Software Manual for Web Browser

Version 5.x

For Product Series: EICP_M, EIDX_M, EISK_M, EISX_M

# TD020851-0MG
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2 History

9/27/2004 Initial Release with RapidRing®
3/01/2005 Added IGMP Snooping, Rate Control & Port Security
9/01/2005 Added STP/RSTP
10/01/2011 Added support for EIDX & EISK8M and dropped support for EISB
28/02/2013 Added VLAN content for 16- and 24-port switches; dropped CD-ROM references

3 Introduction

Managed switches in the CTRLink® family provide capabilities beyond those in both Plug and Play (PnP) and Configurable Switches. Besides conventional PnP features (auto-negotiation, 10/100 Mbps data rate, half- or full-duplex operation, flow control), a managed switch adds advanced features usually found only in high-end switches:

- **Rapid Spanning Tree Protocol (RSTP)** provides a standardized network redundancy scheme with improved network recovery time over Spanning Tree Protocol (STP).
- **RapidRing®** provides high speed network redundancy — allowing recovery from a link loss in under 300 ms.
- **VLAN** allows the physical network to be configured as multiple virtual local area networks — limiting broadcast/multicast domains and improving performance.
- **Trunking** allows ports to be associated in groups — each group functioning as a high-speed backbone to another managed switch.
- **QoS** provides message priority with one of these priority schemes — port-based, MAC-based, 802.1p, DiffServ, or TOS.
- **Rate Control** allows variable data rates by port for bandwidth allocation.
- **Port Security** limits port traffic to only those devices with listed MAC addresses.
- **IGMP Snooping** allows multicasts to be limited to only relevant ports.
- **Port Mirroring** copies traffic from one or more ports to a monitoring port.
- **Programmable Fault Relay** provides a dry contact to a supervisory system if the switch senses a condition such as the loss or addition of a link.
- **Non-blocking wire-speed operation** provides a maximum data rate of 148,810 packets per second for 100 Mbps Ethernet on all ports at full duplex.

These features place managed switches from Contemporary Controls among the most powerful and versatile of Industrial Ethernet switches. Configuration is done through a web browser or a console port. Individual port parameters (data rate, duplicity, flow control) can be pre-set or auto-negotiated. Auto-MDIX can be disabled, if desired. Each port supports the PAUSE function for full-duplex links, and uses the backpressure scheme for half-duplex links.

Each switch is powered from a low-voltage AC or DC source — with redundant power terminals for backup considerations. Each unit includes attachments for either DIN-rail or panel mounting. The front panel features a power LED, a management status LED and bi-colour LEDs for the link status, activity, and data rate of each port.

This software is used in EICP_M, EIDX_M, EISK_M, and EISX_M products.
3.1 Sample Images of the Managed Switch Product Series

EICP8M-100T

EISX8M-100T/FC

EISK8M-100T/FCS

EIDX24M-100T/FC
4 Advanced Operation

4.1 General Considerations

Configuration is accomplished while the switch is connected to a computer running a web browser that accesses the switch’s onboard web server.

4.1.1 LEDs

To aid in troubleshooting, several LEDs have been provided.

Each **port LED** glows solid if a link exists, flashes to show activity and shows data rate by colour — green for 100 Mbps and yellow for 10 Mbps.

The **Power LED** glows solid green to indicate the presence of adequate power.

The **Status LED** on the switch front panel acts as a heartbeat and blinks every 5 seconds during normal operation. If a fault occurs, it blinks every second — except that EIDX models maintain the 5-second heartbeat and the LED turns **red** to indicate a fault.

4.1.2 Accessing the Web Server

4.1.2.1 Web Browser

The switch contains an interactive web server, accessible from any Internet-compatible PC on the local network. It is compatible with all recent Internet browsers. It is factory-programmed with a default IP address of 192.168.92.68 and a Class C subnet mask of 255.255.255.0. Changing the switch IP address is strongly encouraged.

