alarms by email and relay output.

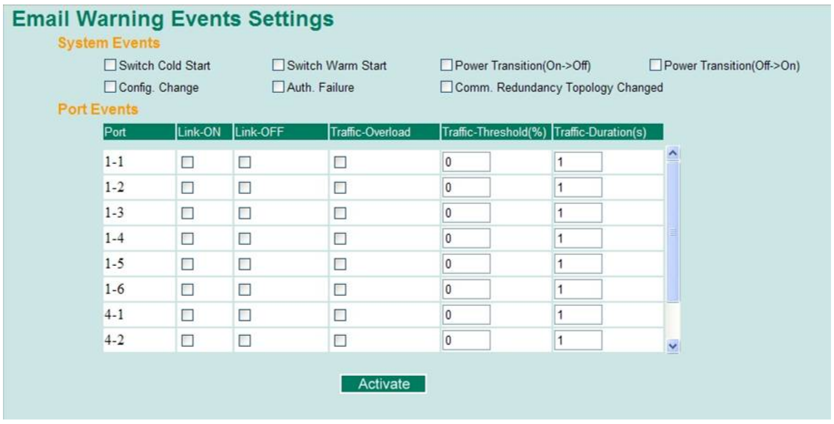
Configuring Email Warning

The Auto Email Warning function uses e-mail to alert the user when certain user-configured events take place.

Three basic steps are required to set up the Auto Warning function:

1. **Configuring Email Event Types**
   Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Email Alarm Events setting* subsection).
2. **Configuring Email Settings**
   To configure PT-7828's email setup from the serial, Telnet, or web console, enter your Mail Server IP/Name (IP address or name), Account Name, Account Password, Retype New Password, and the email address to which warning messages will be sent.
3. **Activate your settings and if necessary, test the email**
   After configuring and activating your PT-7828's Event Types and Email Setup, you can use the **Test Email** function to see if your e-mail addresses and mail server address have been properly configured.

Event Type



Email Warning Events Settings

System Events

□Switch Cold Start □Switch Warm Start □Power Transition(On->Off) □Power Transition(Off->On)

□Config. Change □Auth. Failure □Comm. Redundancy Topology Changed

Port Events

Port	Link-ON	Link-OFF	Traffic-Overload	Traffic-Threshold(%)	Traffic-Duration(s)
1-1	□	□	□	0	1
1-2	□	□	□	0	1
1-3	□	□	□	0	1
1-4	□	□	□	0	1
1-5	□	□	□	0	1
1-6	□	□	□	0	1
4-1	□	□	□	0	1
4-2	□	□	□	0	1

Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

System Events	Warning e-mail is sent when…
Switch Cold Start	Power is cut off and then reconnected.
Switch Warm Start	PT-7828 is rebooted, such as when network parameters are changed (IP address, subnet mask, etc.).
Power Transition (On→Off)	PT-7828 is powered down.
Power Transition (Off→On)	PT-7828 is powered up.
Configuration Change Activated	Any configuration item has been changed.
Authentication Failure	An incorrect password is entered.
Comm. Redundancy Topology Changed	If any Spanning Tree Protocol switches have changed their position (applies only to the root of the tree). If the Master of the Turbo Ring has changed or the backup path is activated.

Port Events	Warning e-mail is sent when…
Link-ON	The port is connected to another device.
Link-OFF	The port is disconnected (e.g., the cable is pulled out, or the opposing device shuts down).
Traffic-Overload	The port's traffic surpasses the Traffic-Threshold for that port (provided this item is Enabled).
Traffic-Threshold (%)	Enter a nonzero number if the port's Traffic-Overload item is Enabled.
Traffic-Duration (sec.)	A Traffic-Overload warning is sent every *Traffic-Duration* seconds if the average Traffic-Threshold is surpassed during that time period.

NOTE The **Traffic-Overload**, **Traffic-Threshold (%)**, and **Traffic-Duration (sec.)** Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a nonzero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

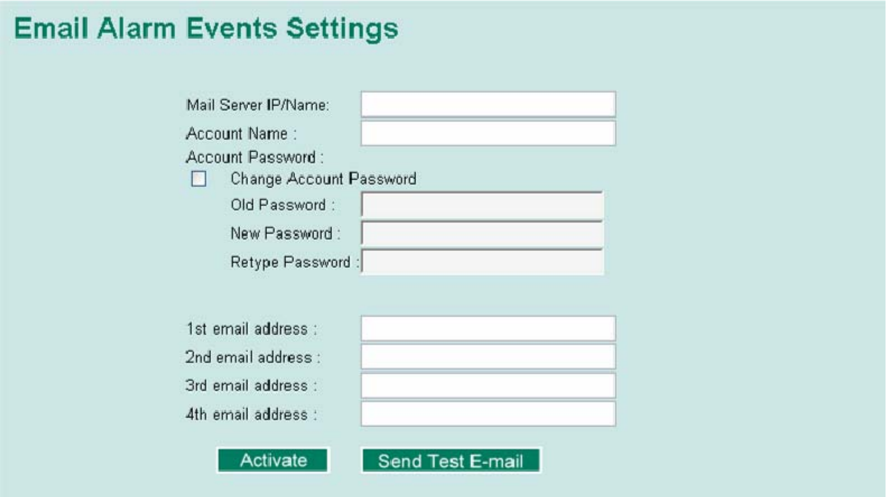
NOTE Warning e-mail messages will have **sender** given in the form:

Moxa_PowerTrans_Switch_0001@Switch_Location

where **Moxa_PowerTrans_Switch** is the default Switch Name, **0001** is PT-7828's serial number, and **Switch_Location** is the default Server Location.

Refer to the **Basic Settings** section to see how to modify **Switch Name** and **Switch Location**.

Email Setup



Mail Server IP/Name

Setting	Description	Factory Default
IP address	The IP Address of your email server.	*None*

Account Name

Setting	Description	Factory Default
Max. 45 Charters	Your email account.	*None*

Password Setting

Setting	Description	Factory Default
Disable/Enable to change password	To reset the password from the Web Browser interface, click the Change password check-box, type the Old password, type the New password, retype the New password, and then click Activate; Max. 45 characters.	Disable
Old password	Type the current password when changing the password	*None*
New password	Type new password when enabled to change password; Max. 45 characters.	*None*
Retype password	If you type a new password in the Password field, you will be required to retype the password in the Retype new password field before updating the new password.	*None*

Email Address

Setting	Description	Factory Default
Max. 30 characters	You can set up to 4 email addresses to receive alarm emails from PT-7828.	*None*

Send Test Email

After finishing with the email settings, you should first click **Activate** to activate those settings, and then press the **Send Test Email** button to verify that the settings are correct.

NOTE Auto warning e-mail messages will be sent through an authentication protected SMTP server that supports the CRAM-MD5, LOGIN, and PAIN methods of SASL (Simple Authentication and Security Layer) authentication mechanism.

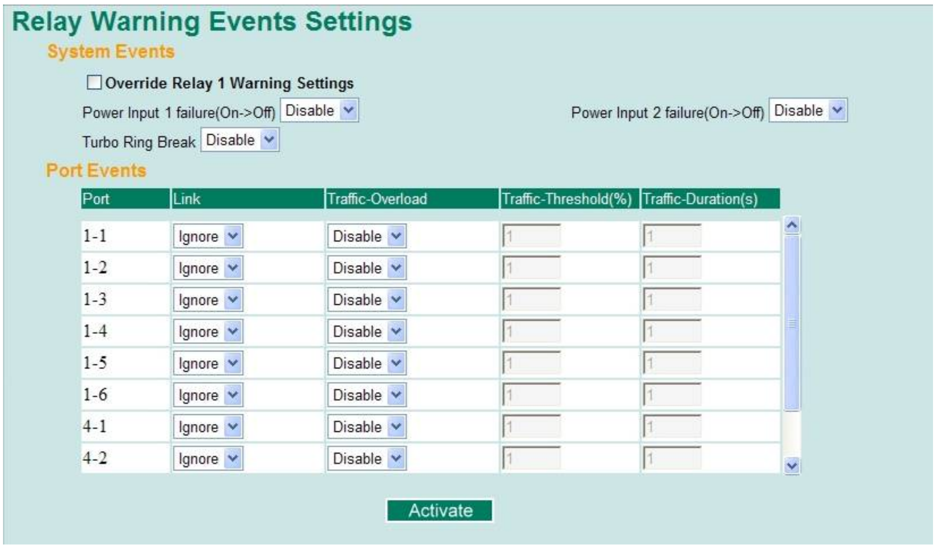
We strongly recommend not entering your Account Name and Account Password if auto warning e-mail messages can be delivered without using an authentication mechanism.

Configuring Relay Warning

The Auto Relay Warning function uses relay output to alert the user when certain user-configured events take place. There are two basic steps required to set up the Relay Warning function:

1. **Configuring Relay Event Types**
   Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Relay Alarm Events setting* subsection).
2. **Activate your settings**
   After completing the configuration procedure, you will need to activate your PT-7828's Relay Event Types.

Event Setup



Relay Warning Events Settings

System Events

☐ Override Relay 1 Warning Settings

Power Input 1 failure(On->Off): Disable

Power Input 2 failure(On->Off): Disable

Turbo Ring Break: Disable

Port Events

Port	Link	Traffic-Overload	Traffic-Threshold(%)	Traffic-Duration(s)
1-1	Ignore	Disable	1	1
1-2	Ignore	Disable	1	1
1-3	Ignore	Disable	1	1
1-4	Ignore	Disable	1	1
1-5	Ignore	Disable	1	1
1-6	Ignore	Disable	1	1
4-1	Ignore	Disable	1	1
4-2	Ignore	Disable	1	1

Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

The PT-7828 supports two relay outputs. You can configure which relay output is related to which events. This helps administrators identify the importance of the different events.

System Events	Warning Relay output is triggered when…
Power Transition (On→Off)	PT-7828 is powered on.
Power Transition (Off→On)	PT-7828 is powered down.

Port Events	Warning e-mail is sent when…
Link-ON	The port is connected to another device.
Link-OFF	The port is disconnected (e.g., the cable is pulled out, or the opposing device shuts down).
Traffic-Overload	The port's traffic surpasses the Traffic-Threshold for that port (provided this item is Enabled).
Traffic-Threshold (%)	Enter a nonzero number if the port's Traffic-Overload item is Enabled.
Traffic-Duration (sec.)	A Traffic-Overload warning is sent every *Traffic-Duration* seconds if the average Traffic-Threshold is surpassed during that time period.

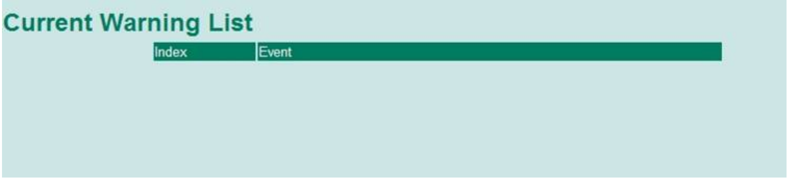
NOTE The **Traffic-Overload**, **Traffic-Threshold (%)**, and **Traffic-Duration (sec)** Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a nonzero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

Override relay alarm settings

Click the checkbox to override the relay warning setting temporarily. Releasing the relay output will allow administrators to fix any problems with the warning condition.

Warning List

Use this table to see if any relay alarms have been issued.



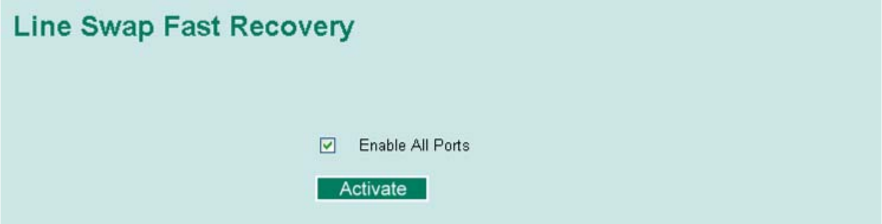
Current Warning List

Index	Event

Using Line-Swap-Fast-Recovery

The Line-Swap Fast Recovery function, which is enabled by default, allows PT-7828 to return to normal operation extremely quickly after devices are unplugged and then re-plugged into different ports. The recovery time is on the order of a few milliseconds (compare this with standard commercial switches for which the recovery time could be on the order of several minutes). To disable the Line-Swap Fast Recovery function, or to re-enable the function after it has already been disabled, access either the Console utility's **Line-Swap recovery** page, or the Web Browser interface's **Line-Swap fast recovery** page, as shown below.