4.1.2.2 Initial Access

The hardware arrangement for initial setting of the switch IP address by web browser appears in Figure 1. Temporarily disconnect the PC from the Ethernet LAN in case the default address of the switch matches that of a device on the existing network. **NOTE:** This procedure for changing the IP address of the switch creates a **temporary LAN** composed of nothing but the switch, the PC used to configure it, and a cable that connects the PC to any switch port.

![Figure 1 — Setup for Initial IP Address Configuration by Web Browser](image)

For initial configuration, the PC chosen for the procedure should temporarily have its IP address modified as shown in Figure 2 — which employs a Windows XP example.
The example in Figure 2 suggests an IP address for the PC of 192.168.92.69, but the final quad of the address could be any value from 1 to 254 — except for 68 which is used by the switch. After the IP address of the PC has been set to the same LAN as the switch, a web browser can access the switch via its default IP address.

Upon accessing the switch, the screen of Figure 3 appears and prompts for **Username** and **Password** — both of which are blank by default. The first time through, leave both of these fields blank and click “Submit”.

---

**Figure 2 — Steps for Changing the IP Address of the PC Used for Setup**

**Figure 3 — Login Screen**
Following the login screen, a Home Page similar to that in Figure 4 appears — but some time for “downloading picture” will be needed before all imagery is displayed. The image of your particular device will appear, as will your current firmware version.

**Figure 4 — Web Server Home Page**

Clicking on System Configuration in Figure 4 displays the menu options of Figure 5.

**Figure 5 — System Configuration Menu**

Choose Configure IP Address to display the screen shown in Figure 6.
By default, the IP Address configuration method is “Fixed”. Either leave it as is or choose the “DHCP” method of changing the IP address. If the “DHCP” option is selected, it will only take effect after the switch is connected to a network which contains a DHCP server. At that point, you must ascertain the IP Address assigned by the DHCP server. \textbf{If your switch has no Console Port}, you can find the assigned IP address with the procedure in Appendix 5.1. \textbf{If your switch has a Console Port}, you can access it via a serial cable to learn the IP Address — as described in the Software Manual for Console Access available at:


| Configure IP Address: |
|---------------------|----------------|
| Assign by          | 0 Fixed 0 DHCP |
| IP Address         | 192.168.92.68  |
| Subnet Mask        | 255.255.255.0  |
| Default Gateway    | 192.168.92.1   |

\textbf{Figure 6 — The Default IP Address}

After the switch has been given its initial configuration, it will be ready for use in the full original LAN. The temporary LAN should then be dismantled and the PC re-configured to restore its original IP address.

4.1.3 On-Screen Help

There are many configuration screens. The upper-right portion of each screen contains a context-sensitive Help option. Clicking this option launches another browser window which contains helpful information about the current screen and which pertains to a certain product series. The example of Figure 7 pertains to the EISX_M Series.

\textbf{Figure 7 — Help Window}
4.1.4 Username and Password

Each time the switch is accessed by a web browser, the Login screen of Figure 8 will appear. You are strongly encouraged to change the Username and Password.

<table>
<thead>
<tr>
<th>Enter Username &amp; Password:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username</td>
</tr>
<tr>
<td>Password</td>
</tr>
</tbody>
</table>

Figure 8 — Login Screen

On models with a Console Port, you can reset login strings to their default (blank) values by shorting pins 2 and 3 of the Console Port (Figure 9) for **10 seconds** during boot. This resets **only** the Username and Password and **only for the current login session** — other parameters are unchanged. Then login strings should be changed and **saved** to overwrite the old values, or the reset must be repeated when a power cycle occurs.