Configuring Line-Swap Fast Recovery



Line Swap Fast Recovery

☑ Enable All Ports

Enable Line-Swap-Fast-Recovery

Setting	Description	Factory Default
Enable/Disable	Check-mark the check box to enable the Line-Swap-Fast-Recovery function	Enable

Using Set Device IP

To reduce the effort required to set up IP addresses, the PT-7828 comes equipped with DHCP/BootP server and RARP protocol to set up IP addresses of Ethernet-enabled devices automatically.

When enabled, the **Set device IP** function allows PT-7828 to assign specific IP addresses automatically to connected devices that are equipped with *DHCP Client* or *RARP* protocol. In effect, PT-7828 acts as a DHCP server by assigning a connected device with a specific IP address stored in its internal memory. Each time the connected device is switched on or rebooted, PT-7828 sends the device the desired IP address.

Take the following steps to use the **Set device IP** function:

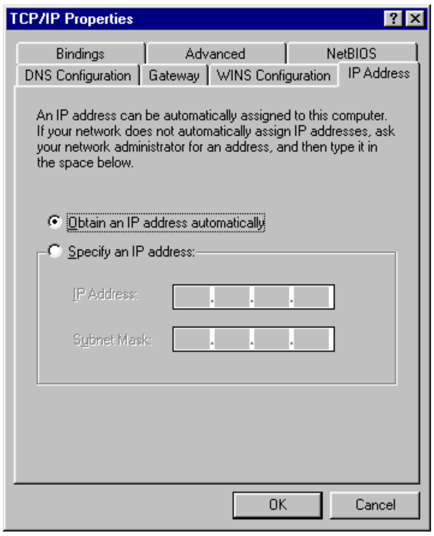
STEP 1—*Set up the connected devices*

Set up those Ethernet-enabled devices connected to PT-7828 for which you would like IP addresses to be assigned automatically. The devices must be configured to *obtain* their IP address automatically.

The devices' configuration utility should include a setup page that allows you to choose an option similar to **Obtain an IP address automatically**.

For example, Windows' **TCP/IP Properties** window is shown at the right. Although your device's configuration utility may look quite a bit different, this figure should give you some idea of what to look for.

You also need to decide which of PT-7828's ports your Ethernet-enabled devices will be connected to. You will need to set up each of these ports separately, as described in the following step.



An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.

● Obtain an IP address automatically

○ Specify an IP address:

IP Address: . . .

Subnet Mask: . . .

STEP 2

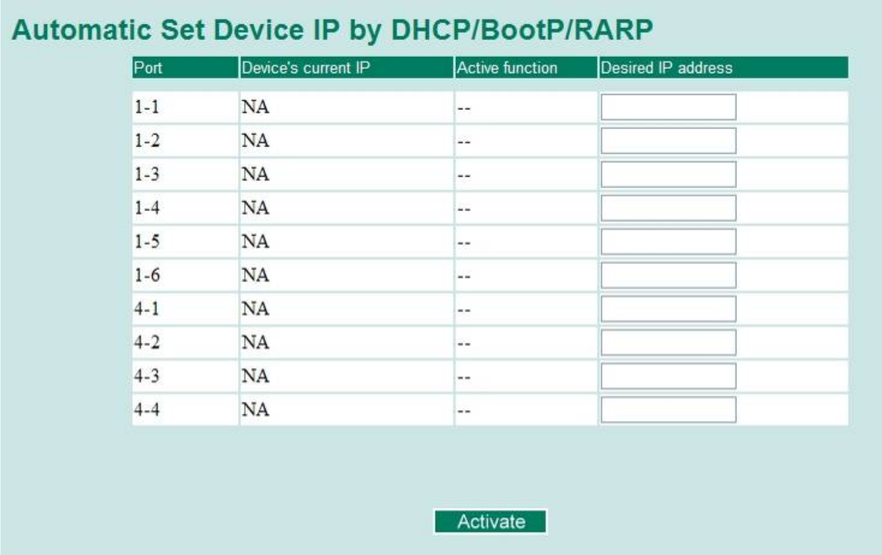
Configure PT-7828's **Set device IP** function, either from the Console utility or from the Web Browser interface. In either case, you simply need to enter the **Desired IP** for each port that needs to be configured.

STEP 3

Be sure to activate your settings before exiting.

- When using the Web Browser interface, activate by clicking on the Activate button.
- When using the Console utility, activate by first highlighting the **Activate** menu option, and then press **Enter**. You should receive the **Set device IP settings are now active! (Press any key to continue)** message.

Configuring Set Device IP



Automatic Set Device IP by DHCP/BootP/RARP

Port	Device's current IP	Active function	Desired IP address
1-1	NA	--	
1-2	NA	--	
1-3	NA	--	
1-4	NA	--	
1-5	NA	--	
1-6	NA	--	
4-1	NA	--	
4-2	NA	--	
4-3	NA	--	
4-4	NA	--	

Desired IP Address

Setting	Description	Factory Default
IP Address	Set the desired IP of connected devices.	None

DHCP Relay Agent (Option 82)

The DHCP Relay Agent makes it possible for DHCP broadcast messages to be sent over routers. The DHCP Relay Agent enables DHCP clients to obtain IP addresses from a DHCP server on a remote subnet, or those that are not located on the local subnet.

Option 82 is used by the relay agent to insert additional information into the client's DHCP request. The Relay Agent Information option is inserted by the DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. Servers can recognize the Relay Agent Information option and use the information to implement IP addresses to Clients.

When Option 82 is enabled on the switch, a subscriber device is identified by the switch port through which it connects to the network (in addition to its MAC address). Multiple hosts on the subscriber LAN can be connected to the same port on the access switch and are uniquely identified.

The Option 82 information contains 2 sub-options: Circuit ID and Remote ID, which define the relationship between end device IP and the DHCP Option 82 server. The "Circuit ID" is a 4-byte number generated by the Ethernet switch—a combination of physical port number and VLAN ID. The format of the "Circuit ID" is as described below:

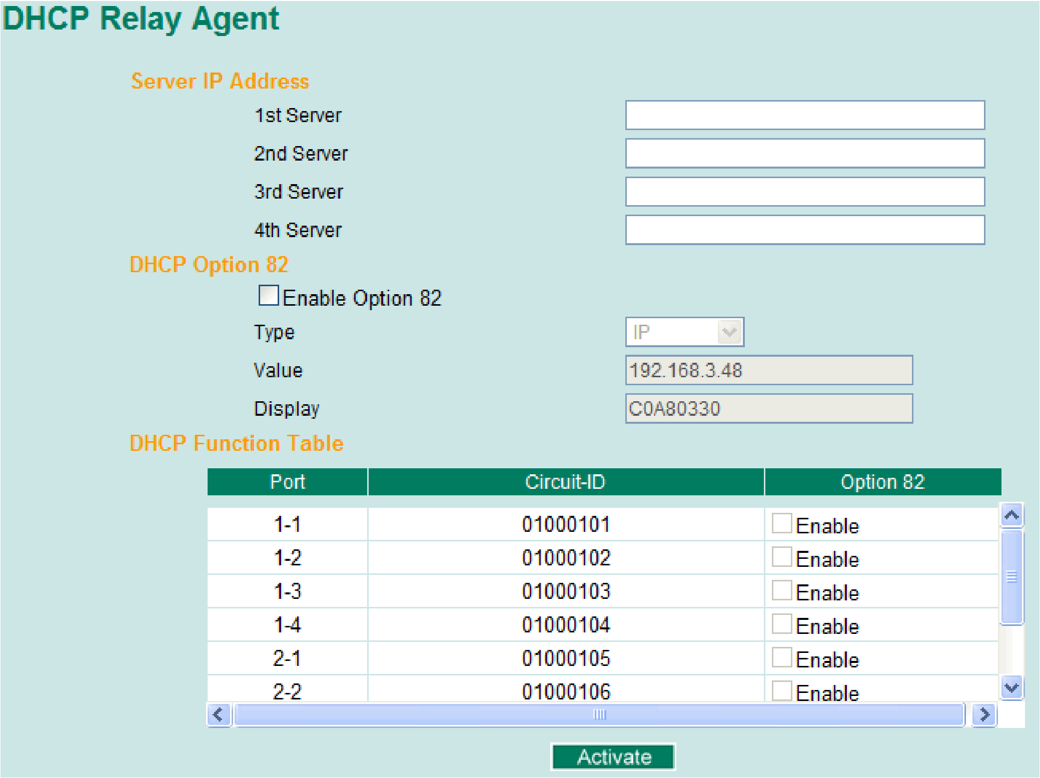
FF–VV–VV–PP

Where the first byte "FF" is fixed to "01", the second and the third byte "VV-VV" is formed by the port VLAN ID in hex, and the last byte "PP" is formed by the port number in hex. For example,

01–00–0F–03 is the "Circuit ID" of port number 3 with port VLAN ID 15.

The "Remote ID" is to identify the relay agent itself and it can be one of the following:

1. The IP address of the relay agent.
2. The MAC address of the relay agent.
3. A combination of IP address and MAC address of the relay agent.
4. A user-defined string.



DHCP Relay Agent

Server IP Address

1st Server

2nd Server

3rd Server

4th Server

DHCP Option 82

□ Enable Option 82

Type: IP

Value: 192.168.3.48

Display: C0A80330

DHCP Function Table

Port	Circuit-ID	Option 82
1-1	01000101	□ Enable
1-2	01000102	□ Enable
1-3	01000103	□ Enable
1-4	01000104	□ Enable
2-1	01000105	□ Enable
2-2	01000106	□ Enable

Server IP Address

1st Server

Setting	Description	Factory Default
IP address for the 1st DHCP server	This assigns the IP address of the 1st DHCP server that the switch tries to access.	None

2nd Server

Setting	Description	Factory Default
IP address for the 2nd DHCP server	This assigns the IP address of the 2nd DHCP server that the switch tries to access.	None

3rd Server

Setting	Description	Factory Default
IP address for the 3rd DHCP server	This assigns the IP address of the 3rd DHCP server that the switch tries to access.	None

4th Server

Setting	Description	Factory Default
IP address for the 4th DHCP server	This assigns the IP address of the 4th DHCP server that the switch tries to access.	None

DHCP Option 82

Enable Option82

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function.	Disable

Type

Setting	Description	Factory Default
IP	Use switch IP address as the remote ID sub-option.	IP
MAC	Use switch MAC address as the remote ID sub-option.	IP
Client-ID	Use the combination of switch MAC address and IP address as the remote ID sub-option.	IP
Other	Use the user-defined value as the remote ID sub-option.	IP

Value

Setting	Description	Factory Default
	Displays the value which you've set.	
Max. 12 characters	If you set the DHCP Option 82 type as Other, you will need to set it here.	switch IP address

Display

Setting	Description	Factory Default
	The actual hexdecimal value set at the DHCP server for the Remote-ID. This value is automatically generated according to the Value field. Users can not modify it.	COA87FFD

DHCP Function Table

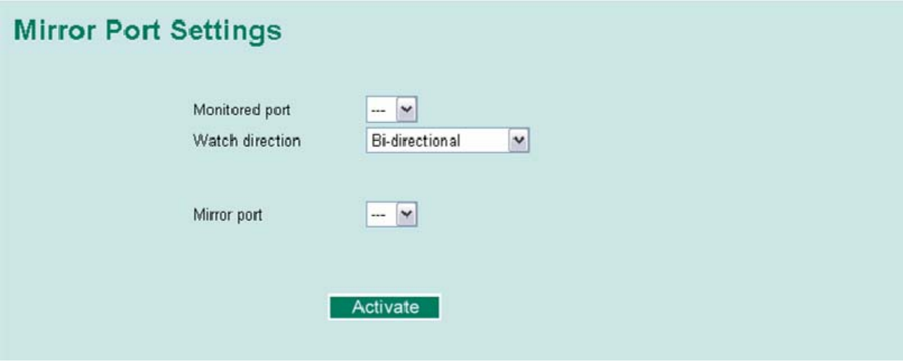
Enable

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function for this port.	Disable

Using Diagnosis

The PT-7828 provides two important tools for administrators to diagnose network systems.

Mirror Port



Mirror Port Settings

Monitored port: ---

Watch direction: Bi-directional

Mirror port: ---

The **Mirror port** function can be used to monitor data being transmitted through a specific port. This is done by setting up another port (the *mirror port*) to receive the same data being transmitted from, or both to and from, the port under observation. This allows the network administrator to **sniff** the observed port and thus keep tabs on network activity.