Figure 9 — Restoring the Default Access Strings

4.1.5 Restoring Factory Default Settings

On models with a Console Port, this can only be done via Console Access. See the Main Menu options in the Software Manual for Console Access for the procedure. The Software Manual for Console Access available at:


On the EISK_M Series, you can reset the switch to **ALL** of its factory default settings via a hole on bottom of the unit. Use a paperclip or similar tool to press the recessed button for at least 3 seconds while the unit is powered. Then release the button and remove power for 3 seconds. Restore power and the unit will now use its factory default values of IP address, subnet mask — and Username and Password, both of which will be blank. **CAUTION:** This action erases **ALL** user-configured information.
4.2 Home Page (Main Menu)

After login, the Home Page (Figure 10) can be accessed from any page via the “Home” link at the right edge of the banner. The Home Page displays the switch Name, Location, Contact person, MAC Address, Firmware Version, Uptime, Temperature and (in the banner) the switch Series. Beneath the banner the following links are displayed:

- System Configuration (explained in Section 4.4)
- SNMP Configuration (explained in Section 4.5)
- Performance Monitor (explained in Section 4.6)
- Save Settings (explained below)
- CTRLLink Webpage (Internet access required) (explained below)
- Logout (explained below)

Save Settings stores currently modified settings to the non-volatile memory within the switch. On models with a Console Port, storage to a PC is explained Section 4.2.1.

CAUTION: If the “Save Settings” option is NOT selected after modifications have been made, any modified settings will be lost when a power cycle occurs.

CTRLLink Webpage links to the CTRLLink home page if an Internet connection exists.

Logout restarts the session and prompts the user for a Username and Password.

Also on this page, individual Port Configuration and Port Statistics (Section 4.3) are invoked by clicking the image of the port socket of interest. As the cursor hovers over a picture element, a helpful Tool Tip appears to confirm the item being accessed.
4.2.1 Upload/Download Settings (console port models)

*On models with a Console Port,* settings can also be stored to a PC and retrieved from a PC — but only via the Console Port, not via web browser. For a description of the process, refer to the *Software Manual for Console Access* available at:


4.2.2 Uptime

*Uptime* displays the number of seconds since the previous hard power recycle or soft restart. The *Refresh* option updates the value (the counter only resets due to a restart).

4.2.3 Switch Temperature

*Switch Temperature* displays the current internal temperature of the switch in degrees Celsius (±3º). Select the *Refresh* item to update the currently displayed value.
4.3 Port Configuration and Port Statistics

To configure a port or view its statistics, go to the switch Home Page and click on the image of the socket associated with the port of interest. Figure 11 shows the default settings for port 1, as an example, with controls in the upper panel and typical traffic statistics in the lower panel. The port number appears in the top centre of the screen.

4.3.1 Port Configuration (Figure 11, upper panel)

With the upper-panel controls, you can turn the port on or off (Port State), set its data rate and duplicity (Mode), manage its Auto-MDIX function and enable or disable its Flow Control. (Flow Control is explained in Section 4.4.7.1). The type of cabling which the port supports is identified in the box to the right of the word Media Type.

NOTE: Some models include fibre optic cable ports. Such ports do NOT auto-negotiate. Their only Mode option is Full or Half Duplex because their data rate is fixed at 100 Mbps.

Auto-Negotiation for Copper Ports

A single cable links two Ethernet devices. When these devices auto-negotiate, the data rate will be 100 Mbps only if both are capable of that speed. Likewise, full-duplex will only be selected if both can support it. If only one device supports auto-negotiation, then it will match the data rate and duplex mode of the non-auto-negotiating device. Sometimes it is advantageous to select a fixed data rate and duplicity setting on both Ethernet devices to eliminate the auto-negotiation process.

Auto-MDIX

When interconnecting two switches, crossover cables are traditionally used — but if one switch uses Auto-MDIX, the communication can be via either crossover or straight-through cable. This functionality does not require both switches to have Auto-MDIX.

Figure 11 — Port Configuration and Port Statistics
4.3.2 Port Frame Statistics  (Figure 11, lower panel)

These numbers will remain static until the Refresh option is used to provide an update. The displayed values are the total number of these events from when the switch was last powered-up, its IP address was redefined or its parameters were reset to their default values. Recycling power, redefining the IP address or resetting parameters to their default values will reset the Port Frames Statistics to zero.

Port Frame Statistics are available for the following counts:

Unicast Frames Received  This counts unicast frames received by the switch.
Unicast Frames Sent     This counts unicast frames transmitted by the switch.
Multicast Frames Received This counts multicast frames received by the switch.
Multicast Frames Sent   This counts multicast frames transmitted by the switch.
Broadcast Frames Received This counts broadcast frames received by the switch.
Broadcast Frames Sent   This counts broadcast frames transmitted by the switch.
Dropped Frames          This counts the frames dropped on transmission due to an excessive number of collisions.
Oversize Frames         This counts the frames dropped on reception because they exceeded 1518 bytes — often due to faulty drivers.
Undersize Frames        This counts “runt” frames dropped on reception because they were under 64 bytes with no valid CRC/FCS. Runt frames are usually created by collisions.
Fragments               This counts the number of fragmented frames.
Jabbers                 These frames exceed 1518 bytes, have invalid CRC/FCS values and are due to constant transmissions from a network interface card which likely is faulty.
Collisions              This counts the collisions on a half-duplex segment — most often due to physical-layer issues.
Deferred Transmissions This counts the frames delayed on the first transmission attempt because the media was busy.
4.4 System Configuration

Each of the System Configuration menu selections of Figure 12 will activate additional sub-menus from among the following list:

- Configure IP Address (explained in Section 4.4.1)
- Configure Trunking (explained in Section 4.4.2)
- Configure Port Mirroring (explained in Section 4.4.3)
- Configure VLAN (explained in Section 4.4.4)
- Configure Filtering & Forwarding Table (explained in Section 4.4.5)
- Configure Quality of Service (explained in Section 4.4.7)
- Configure Fault Relay (explained in Section 4.4.8)
- Configure Redundancy (explained in Section 4.4.9)
- Configure Rate Control (explained in Section 4.4.10)
- Configure Port Security (explained in Section 4.4.11)
- Configure IGMP Snooping (explained in Section 4.4.12)
- Configure Username/Password (explained in Section 4.4.13)

![System Configuration Menu](image)

Figure 12 — System Configuration Menu
4.4.1 Configure IP Address

Figure 13 displays the Configure IP Address menu with its default values. The address can be assigned in either of two ways.

![Configure IP Address Menu]

By default, the switch uses a fixed IP address. And as long as the FIXED button is selected in the Assign by field, the user must fill in the IP Address, Subnet Mask and Default Gateway. The switch can also have its IP Address assigned automatically by a Dynamic Host Configuration Protocol (DHCP) server if the DHCP button is selected. The response to clicking the Apply button is as follows.

**Using Fixed configuration:** When the Apply button is clicked, the switch restarts using the new IP configuration, the Uptime clock restarts and a redirect page displays:

The new IP address is [hyperlink to new IP Address]

Clicking on the hyperlink begins a new session as the Login screen appears.

**Using DHCP:** When the Apply button is clicked, the Uptime clock restarts and a redirect page displays the following:

IP Address assigned by DHCP.

At this point, further browser access to the switch will not be possible until you learn the new address that was assigned by the DHCP (a process of many seconds — perhaps half a minute, depending on network conditions). Determine the assigned IP address by one of the following:

- retrieve it from your DHCP server
- discover it with SwitchInfo as explained in Appendix 5.1.

**Note for SNMP:** The “Warm Start” trap is transmitted once the address assignment has been made — immediately for Fixed address assignment but after a delay of many seconds if the address has been assigned by DHCP.
4.4.2 Configure Trunking  (copper ports only)

Port Trunking allows two or more ports to be grouped with the resulting group behaving as a single logical link. A managed switch supports multiple trunks — each constructed of 2 or more fixed physical ports.

To keep frames in order, packets with the same source/destination MAC addressing are sent over the same trunk path — but the reverse path may follow a different link because a hash algorithm is used to balance the load between links in a trunk.

Adding more ports (links) to a trunk group will increase the communication bandwidth between two switches. Either one or two trunk groups can be defined — but always from among ports 1–8. Even with a 16- or 24-port unit, only ports 1–8 support trunking.