Take the following steps to set up the **Mirror Port** function:

STEP 1

Configure PT-7828's **Mirror Port** function from either the Console utility or Web Browser interface. You will need to configure three settings:

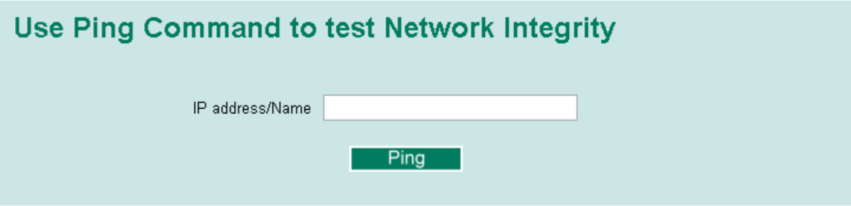
Monitored Port	Select the port number of the port whose network activity will be monitored.
Mirror Port	Select the port number of the port that will be used to monitor the activity of the monitored port.
Watch Direction	Select one of the following two watch direction options: ● **Output data stream** Select this option to monitor only those data packets being sent *out through* PT-7828's port. ● **Bi-directional** Select this option to monitor data packets both coming *into*, and being sent *out through*, PT-7828's port.

STEP 2

Be sure to activate your settings before exiting.

- When using the Web Browser interface, activate by clicking on the **Activate** button.
- When using the Console utility, activate by first highlighting the Activate menu option, and then press **Enter**. You should receive the **Mirror port settings are now active! (Press any key to continue)** message.

Ping



Use Ping Command to test Network Integrity

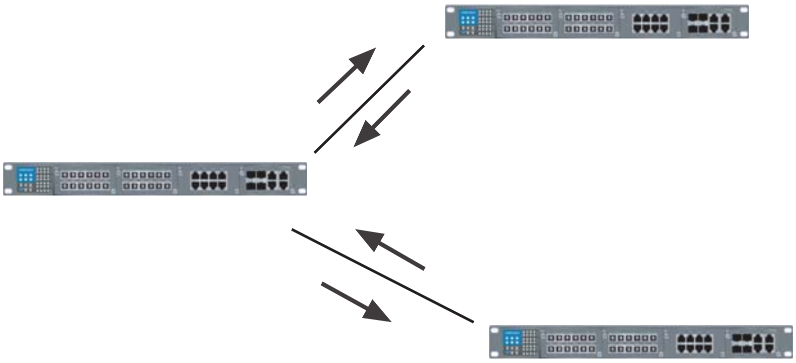
IP address/Name

The **Ping** function uses the *ping* command to give users a simple but powerful tool for troubleshooting network problems. The function's most unique feature is that even though the ping command is entered from the user's PC keyboard, the actual ping command originates from PT-7828 itself. In this way, the user can essentially sit on top of PT-7828 and send ping commands out through its ports.

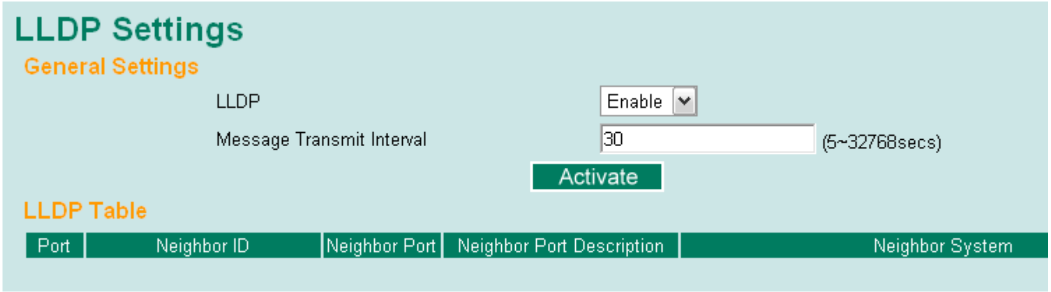
To use the Ping function, type in the desired IP address, and then press **Enter** from the Console utility, or click **Ping** when using the Web Browser interface.

LLDP Function Overview

Defined by IEEE 802.11AB, LLDP is an OSI Layer 2 Protocol that standardizes the self-identity advertisement methodology. It allows each networking device, e.g. a Moxa managed switch, to periodically inform its neighbors about its self-information and configurations. As a result, all of the devices will have knowledge about each other; and through SNMP, this knowledge can be transferred to Moxa's MXview for auto-topology and network visualization.



LLDP Web Interface



LLDP Settings

General Settings

LLDP: Enable

Message Transmit Interval: 30 (5~32768secs)

LLDP Table

Port	Neighbor ID	Neighbor Port	Neighbor Port Description	Neighbor System

From the switch's web interface, users have the option of either enabling or disabling the LLDP, as well as setting the LLDP transmit interval (as shown in the figure below). In addition, users are able to view each switch's neighbor-list, which is reported by its network neighbors. Most importantly, enabling the LLDP function allows Moxa's MXview to automatically display the network's topology as well as system setup details such as VLAN, and Trunking for the entire network.

LLDP Settings

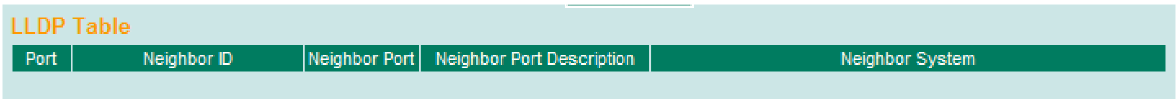
Enable LLDP

Setting	Description	Factory Default
Enable or Disable	Enable or disable LLDP function.	Enable

Message Transmit Interva

Setting	Description	Factory Default
IP Address	Set the desired IP of connected devices.	None

LLDP Table



LLDP Table

Port	Neighbor ID	Neighbor Port	Neighbor Port Description	Neighbor System

Port: The port number that connects to the neighbor device.

Neighbor ID: A unique entity which identifies a neighbor device; this is typically the MAC address.

Neighbor Port: The port number of the neighbor device.

Neighbor Port Description: A textual description of the neighbor device's interface.

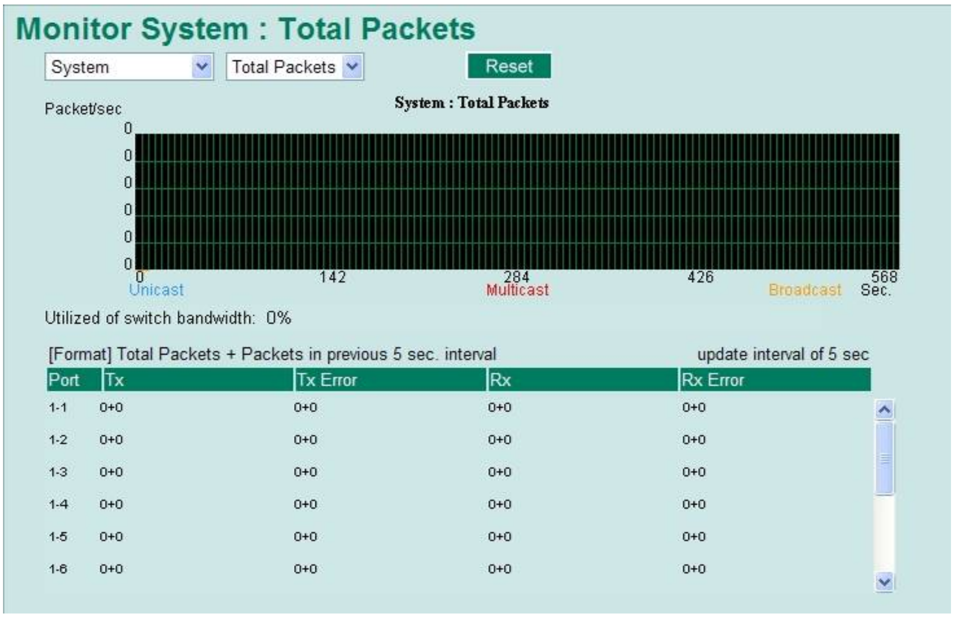
Neighbor System: Hostname of the neighbor device.

Using Monitor

You can monitor statistics in real time from PT-7828's web console and serial console.

Monitor by Switch

Access the Monitor by selecting **System** from the left selection bar. Monitor by System allows the user to view a graph that shows the combined data transmission activity of all of PT-7828's 18 ports. Click one of the four options—**Total Packets**, **TX Packets**, **RX Packets**, or **Error Packets**—to view transmission activity of specific types of packets. Recall that TX Packets are packets sent out from PT-7828, RX Packets are packets received from connected devices, and Error Packets are packets that did not pass TCP/IP's error checking algorithm. The Total Packets option displays a graph that combines TX, RX, and TX Error, RX Error Packets activity. The graph displays data transmission activity by showing **Packets/s** (i.e., packets per second, or pps) versus **sec.** (seconds). In fact, three curves are displayed on the same graph: **Uni-cast** packets (in red color), **Multi-cast** packets (in green color), and **Broad-cast** packets (in blue color). The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.



Monitor System : Total Packets

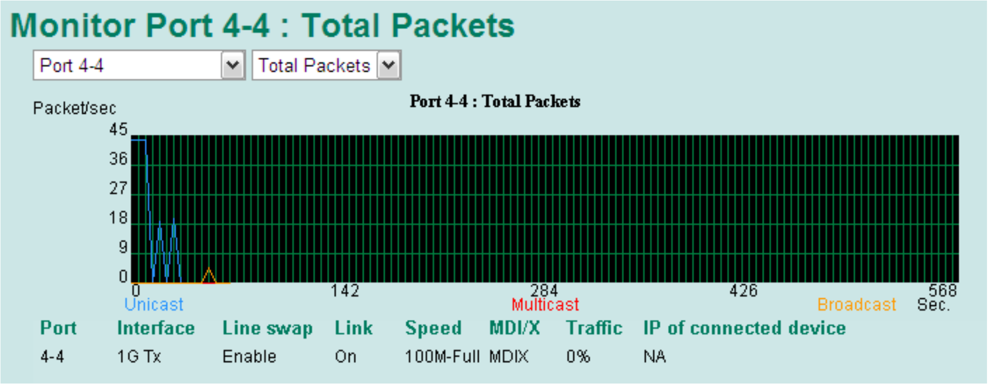
Utilized of switch bandwidth: 0%

[Format] Total Packets + Packets in previous 5 sec. interval update interval of 5 sec

Port	Tx	Tx Error	Rx	Rx Error
1-1	0+0	0+0	0+0	0+0
1-2	0+0	0+0	0+0	0+0
1-3	0+0	0+0	0+0	0+0
1-4	0+0	0+0	0+0	0+0
1-5	0+0	0+0	0+0	0+0
1-6	0+0	0+0	0+0	0+0

Monitor by Port

Access the Monitor by Port function by selecting **ALL 10/100M or 1G Ports** or **Port *i***, in which ***i*= 1-1, 1-2, …, 4-4**, from the left pull-down list. The **Port *i*** options are identical to the Monitor by System function discussed above, in that users can view graphs that show All Packets, TX Packets, RX Packets, or Error Packets activity, but in this case, only for an individual port. The **All Ports** option is essentially a graphical display of the individual port activity that can be viewed with the Console Monitor function discussed above. The All Ports option shows three vertical bars for each port. The height of the bar represents **Packets/s** for the type of packet, at the instant the bar is being viewed. That is, as time progresses, the height of the bar moves up or down so that the user can view the change in the rate of packet transmission. The blue colored bar shows **Uni-cast** packets, the red colored bar shows **Multi-cast** packets, and the orange colored bar shows **Broad-cast** packets. The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.

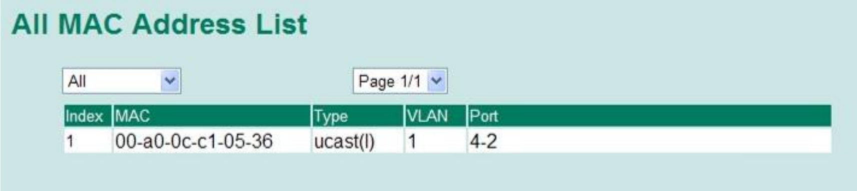


Monitor Port 4-4 : Total Packets

Port	Interface	Line swap	Link	Speed	MDI/X	Traffic	IP of connected device
4-4	1G Tx	Enable	On	100M-Full	MDIX	0%	NA

Using the MAC Address Table

This section explains the information provided by PT-7828's MAC address table.



All MAC Address List

Index	MAC	Type	VLAN	Port
1	00-a0-0c-c1-05-36	ucast(l)	1	4-2

The MAC Address table can be configured to display the following PT-7828 MAC address groups.