Port Trunking on managed switches from Contemporary Controls also provides redundancy with a fast recovery time (several milliseconds). If a link in the trunk group is lost, the remaining links immediately take over and maintain communication between the switches.

Figure 14 illustrates three two-link trunks (A, B and C) connecting two computers through four switches. This configuration could sustain a link loss in Trunk A, but within milliseconds a redundant data path would be reconstructed between the two computers. A similar recovery would manifest for a link lost in Trunk B or C. Indeed, even multiple link losses — one in each trunk group — would not disrupt communication between the two end stations except for the brief recovery time.

Figure 15 displays a sample Configure Trunking screen with two trunk groups defined. The sample shows that only Group 1 is currently active. It would be permissible for both of these two sample groups to be enabled simultaneously — but only because they do not have any ports in common (overlapping ports).

<table>
<thead>
<tr>
<th>Configure Trunking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
</tr>
</tbody>
</table>

Submit
4.4.3 Configure Port Mirroring

Port mirroring allows a port to copy or “mirror” traffic for one or many ports — useful when a diagnostic tool is used. Switches normally send frames only to ports involved in a conversation, so mirroring is required if a diagnostic tool must capture network traffic. Various settings control how data is mirrored, but apply only if (in Figure 16, upper panel) the Status option is enabled and a Mirror Port (to which the data is copied) is specified.

**Ingress (Ingoing) Mirroring Rules** (centre panel) apply to data received by the Source Ports being mirrored; **Egress (Outgoing) Mirroring Rules** (lower panel) for data sent by Source Ports being mirrored. Both sets of rules allow a MAC Address Filter and a MAC Address to be defined. The Divider specifies the fraction of frames copied from each source port.

The **MAC Address** options are:
- **All** — mirrors all traffic regardless of MAC address. This is the default.
- **Source** — mirrors frames whose source addresses match the entered value.
- **Destination** — mirrors frames whose destination addresses match the entered value.

### Table 1

<table>
<thead>
<tr>
<th><strong>Configure Port Mirroring</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status</strong></td>
</tr>
<tr>
<td><strong>Mirror Port</strong></td>
</tr>
</tbody>
</table>

**Ingress (Ingoing) Mirror Rules:**

| **Source Ports** | ![1](false) ![2](true) ![3](false) ![4](false) ![5](false) ![6](false) ![7](false) ![8](true) |
| **Divider**      | ![1](true) (1-1023) |
| **MAC Address Filter** | ![Capture All](true) ![Capture by Source](false) ![Capture by Destination](false) |
| **MAC Address**  | 0050DBFF0000 |

**Egress (Outgoing) Mirror Rules:**

| **Source Ports** | ![1](false) ![2](false) ![3](true) ![4](false) ![5](false) ![6](false) ![7](false) ![8](true) |
| **Divider**      | ![10](true) (1-1023) |
| **MAC Address Filter** | ![Capture All](true) ![Capture by Source](false) ![Capture by Destination](false) |
| **MAC Address**  | blank |

*Figure 16 — Configure Port Mirroring for 8-port Models*

Figure 16 is for an 8-port model. A 16- or 24-port screen would be similar but simply display more ports. The example has ports 2 and 3 as *Ingress Source Ports* and port 4 as the sole *Egress Source Port* — all to be copied to port 1. Since the *Ingress Divider* is 1, each frame from ports 2 and 3 will be mirrored — but only if its source address matches 0050DBFF0000. The *Egress Divider* value is 10, so only 1 in 10 frames transmitted by port 4 will be mirrored — and since the *Egress MAC Address* setting is *All*, the source/destination address field in the transmitted frames will be ignored.
4.4.4 Virtual Local Area Networks (VLANs)

A VLAN (Virtual Local Area Network) is comprised of devices grouped on some basis other than geographic location (i.e., by work group, security level, user type, or application). The devices logically behave as if tied to the same wire although they may be physically located on very different LAN segments. VLANs are configured with software, which offers much greater flexibility than hardware configuration.

A chief advantage of VLANs is that they block broadcasts and multicasts from non-VLAN ports. Most switches tend to transmit unicast frames sent only to ports involved in a conversation (directed messages) and cannot accommodate broadcast or multicast frames. VLANs keep broadcasts and multicasts within a VLAN group.

Another advantage of VLANs is that despite being physically relocated, a device can remain in the same VLAN — with no hardware reconfiguration needed. The VLAN supervisor can change/add workstations and manage load-balancing (bandwidth) far more easily than with a LAN modified only by hardware. Management software maintains a virtual image of how the logical and physical networks compare.

4.4.4.1 All Ports Should Be VLAN Ports

When VLANs are enabled on the switch, all ports should be assigned to one or more VLANs. Such ports are called VLAN ports. If a port is not assigned to a VLAN while VLANs are enabled, that port cannot receive messages from the switch. A frame received from a VLAN port will only be forwarded to those ports with which it shares a VLAN membership. If the destination belongs to another VLAN, the frame will be discarded. This topology allows networks to share a common server or router, but use different VLANs for security or performance reasons.
4.4.4.2 **VLAN Tags and VLAN Identifiers (VIDs)**

Each VLAN frame contains an 802.1Q VLAN tag having a VID (VLAN Identifier) indicating to which VLAN this message belongs. The switch can be configured to allow frames with specific VIDs to be received on specific ports within a VLAN.

VID values can range from 1 to 4094 — but only within one contiguous block of 512 values. The allowable VID blocks (ranges) are:

<table>
<thead>
<tr>
<th>Block</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–511</td>
<td>1024–1535</td>
</tr>
<tr>
<td>512–1023</td>
<td>1536–2047</td>
</tr>
<tr>
<td></td>
<td>2048–2559</td>
</tr>
<tr>
<td></td>
<td>2560–3071</td>
</tr>
<tr>
<td></td>
<td>3072–3583</td>
</tr>
<tr>
<td></td>
<td>3584–4094</td>
</tr>
</tbody>
</table>

Packets having VID values outside of the one defined block will be dropped.

4.4.4.3 **Two Types of VLANs**

The managed switch supports two types of VLANs, Port VLAN and 802.1Q VLAN. A Port VLAN is normally used to interconnect VLAN-unaware devices (such as desktop computers) which do not use VLAN tags. But 802.1Q VLANs require 802.1Q tags in the frames passing through the switch.

4.4.4.4 **VLANS and Trunking**

A problem can occur if all of the ports in a trunk do not share the same VLAN. If two trunk ports were in different VLANs and one port suffered a link failure, frames would then pass through the other port. As a result, the frames would be discarded. If more than two ports support a trunk, the problem is not quite the same because when a path fails, the alternate path is not user selectable — thus, the alternate port might or might not be in the same VLAN unless all of the ports in the trunk were in the same VLAN.

Therefore, the rule when using trunking and VLANs is for all ports in the trunk to be in the same VLAN and have the same default VID number — and every port in potential use should have a VLAN defined for it.
4.4.4.5 Core Switches and Edge Switches

A core switch is connected only to devices that are VLAN aware — thus, all frames received by a core switch should already contain 802.1Q VLAN tags. An edge switch adds VLAN tags to frames sent by non-VLAN aware devices and it removes VLAN tags from frames destined for non-VLAN aware devices. Figure 18 illustrates how core and edge switches differ in their placements within a typical network.

![Figure 18 — Core Switches and Edge Switches](image)

To function in VLAN mode, the switch requires VLAN tags. When it performs as a Port VLAN switch (connected only to non-VLAN aware devices that do not use VLAN tags), a default tag will be applied to the untagged frames entering the switch. When these frames leave the switch, the tags should be removed. The switch can act as either a core or an edge switch on a port-by-port basis — and this functionality allows the switch to isolate non-VLAN aware devices by tags and impart added security.