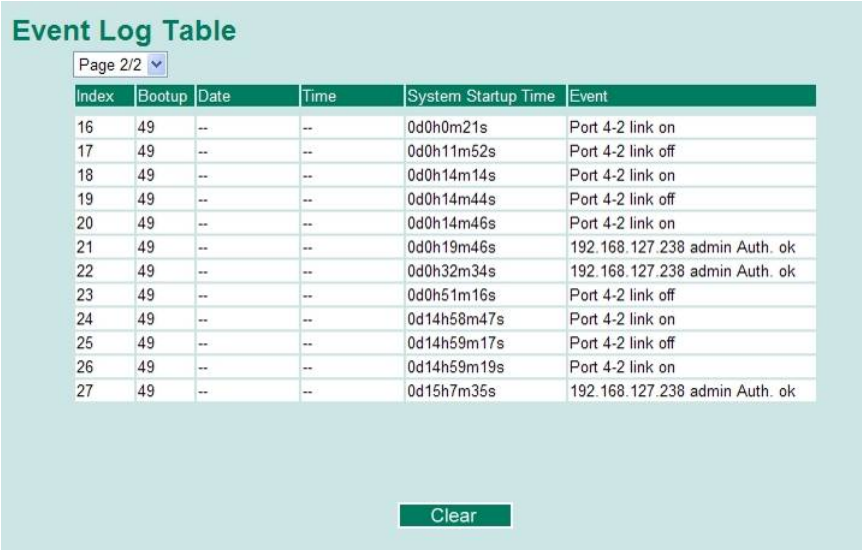
ALL	Select this item to show all PT-7828 MAC addresses
ALL Learned	Select this item to show all PT-7828 Learned MAC addresses
ALL Static Lock	Select this item to show all PT-7828 Static Lock MAC addresses
ALL Static	Select this item to show all PT-7828 Static/Static Lock /Static Multicast MAC addresses
ALL Static Multicast	Select this item to show all PT-7828 Static Multicast MAC addresses
Port x	Select this item to show all MAC addresses of dedicated ports

The table will display the following information:

MAC	This field shows the MAC address
Type	This field shows the type of this MAC address
Port	This field shows the port that this MAC address belongs to

Using System Log

Event Log



Event Log Table

Page 2/2

Index	Bootup	Date	Time	System Startup Time	Event
16	49	--	--	0d0h0m21s	Port 4-2 link on
17	49	--	--	0d0h11m52s	Port 4-2 link off
18	49	--	--	0d0h14m14s	Port 4-2 link on
19	49	--	--	0d0h14m44s	Port 4-2 link off
20	49	--	--	0d0h14m46s	Port 4-2 link on
21	49	--	--	0d0h19m46s	192.168.127.238 admin Auth. ok
22	49	--	--	0d0h32m34s	192.168.127.238 admin Auth. ok
23	49	--	--	0d0h51m16s	Port 4-2 link off
24	49	--	--	0d14h58m47s	Port 4-2 link on
25	49	--	--	0d14h59m17s	Port 4-2 link off
26	49	--	--	0d14h59m19s	Port 4-2 link on
27	49	--	--	0d15h7m35s	192.168.127.238 admin Auth. ok

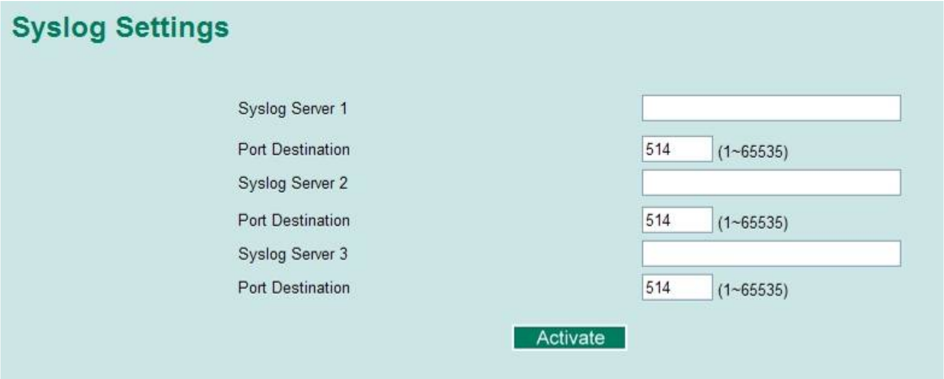
Bootup	This field shows how many times the PT-7828 has been rebooted or cold started.
Date	The date is updated based on how the current date is set in the **Basic Setting** page.
Time	The time is updated based on how the current time is set in the **Basic Setting** page.
System Startup Time	The system startup time related to this event.
Events	Events that have occurred.

NOTE The following events will be record into PT-7828's Event Log Table.

- Cold start
- Warm start
- Configuration change activated
- Power 1/2 transition (Off → On), Power 1/2 transition (On → Off)
- Authentication fail
- Topology changed
- Master setting is mismatched
- Port traffic overload
- dot1x Auth Fail
- Port link off / on

Syslog

This function provides the event logs for the syslog server. The function supports 3 configurable syslog servers and syslog server UDP port numbers. When an event occurs, the event will be sent as a syslog UDP packet to the specified syslog servers.



Syslog Settings

Syslog Server 1	
Port Destination	514 (1~65535)
Syslog Server 2	
Port Destination	514 (1~65535)
Syslog Server 3	
Port Destination	514 (1~65535)

Syslog Server 1

Setting	Description	Factory Default
IP Address	Enter the IP address of 1st Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 1st Syslog server.	514

Syslog Server 2

Setting	Description	Factory Default
IP Address	Enter the IP address of 2nd Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 2nd Syslog server.	514

Syslog Server 3

Setting	Description	Factory Default
IP Address	Enter the IP address of 3rd Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 3rd Syslog server.	514

NOTE

The following events will be recorded into the PT-7828's Event Log table, and will then be sent to the specified Syslog Server:

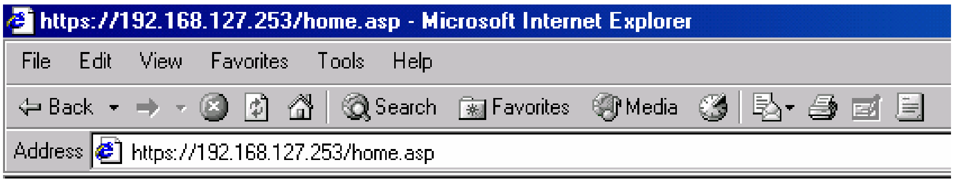
- Cold start
- Warm start
- Configuration change activated
- Power 1/2 transition (Off → On), Power 1/2 transition (On → Off)
- Authentication fail
- Topology changed
- Master setting is mismatched
- Port traffic overload

- dot1x Auth Fail
- Port link off / on

Using HTTPS/SSL

To secure your HTTP access, the PT-7828 supports HTTPS/SSL to encrypt all HTTP traffic. Perform the following steps to access the PT-7828's web browser interface via HTTPS/SSL.

1. Open Internet Explorer and type **https://PT-7828's IP address** in the address field. Press Enter to establish the connection.

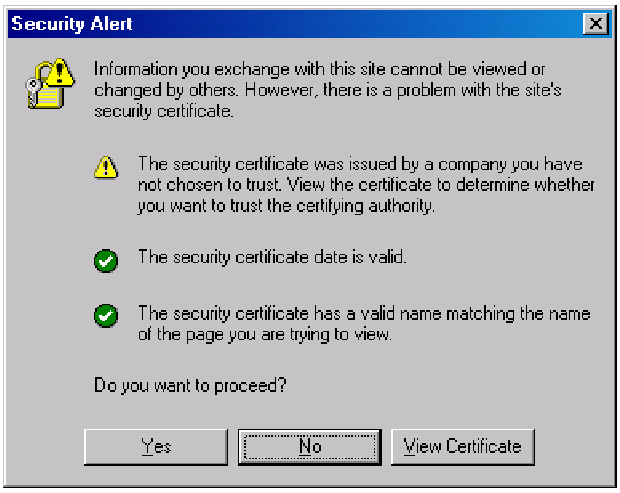


https://192.168.127.253/home.asp - Microsoft Internet Explorer

File Edit View Favorites Tools Help
Back Search Favorites Media
Address

https://192.168.127.253/home.asp

2. Warning messages will pop out to warn the user that the security certificate was issued by a company they have not chosen to trust.
3. Select **Yes** to enter the PT-7828's web browser interface and access the web browser interface secured via HTTPS/SSL.



Security Alert

Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.

The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.

The security certificate date is valid.

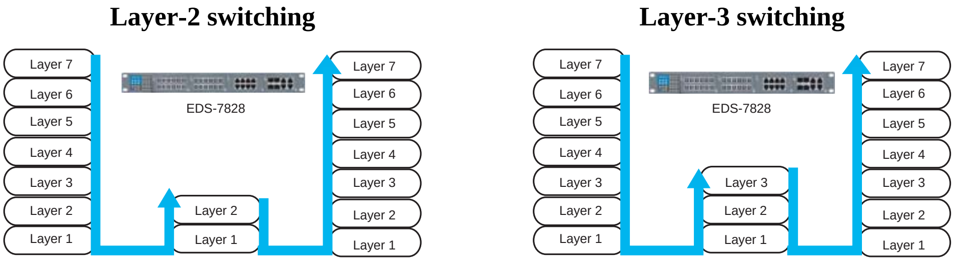
The security certificate has a valid name matching the name of the page you are trying to view.

Do you want to proceed?

NOTE Moxa provides a Root CA certificate .After installing this certificate into your PC or Notebook, you can access the web browser interface directly and will not see any warning messages again. You may download the certificate from the PT-7828A's CD-ROM.

Using Layer 3 Settings

The PT-7828 is a Layer-3 switch uses the Network Layer (layer 3) of the ISO's OSI layer model for data switching. Unlike Layer-2 switching for which the MAC address is used for exchanging data, a Layer-3 switch uses the IP address to determine the destination of a data packet.



The Layer-3 Switching Concept

IP (Internet Protocol) is a protocol defined on layer 3 of the OSI 7-layer model. The IP address is used to address data packets on the Network Layer, and is not tied to the hardware of a device or PC. The IP address can be assigned by the system operator or network administrator.

Whereas a layer 2 switch uses the MAC address of a network card to determine the destination of data packets, a layer 3 switch uses IP address currently assigned to the network card to transmit data packets. Switches use ARP (Address Resolution Protocol) to establish the relationship between MAC addresses and IP addresses.

When a PC sends out an ARP request, which is a broadcast packet requiring the IP address owner to send back his MAC address, one of two situations could be encountered:

- If your PC and the IP address owner are on the same subnet, the IP address owner will use a unicast packet, which contains his MAC address, to reply to your PC. Henceforth, your PC will use this MAC address to transmit to the IP address owner directly.
- If your PC and the IP address owner are not on the same subnet, your PC will not receive a reply, so it will ask for the MAC address of the Layer-3 switch (gateway/ router). To transmit data packets to IP address owner, your PC packs the data packet with IP address and sends this packet to the Layer-3 switch (gateway/ router) with its MAC address. The Layer-3 switch (gateway/ router) receives the data packet, and then repacks and forwards it to the next hop, based on the routing rules.

Static Routing and Dynamic Routing

The PT-7828 supports both static and dynamic routing. Dynamic routing can use either RIP V1 and/or V2. You can either choose one of the routing methods, or combine the two methods to establish your routing table.

A routing entry includes the following items: the destination address, the next hop address (which is the next router along the path to the destination address), and the metric that gives the cost we have to pay to access a different network.

Static Routing

You can define the routes yourself by specifying the next hop (or router) that PT-7828 should forward data to for a specific subnet. The Static Route settings will be stored in the PT-7828's routing table.

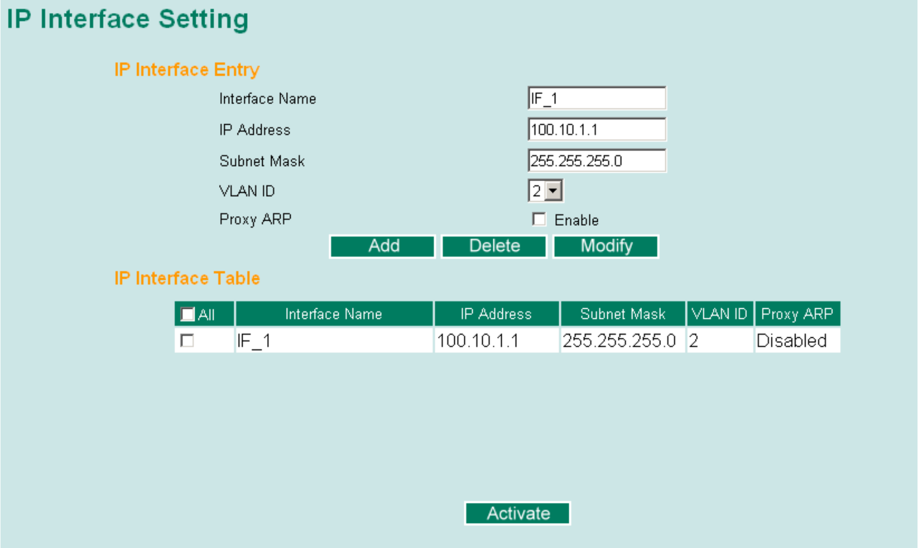
RIP (Routing Information Protocol)

RIP is a distance vector-based routing protocol that can automatically build up a routing table in the PT-7828.