Figure 19 shows how an edge switch adds a VLAN tag to an untagged frame from PC1 so it can be used by the core switch and thus all of the VLAN, but the edge switch also removes the tag from the frame destined for the VLAN-unaware PC2.

![Figure 19 — Edge Switches Add or Drop VLAN Tags as Needed](image)
4.4.4.6 Creating VLAN Groups and VIDs

When creating VLANs, several steps and two pages are needed to complete the configuration. The first step is to define each VLAN Group. Because 8-port switches can have up to 9 VLAN groups but 16- or 24-port switches can have up to 30 VLAN groups, the pages differ. Move between pages via the link at the bottom of each page.

For an 8-port switch, the first 7 groups are on Page 1 (Figure 20) and the last 2 groups are atop Page 2 (Figure 22). For 16- and 24-port units, all groups are defined on Page 1. Each group can have its Status “Enabled” or “Disabled” and is assigned a default VID. Set the Group Members (ports) via these drop-down options: In each group, a port can be omitted (--) or be a Member with No filter (MN) or a Member with a Filter (MF).

**NOTE:** 8-port units (Figure 20) have a dedicated row of settings for each group, but larger switches have a bank of settings used for all groups. That is, the settings atop Figure 21 could be used for any group but actually apply to that specified in the Group No. box — and your settings are confirmed in the read-only scrollable display lower down the page.

When a VLAN frame leaves the switch, take care regarding the VLAN tag it contains. In Port VLAN mode as shown in Figure 19, the switch will insert a VLAN tag into any frame arriving from a non-VLAN-aware device. When the frame exits the switch, the tag could cause a problem if the receiving device is not VLAN-aware.

In an 802.1Q-compliant network, does the unit act as a core switch or an edge switch? If acting as a core switch, VLAN tags should be kept in the frame. For an edge switch, VLAN tags should be removed from those ports connected to non-VLAN-aware devices.

**NOTE:** A switch can act as both a core and edge switch on a port-by-port basis.

To remove tags from frames destined for a non-VLAN-aware device such as PC2 in Figure 19, choose the “MF” option as for most ports in Figure 20. (The only port not filtering egress tags is port 2 of group 1). A core switch should have all selected ports set to “MN” since each of its ports needs to pass frames with tags intact (unfiltered).

### Figure 20 — Configure VLAN Groups and VIDs for 8-port Models

<table>
<thead>
<tr>
<th>Group</th>
<th>VID</th>
<th>Members and Tag Filter</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Apply</td>
<td>1</td>
<td>1...</td>
<td>MN</td>
</tr>
<tr>
<td>2 Apply</td>
<td>2</td>
<td>1...</td>
<td>2...</td>
</tr>
<tr>
<td>3 Apply</td>
<td>3</td>
<td>1...</td>
<td>2...</td>
</tr>
<tr>
<td>4 Apply</td>
<td>4</td>
<td>1...</td>
<td>2...</td>
</tr>
<tr>
<td>5 Apply</td>
<td>5</td>
<td>1...</td>
<td>2...</td>
</tr>
<tr>
<td>6 Apply</td>
<td>6</td>
<td>1...</td>
<td>2...</td>
</tr>
<tr>
<td>7 Apply</td>
<td>7</td>
<td>1...</td>
<td>2...</td>
</tr>
</tbody>
</table>
4.4.4.7 Management Port

Below the group settings is the “Management Port” checkbox (appearing repeatedly below each row in Figure 20 or singly atop Figure 21). For a VLAN group to extend management functionality to any of its ports, the Management Port must be included as a member. This port does work solely within the Ethernet controller chip — it has no physical port. A VLAN group that excludes this port can add security to its ports — but such a group cannot support IGMP Snooping, the web server or SNMP.

For 8-port models, modify a VLAN group via the individual groups in Figure 20. For 16- and 24-port switches (using the features shown in Figure 21), enter the Group number you wish to modify then click the Modify Group No button. This populates the top portion of the screen with current settings for the selected Group No. You can then make changes and click Apply. The modified settings can be confirmed by checking