The PT-7828 can efficiently update and maintain the routing table and optimize the routing with the smallest metric and most matched mask prefix.

Interface Setting

The IP Interface Setting page is used to assign the interface.



IP Interface Setting

IP Interface Entry

Interface Name	IF_1
IP Address	100.10.1.1
Subnet Mask	255.255.255.0
VLAN ID	2
Proxy ARP	□ Enable

IP Interface Table

□ All	Interface Name	IP Address	Subnet Mask	VLAN ID	Proxy ARP
□	IF_1	100.10.1.1	255.255.255.0	2	Disabled

Interface Name

Use this option to describe this interface (Max. of 30 characters).

IP Address

Use this option to specify the IP address of this interface.

Subnet Mask

Use this option to specify the subnet mask for this IP address.

VLAN ID

Setting	Description	Factory Default
ID numbers	Display all available VLAN ID that you have set in *Virtual LAN*. To establish a interface, you have to assign an available ID for this interface firstly. If a VLAND ID is assigned twice, a warning message will be shown.	None (if no VLAN ID is available)

Proxy ARP

Setting	Description	Factory Default
Enable/Disable	This option is used to enable or disable the function of Proxy ARP.	Disabled

There are three action buttons for setting up the IP Interface Table:

Add

For adding an entry into the IP Interface Table.

Delete

For removing the selected entries in the IP Interface Table.

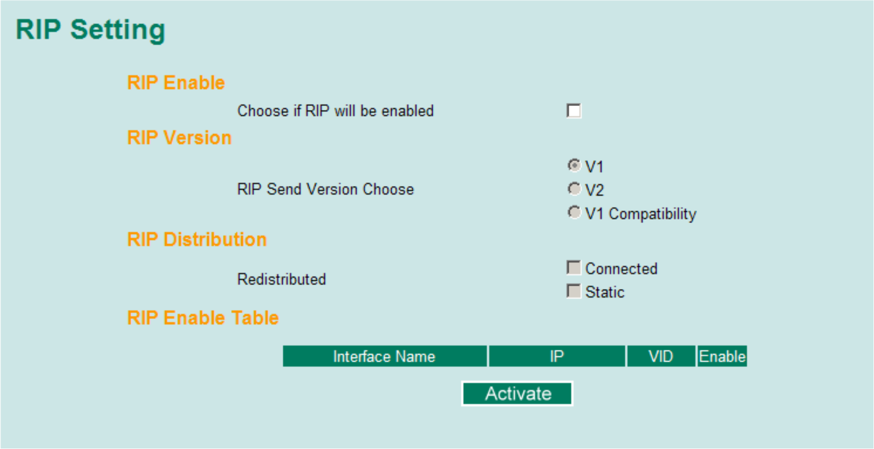
Modify

For modifying the content of a selected entry in the IP Interface Table.

NOTE The entries in the IP Interface Table will not be added into the PT-7828's interface table until you click the Activate button.

RIP

The RIP page is used to set up the RIP parameters.



RIP Setting

RIP Enable

Choose if RIP will be enabled □

RIP Version

RIP Send Version Choose ● V1 ○ V2 ○ V1 Compatibility

RIP Distribution

Redistributed □ Connected □ Static

RIP Enable Table

Interface Name	IP	VID	Enable

RIP Enable

Setting	Description	Factory Default
Enable/Disable	This option is used to enable or disable the RIP function globally.	Disabled

RIP Version

You can specify which version the RIP should follow. You can also select V1 Compatibility to make sure that Version 1 PIP packets can also be received.

RIP Distribution

Setting	Description	Factory Default
Connected	The entries that are learned from the connected ports will be re-distributed if this option is enabled.	*Unchecked* (disabled)
Static	The entries that are set in a static route will be re-distributed if this option is enabled.	*Unchecked* (disabled)

RIP Enable Table

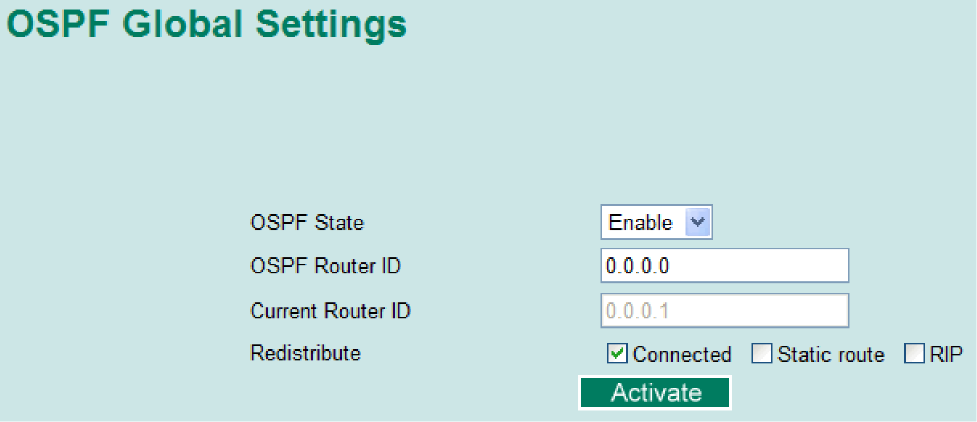
This is a table showing the entries learned from RIP.

NOTE The RIP settings will not function until you click the Activate button.

OSPF Settings

OSPF (Open Shortest Path First) is a dynamic routing protocol for use in Internet Protocol (IP) networks. Specifically, it is a link-state routing protocol and falls into the group of interior gateway protocols, operating within a single autonomous system. As a link-state routing protocol, OSPF establishes and maintains neighbor relationships in order to exchange routing updates with other routers. The neighbor relationship table is called an adjacency database in OSPF. OSPF forms neighbor relationships only with the routers directly connected to it. In order to form a neighbor relationship between two routers, the interfaces used to form the relationship must be in the same area. An interface can only belong to a single area. With OSPF enabled, PT-7828 is capable to exchange routing information with other L3 switches or routers more efficiently in a large system. The OSPF Settings page is used to set up OSPF configurations.

OSPF Global Settings



OSPF Global Settings

OSPF State: Enable

OSPF Router ID: 0.0.0.0

Current Router ID: 0.0.0.1

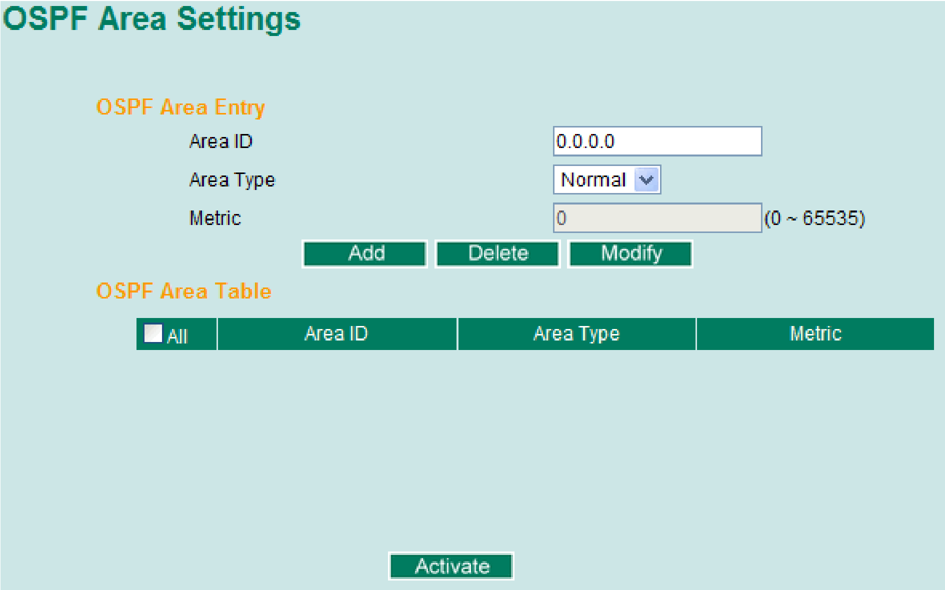
Redistribute: ☑ Connected ☐ Static route ☐ RIP

Each L3 switch/router has an OSPF router ID, customarily written in the dotted decimal format (e.g., 1.2.3.4) of an IP address. This ID must be established in every OSPF instance. If not explicitly configured, the default ID (0.0.0.0) will be regarded as the router ID. Since the router ID is an IP address, it does not have to be a part of any routable subnet in the network.

OSPF State, OSPF Router ID, Current Router ID, Redistribute

Setting	Description	Factory Default
OSPF State	Select the option to enable/disable the OSPF Function.	Disable
OSPF Router ID	Set the L3 switch's Router ID.	0.0.0.0
Current Router ID	Show the current L3 switch's Router ID.	0.0.0.0
Redistribute	Redistribute routing information to other protocols	Connected

OSPF Area Settings



OSPF Area Settings

OSPF Area Entry

Area ID	0.0.0.0
Area Type	Normal
Metric	0 (0 ~ 65535)

OSPF Area Table

☐ All	Area ID	Area Type	Metric

An OSPF domain is divided into areas that are labeled with 32-bit area identifiers which are commonly written in the dot-decimal notation of an IPv4 address. Areas are used to divide a large network into smaller network areas. They are logical groupings of hosts and networks, including their routers having interfaces connected to any of the included networks. Each area maintains a separate link state database whose information may be summarized towards the rest of the network by the connecting router. Thus, the topology of an area is unknown outside of the area. This reduces the amount of routing traffic between parts of an autonomous system.

OSPF Area Entry

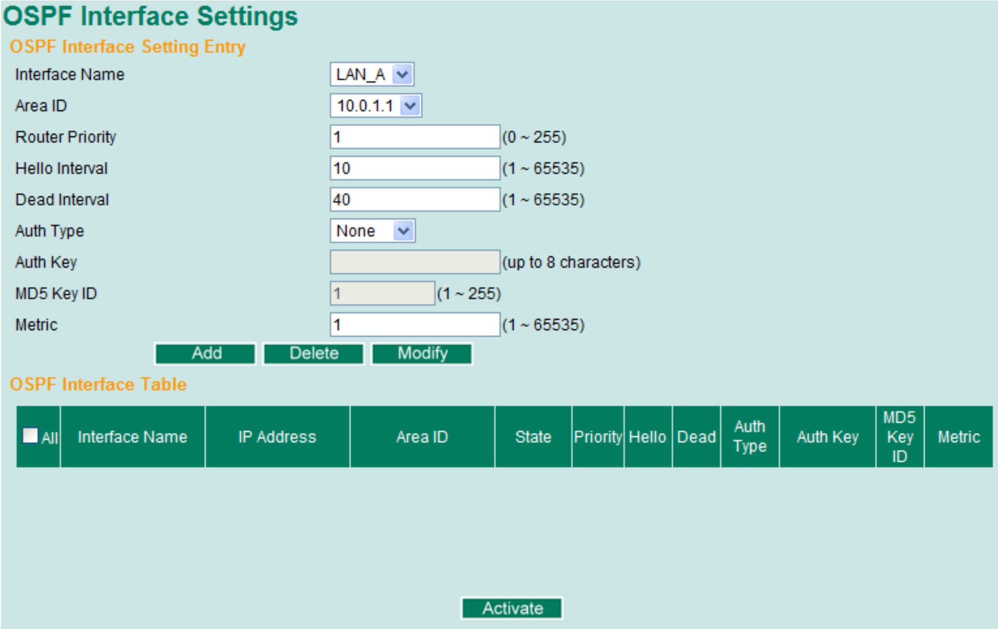
Area ID, Area Type, Metric

Setting	Description	Factory Default
Area ID	Define the areas that this L3 switch/router connects to.	0.0.0.0
Area Type	Define the area type, Stub Area or NSSA.	Normal
Metric	Define the metric value.	0

OSPF Area Table

Shows the current OSPF area table in the L3 switch/router.

OSPF Interface Settings



OSPF Interface Settings

OSPF Interface Setting Entry

Interface Name	LAN_A	
Area ID	10.0.1.1	
Router Priority	1	(0 ~ 255)
Hello Interval	10	(1 ~ 65535)
Dead Interval	40	(1 ~ 65535)
Auth Type	None	
Auth Key		(up to 8 characters)
MD5 Key ID	1	(1 ~ 255)
Metric	1	(1 ~ 65535)

OSPF Interface Table

□ All	Interface Name	IP Address	Area ID	State	Priority	Hello	Dead	Auth Type	Auth Key	MD5 Key ID	Metric

Before using OSPF, we have to assign an interface for each area. Also the detailed information of the interface can be defined in this section. See the details in the following descriptions:

OSPF Interface Setting Entry

Configuration details

Setting	Description	Factory Default
Interface Name	Define the interface name.	N/A
Area ID	Define the Area ID.	N/A
Router Priority	Define the L3 switch/router’s priority.	1
Hello Interval	Hello packets are packets that an OSPF process sends to its OSPF neighbors to maintain connectivity with those neighbors. The hello packets are sent at a configurable interval (in seconds). The value of all hello intervals must be the same within a network.	10
Dead Interval	The dead interval is also a configurable interval (in seconds), and defaults to four times the value of the hello interval.	40
Auth Type	OSPF authentication allows the flexibility to authenticate OSPF neighbors. Users can enable authentication to exchange routing update information in a secure manner. OSPF authentication can either be none, simple, or MD5. However, authentication is not necessary to be set. If it is set, all L3 switches / routers on the same segment must have the same password and authentication method.	None

Auth Key	Authentication key means the clear-text password when using "Simple" method of the authentication type or MD5 encrypted password when using MD5 of authentication type.	N/A
MD5 Key ID	MD5 authentication provides higher security than plain text authentication. This method uses the MD5 to calculate a hash value from the contents of the OSPF packet and the authentication key. This hash value is transmitted in the packet, along with a key ID.	1
Metric	Manually set Metric / Cost of OSPF.	1

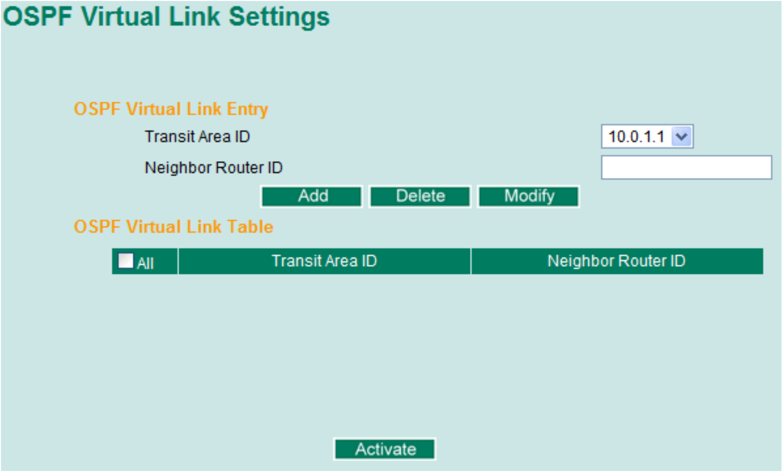
OSPF Interface Table

Shows the current OSPF interface table in a list.

Area ID, Area Type, Metric

Setting	Description	Factory Default
Area ID	Define the areas that this L3 switch/router connects to.	0.0.0.0
Area Type	Define the area type, Stub Area or NSSA.	Normal
Metric	Define the metric value.	0

OSPF Virtual Link Settings



OSPF Virtual Link Settings

OSPF Virtual Link Entry

Transit Area ID 10.0.1.1

Neighbor Router ID

OSPF Virtual Link Table

□ All	Transit Area ID	Neighbor Router ID

All areas in an OSPF autonomous system must be physically connected to the backbone area (Area 0.0.0.0). However, this is impossible in some cases. For those cases, users can create a virtual link to connect to the backbone through a non-backbone area and also use virtual links to connect two parts of a partitioned backbone through a non-backbone area.

OSPF Virtual Link Entry

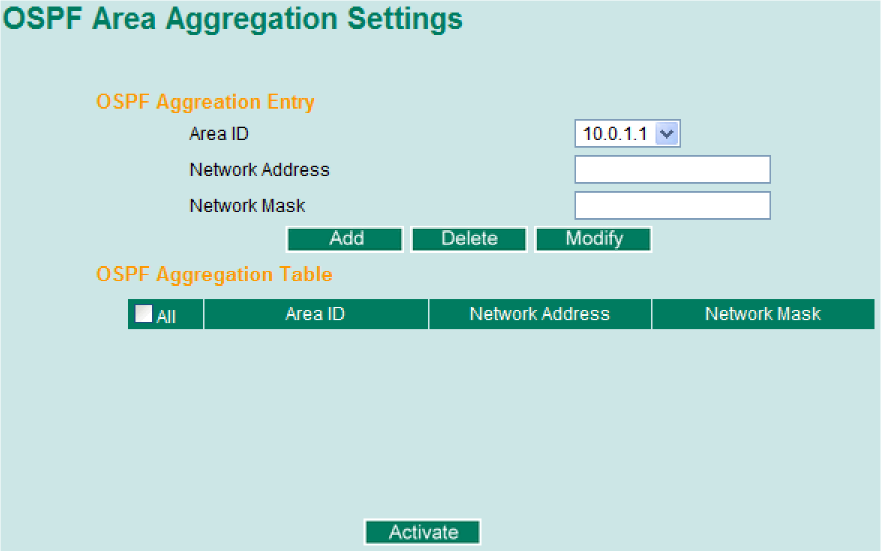
Area ID, Area Type, Metric

Setting	Description	Factory Default
Transit Area ID	Define the areas that this L3 switch/router connects to.	N/A
Neighbor Router ID	Define the neighbor L3 switch/route's ID.	N/A

OSPF Virtual Link Table

Shows the current OSPF virtual link table.

OSPF Area Aggregation Settings



OSPF Area Aggregation Settings

OSPF Aggregation Entry

Area ID: 10.0.1.1

Network Address:

Network Mask:

OSPF Aggregation Table

□ All	Area ID	Network Address	Network Mask

Each of OSPF areas which consist of a set of interconnected subnets and traffic across areas is handled by routers attached to two or more areas, known as Area Border Routers (ABRs). With OSPF aggregation function, users can combine groups of routes with common addresses into a single routing table entry. The function is used to reduce the size of routing tables.

OSPF Aggregation Entry

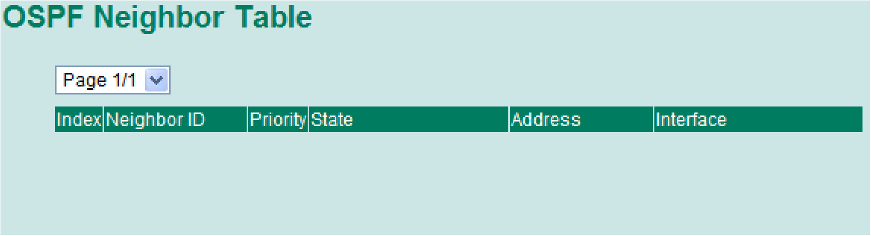
Configuration details

Setting	Description	Factory Default
Area ID	Select the Area ID that you want to configure.	N/A
Network Address	Fill in the network address in the area.	N/A
Network Mask	Fill in the network mask.	N/A

OSPF Aggregation Entry

Shows the current OSPF aggregation table.

OSPF Neighbor Table



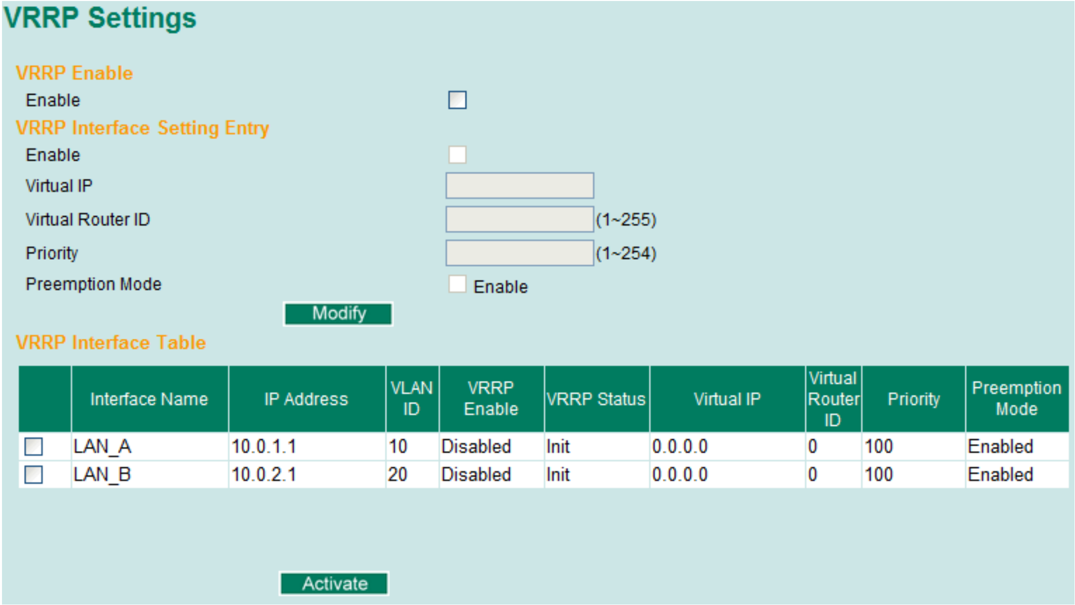
OSPF Neighbor Table

Page 1/1

Index	Neighbor ID	Priority	State	Address	Interface

Shows the current OSPF database table.

VRRP Settings



VRRP Settings

VRRP Enable

Enable □

VRRP Interface Setting Entry

Enable □

Virtual IP

Virtual Router ID (1~255)

Priority (1~254)

Preemption Mode □ Enable

VRRP Interface Table

	Interface Name	IP Address	VLAN ID	VRRP Enable	VRRP Status	Virtual IP	Virtual Router ID	Priority	Preemption Mode
□	LAN_A	10.0.1.1	10	Disabled	Init	0.0.0.0	0	100	Enabled
□	LAN_B	10.0.2.1	20	Disabled	Init	0.0.0.0	0	100	Enabled

The Virtual Router Redundancy Protocol (VRRP) feature can solve the static configuration problem. VRRP enables a group of routers to form a single virtual router with a virtual IP address. The LAN clients can then be configured with the virtual router's virtual IP address as their default gateway. The virtual router is the combination of a group of routers, and also known as a VRRP group.

Enable

Setting	Description	Factory Default
Enable	Checkmark the checkbox to enable the VRRP.	N/A

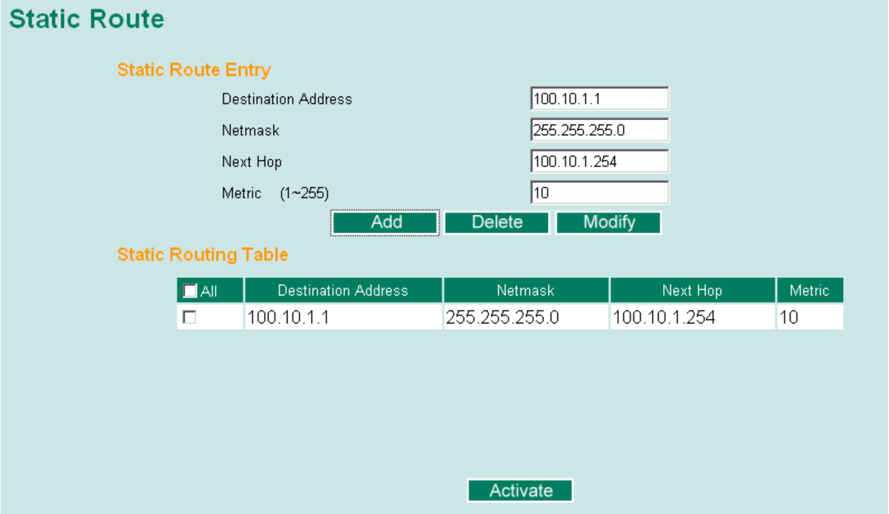
VRRP Interface Setting Entry

Setting	Description	Factory Default
Enable	Determines to enable the VRRP entry or not.	Disabled
Virtual IP	L3 switches / routers in the same VRRP group must have the identical virtual IP address like VRRP ID. This virtual IP address must belong to the same address range as the real IP address of the interface.	0.0.0.0
Virtual Router ID	Virtual Router ID is used to assign a VRRP group. The L3 switches / routers, which operate as master / backup, should have the same	
ID. Moxa L3 switches / routers support one virtual router ID for each interface. The usable range of ID is 1 to 255.	0	

Priority	Determines priority in a VRRP group. The priority value range is 1 to 255 and the 255 is the highest priority. If several L3 switches / routers have the same priority, the router with higher IP address has the higher priority. The usable range is "1 to 255".	100

Static Route

The Static Route page is used to set up the PT-7828's static routing table.



Static Route

Static Route Entry

Destination Address	100.10.1.1
Netmask	255.255.255.0
Next Hop	100.10.1.254
Metric (1~255)	10

Static Routing Table

□ All	Destination Address	Netmask	Next Hop	Metric
□	100.10.1.1	255.255.255.0	100.10.1.254	10

Destination Address
Use this option to specify the destination's IP address.

Subnet Mask
Use this option to specify the subnet mask for this IP address.

Next Hop
Use this option to specify the next router along the path to the destination.

Metric
Use this option to specify the cost you must pay to access the neighboring network.

Three action buttons are available for setting up the Static Routing Table:

Add
Use this button to add an entry to the Static Routing Table

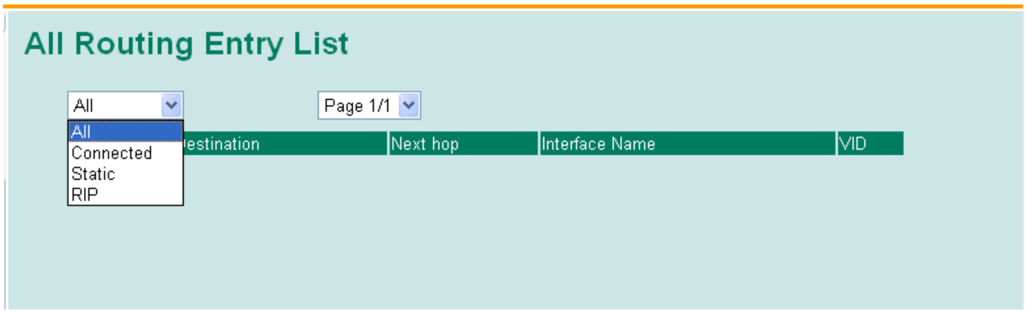
Delete
Use this button to remove the selected entries from the Static Routing Table

Modify
Use this option to modify the content of a selected entry in the Static Routing Table

NOTE The entries in the Static Route Table will not be added into the PT-7828's routing table until you click the Activate button.

Routing Table

The Routing Table page shows all routing entries that the PT-7828 is using.

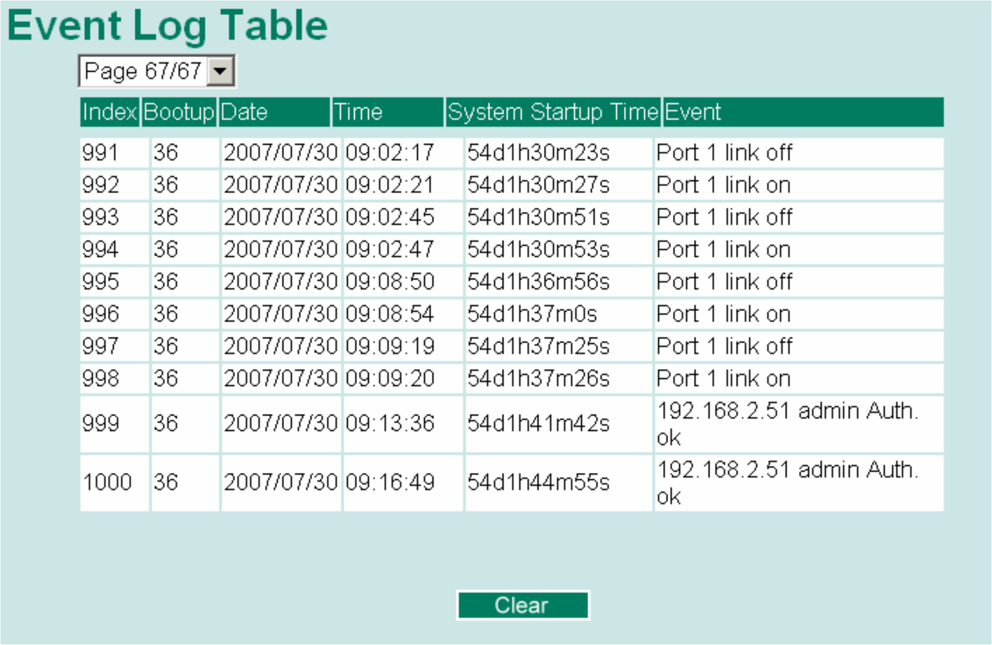


All Routing Entry List

Setting	Description	Factory Default
All	Show all routing rules	N/A
Connected	Show connected routing rules	N/A
Static	Show static routing rules	N/A
RIP	Show RIP exchanged routing rules	N/A
OSPF	Show OSPF exchanged routing rules	N/A

Using System Log

Event Log



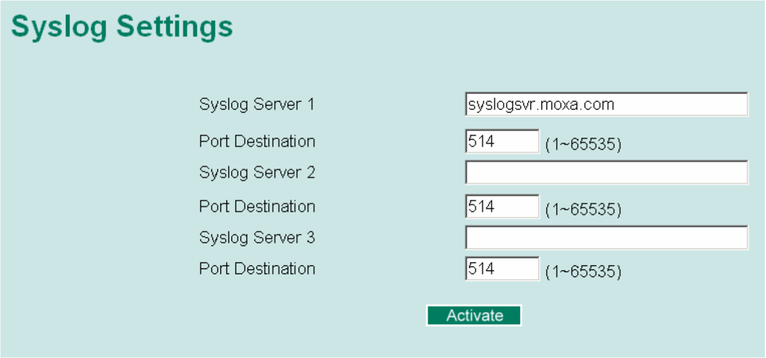
Index	Bootup	Date	Time	System Startup Time	Event
991	36	2007/07/30	09:02:17	54d1h30m23s	Port 1 link off
992	36	2007/07/30	09:02:21	54d1h30m27s	Port 1 link on
993	36	2007/07/30	09:02:45	54d1h30m51s	Port 1 link off
994	36	2007/07/30	09:02:47	54d1h30m53s	Port 1 link on
995	36	2007/07/30	09:08:50	54d1h36m56s	Port 1 link off
996	36	2007/07/30	09:08:54	54d1h37m0s	Port 1 link on
997	36	2007/07/30	09:09:19	54d1h37m25s	Port 1 link off
998	36	2007/07/30	09:09:20	54d1h37m26s	Port 1 link on
999	36	2007/07/30	09:13:36	54d1h41m42s	192.168.2.51 admin Auth. ok
1000	36	2007/07/30	09:16:49	54d1h44m55s	192.168.2.51 admin Auth. ok

Enable

Setting	Description
Bootup	This field shows how many times the PT-7828 has been rebooted or cold started.
Date	The date is updated based on how the current date is set in the "Basic Setting" page.
Time	The time is updated based on how the current time is set in the "Basic Setting" page.
System Startup Time	The system startup time related to this event.
Events	Events that have occurred.

Syslog Settings

This function provides the event logs for the syslog server. The function supports 3 configurable syslog servers and syslog server UDP port numbers. When an event occurs, the event will be sent as a syslog UDP packet to the specified syslog servers.



Syslog Settings

Syslog Server 1 syslogsvr.moxa.com

Port Destination 514 (1~65535)

Syslog Server 2

Port Destination 514 (1~65535)

Syslog Server 3

Port Destination 514 (1~65535)

Syslog Server 1

Setting	Description	Factory Default
IP Address	Enter the IP address of 1st Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 1st Syslog Server.	514

Syslog Server 2

Setting	Description	Factory Default
IP Address	Enter the IP address of 2nd Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 2nd Syslog Server.	514

Syslog Server 3

Setting	Description	Factory Default
IP Address	Enter the IP address of 3rd Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 3rd Syslog Server.	514

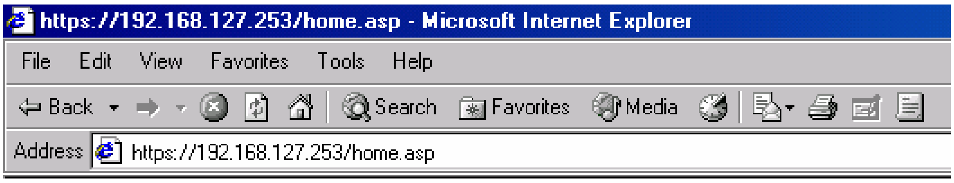
NOTE The following events will be recorded into the PT-7828's Event Log table, and will then be sent to the specified Syslog Server:

1. Cold start
2. Warm start
3. Configuration change activated
4. Power 1/2 transition (Off (On), Power 1/2 transition (On (Off)
5. Authentication fail
6. Topology changed
7. Master setting is mismatched
8. DI 1/2 transition (Off (On), DI 1/2 transition (On (Off)
9. Port traffic overload
10. dot1x Auth Fail
11. Port link off / on

Using HTTPS/SSL

To secure your HTTP access, the PT-7828 supports HTTPS/SSL to encrypt all HTTP traffic. Perform the following steps to access the PT-7828's web browser interface via HTTPS/SSL.

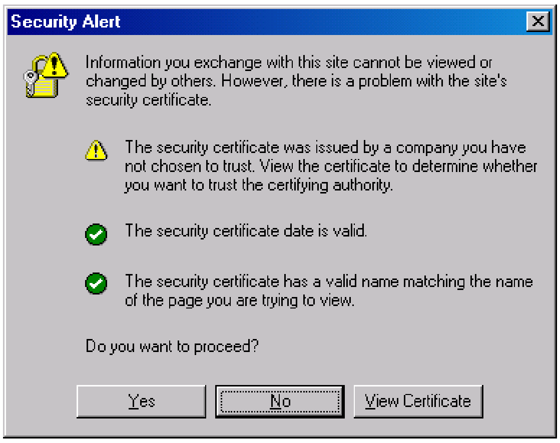
1. Open Internet Explorer and type https://PT-7828's IP address in the address field. Press Enter to establish the connection.



https://192.168.127.253/home.asp - Microsoft Internet Explorer

Address https://192.168.127.253/home.asp

2. Warning messages will pop out to warn the user that the security certificate was issued by a company they have not chosen to trust.



Security Alert

Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.

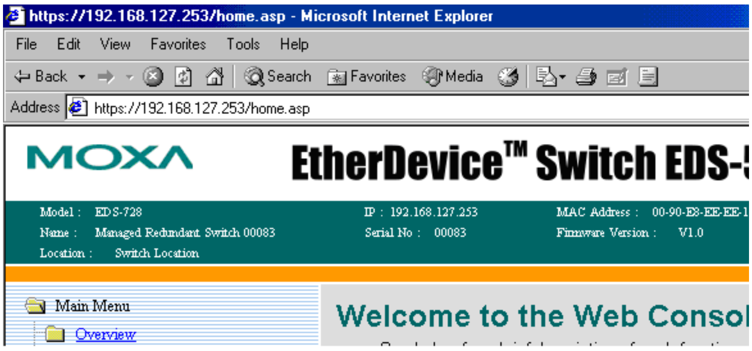
The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.

The security certificate date is valid.

The security certificate has a valid name matching the name of the page you are trying to view.

Do you want to proceed?

3. Select Yes to enter the PT-7828's web browser interface and access the web browser interface secured via HTTPS/SSL.


https://192.168.127.253/home.asp - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://192.168.127.253/home.asp
MOXA
EtherDevice™ Switch EDS-
Model : EDS-728
Name : Managed Redundant Switch 00083
Location : Switch Location
IP : 192.168.127.253
Serial No : 00083
MAC Address : 00-90-E8-EE-EE-1
Firmware Version : V1.0
Main Menu
Overview
Welcome to the Web Consol

NOTE Moxa provides a Root CA certificate. After installing this certificate into your PC or Notebook, you can access the web browser interface directly and will not see any warning messages again. You may download the certificate from the PT-7828's CD-ROM.

A

MIB Groups

The PT-7828 comes with built-in SNMP (Simple Network Management Protocol) agent software that supports cold/warm start trap, line up/down trap, and RFC 1213 MIB-II.

The standard MIB groups that the PT-7828 supports are as follows:

MIB II.1 – System Group

sysORTable

MIB II.2 – Interfaces Group

ifTable

MIB II.4 – IP Group

ipAddrTable

ipNetToMediaTable

IpGroup

IpBasicStatsGroup

IpStatsGroup

MIB II.5 – ICMP Group

IcmpGroup

IcmpInputStatus

IcmpOutputStats

MIB II.6 – TCP Group

tcpConnTable

TcpGroup

TcpStats

MIB II.7 – UDP Group

udpTable

UdpStats

MIB II.10 – Transmission Group

- dot3
- dot3StatsTable

MIB II.11 – SNMP Group

- SnmpBasicGroup
- SnmpInputStats
- SnmpOutputStats

MIB II.17 – dot1dBridge Group

- dot1dBase
  - dot1dBasePortTable
- dot1dStp
  - dot1dStpPortTable
- dot1dTp
  - dot1dTpFdbTable
  - dot1dTpPortTable
  - dot1dTpHCPortTable
  - dot1dTpPortOverflowTable
- pBridgeMIB
  - dot1dExtBase
  - dot1dPriority
  - dot1dGarp
- qBridgeMIB
  - dot1qBase
  - dot1qTp
    - dot1qFdbTable
    - dot1qTpPortTable
    - dot1qTpGroupTable
    - dot1qForwardUnregisteredTable
  - dot1qStatic
    - dot1qStaticUnicastTable
    - dot1qStaticMulticastTable
  - dot1qVlan
    - dot1qVlanCurrentTable
    - dot1qVlanStaticTable
    - dot1qPortVlanTable

The PT-7828 also provides a private MIB file, located in the file **Moxa-PT7828-MIB.my** on the PT-7828 utility CD-ROM.

Public Traps

- Cold Start
- Link Up
- Link Down
- Authentication Failure
- dot1dBridge New Root
- dot1dBridge Topology Changed

Private Traps

- Configuration Changed
- Power On
- Power Off
- Traffic Overloaded
- Turbo Ring Topology Changed
- Turbo Ring Coupling Port Changed
- Turbo Ring Master Mismatch

B

Specifications

Technology	
Standards	IEEE 802.3 for 10BaseT, IEEE 802.3u for 100BaseT(X) and 100BaseFX, IEEE 802.3ab for 1000BaseT(X), IEEE 802.3z for 1000BaseSX/LX/LHX/ZX, IEEE 802.3x for Flow Control, IEEE 802.1D for Spanning Tree Protocol, IEEE 802.1w for Rapid STP, IEEE 802.1Q for VLAN Tagging, IEEE 802.1p for Class of Service, IEEE 802.1X for Authentication, IEEE 802.3ad for Port Trunk with LACP RFC 1058 RFC 2453
Flow control	IEEE 802.3x flow control, back pressure flow control
Protocols:	IGMP V1/V2/V3 device, GMRP, GVRP, SNMP V1/V2c/V3, DHCP Server/Client, DHCP Option 82, BootP, TFTP, SNTP, SMTP, RARP, RMON, RIP V1/V2.
MIB:	MIB-II, Ethernet-like MIB, P-BRIDGE MIB, Q-BRIDGE MIB, Bridge MIB, RSTP MIB, RMON MIB Group 1, 2, 3, 9
Switch Properties	
Priority Queues:	4
Max. Number of Available VLANs:	64
VLAN ID Range:	VID 1 to 4094
IGMP Groups:	256
Interface	
Fast Ethernet	Slot 1, 2, 3 for any combination of 8, 7, or 6-port PM-7200 Fast Ethernet modules with 10/100BaseT(X) or 100BaseFX (SC/ST connector or SFP slot)

Optical Fiber (100BaseFX)

	100BaseFX		
	Multi Mode	Single Mode	Single Mode, 80 km
Wavelength	1300 nm	1310 nm	1550 nm
Max. TX	-10 dBm	0 dBm	0 dBm
Min. TX	-20 dBm	-5 dBm	-5 dBm
RX Sensitivity	-32 dBm	-34 dBm	-34 dBm
Link Budget	12 dB	29 dB	29 dB
Typical Distance	5 km[a] 4 km[b]	40 km[c]	80 km[d]
Saturation	-6 dBm	-3 dBm	-3 dBm

a. 50/125 µm, 800 MHz*km fiber optic cable
b. 62.5/125 µm, 500 MHz*km fiber optic cable
c. 9/125 µm, 3.5 PS/(nm*km) fiber optic cable
d. 9/125 µm, 19 PS/(nm*km) fiber optic cable

Gigabit Ethernet	Slot 4 for 4 or 2-port PM-7200 Gigabit Ethernet combo module with 10/100/1000BaseT(X) and 1000BaseSX/LX/LHX/ZX (SFP slot, LC connector)

	Gigabit Ethernet			
	SFP-SX	SFP-LX	SFP-LHX	SFP-ZX
Wavelength	850 nm	1310 nm	1310 nm	1310 nm
Max. TX	-4 dBm	-3 dBm	1 dBm	5 dBm
Min. TX	-9.5 dBm	-9.5 dBm	-4 dBm	0 dBm
RX Sensitivity	-18 dBm	-20 dBm	-24 dBm	24 dBm
Link Budget	8.5 dB	10.5 dB	20 dB	24 dB
Typical Distance	550 m[a] 275 m[b]	1100 m[c] 550 m[d] 10 km[e]	40 km[e]	80 km[f]
Saturation	0 dBm	-3 dBm	-3 dBm	-3 dBm

a. 50/125 µm, 400 MHz*km fiber optic cable
b. 62.5/125 µm, 200 MHz*km fiber optic cable
c. 50/125 µm, 800 MHz*km fiber optic cable
d. 62.5/125 µm, 500 MHz*km fiber optic cable
e. 9/125 µm, 3.5 PS/(nm*km) fiber optic cable
f. 9/125 µm, 19 PS/(nm*km) fiber optic cable

Console:	RS-232 (RJ45)
System LED Indicators:	STAT, PWR1, PWR2, FAULT, MASTER, COUPLER
Module LED Indicators:	LNK/ACT, FDX/HDX, RING PORT, COUPLER PORT, SPEED
Alarm Contact:	One relay output with current carrying capacity of 3A @ 24 VDC or 3A @ 240 VAC
Power	
Input Voltage	24 VDC (18 to 36 V), or 48 VDC (36 to 72 V), or 125/250 VDC (88 to 300 V) and 110/240 VAC (85 to 264 V)
Input Current	(All ports are equipped with fiber) Max. 2.58A @ 24VDC, Max. 1.21A @48VC, Max 0.53A @ 250VDC/240VAC

Connection	10-pin terminal block
Overload Current Protection	Present
Reverse Polarity Protection	Present
Mechanical	
Casing	IP30 protection
Dimensions (W x H x D)	440 x 44 x 325 mm (17.32 x 1.73 x 12.80 in.)
Installation	19-inch rack mounting
Environmental	
Operating Temp.	-40 to 85°C (-40 to 185°F) Cold start of min. 100 VAC at -40˚C
Storage Temp.	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity	5 to 95% (non-condensing)
Warranty	5 years

C

Modbus/TCP Map

PT-7828 Modbus information v1.0

Read Only Registers (Support Function Code 4)   1 Word = 2 Bytes

Address	Data Type	Description
System Information		
0x0000	1 word	Vendor ID = 0x1393
0x0001	1 word	Unit ID (Ethernet = 1)
0x0002	1 word	Product Code = 0x0006
0x0010	20 words	Vendor Name = "Moxa" Word 0 Hi byte = ‘M’ Word 0 Lo byte = ‘o’ Word 1 Hi byte = ‘x’ Word 1 Lo byte = ‘a’ Word 2 Hi byte = ‘\0’ Word 2 Lo byte = ‘\0’
0x0030	20 words	Product Name = "PT-7828" Word 0 Hi byte = ‘P’ Word 0 Lo byte = ‘T’ Word 1 Hi byte = ‘-’ Word 1 Lo byte = ‘7’ Word 2 Hi byte = ‘8’ Word 2 Lo byte = ‘2’ Word 3 Hi byte = ‘8’ Word 3 Lo byte = ‘\0’ Word 4 Hi byte = ‘\0’ Word 4 Lo byte = ‘\0’
0x0050	1 word	Product Serial Number
0x0051	2 words	Firmware Version Word 0 Hi byte = major (A) Word 0 Lo byte = minor (B) Word 1 Hi byte = release (C) Word 1 Lo byte = build (D)
0x0053	2 words	Firmware Release Date Firmware was released on 2007-05-06 at 09 o’clock Word 0 = 0x0609 Word 1 = 0x0705

0x0055	3 words	Ethernet MAC Address Ex: MAC = 00-01-02-03-04-05 Word 0 Hi byte = 0x00 Word 0 Lo byte = 0x01 Word 1 Hi byte = 0x02 Word 1 Lo byte = 0x03 Word 2 Hi byte = 0x04 Word 2 Lo byte = 0x05
0x0058	1 word	Power 1 0x0000:Off 0x0001:On
0x0059	1 word	Power 2 0x0000:Off 0x0001:On
0x005A	1 word	Fault LED Status 0x0000:No 0x0001:Yes
0x0080	1 word	DI1 0x0000:Off 0x0001:On
0x0081	1 word	DI2 0x0000:Off 0x0001:On
0x0082	1 word	DO1 0x0000:Off 0x0001:On
0x0083	1 word	DO2 0x0000:Off 0x0001:On
Port Information		
0x1000 to 0x1011	1 word	Port 1 to 10 Status 0x0000:Link down 0x0001:Link up 0x0002:Disable 0xFFFF:No port
0x1100 to 0x1111	1 word	Port 1 to 10 Speed 0x0000:10M-Half 0x0001:10M-Full 0x0002:100M-Half 0x0003:100M-Full 0x0004:1G-Half 0x0005:1G- Full 0xFFFF:No port
0x1200 to 0x1211	1 word	Port 1 to 10 Flow Ctrl 0x0000:Off 0x0001:On 0xFFFF:No port
0x1300 to 0x1311	1 word	Port 1 to 10 MDI/MDIX 0x0000:MDI 0x0001:MDIX 0xFFFF:No port

0x1400 to 0x1413(Port 1) 0x1414 to 0x1427(Port 2)	20 words	Port 1 to 10 Description Port Description = "100TX,RJ45." Word 0 Hi byte = '1' Word 0 Lo byte = '0' Word 1 Hi byte = '0' Word 1 Lo byte = 'T' … Word 4 Hi byte = '4' Word 4 Lo byte = '5' Word 5 Hi byte = '.' Word 5 Lo byte = '\0'
Packet Information		
0x2000 to 0x2023	2 words	Port 1 to 10 Tx Packets Ex: port 1 Tx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2100 to 0x2123	2 words	Port 1 to 10 Rx Packets Ex: port 1 Rx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2200 to 0x2223	2 words	port 1 to 10 Tx Error Packets Ex: port 1 Tx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2300 to 0x2323	2 words	port 1 to 10 Rx Error Packets Ex: port 1 Rx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
Redundancy Information		
0x3000	1 word	Redundancy Protocol 0x0000:None 0x0001:RSTP 0x0002:Turbo Ring 0x0003:Turbo Ring V2 0x0004:Turbo Chain
0x3100	1 word	RSTP Root 0x0000:Not Root 0x0001:Root 0xFFFF:RSTP Not Enable
0x3200 to 0x3211	1 word	RSTP Port 1 to 10 Status 0x0000:Port Disabled 0x0001:Not RSTP Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:RSTP Not Enable
0x3300	1 word	TR Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring Not Enable

0x3301	1 word	TR 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3302	1 word	TR 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3303	1 word	TR Coupling 0x0000:Off 0x0001:On 0xFFFF:Turbo Ring Not Enable
0x3304	1 word	TR Coupling Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0xFFFF:Turbo Ring Not Enable
0x3305	1 word	TR Coupling Control Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0x0006:Inactive 0x0007:Active 0xFFFF:Turbo Ring Not Enable
0x3500	1 word	TR2 Coupling Mode 0x0000:None 0x0001:Dual Homing 0x0002:Coupling Backup 0x0003:Coupling Primary 0xFFFF:Turbo Ring V2 Not Enable
0x3501	1 word	TR2 Coupling Port Primary status (Using in Dual Homing, Coupling Backup, Coupling Primary) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable

0x3502	1 word	TR2 Coupling Port Backup status (Only using in Dual Homing) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable
0x3600	1 word	TR2 Ring 1 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Not Enable
0x3601	1 word	TR2 Ring 1 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3602	1 word	TR2 Ring 1 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3603	1 word	TR2 Ring 1 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3680	1 word	TR2 Ring 2 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3681	1 word	TR2 Ring 2 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3682	1 word	TR2 Ring 2 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable

0x3683	1 word	TR2 Ring 2 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3700	1 word	Turbo Chain Switch Role 0x0000:Head 0x0001:Member 0x0002:Tail 0xFFFF: Turbo Chain Not Enable
0x3701	1 word	Turbo Chain 1st Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3702	1 word	Turbo Chain 2nd Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable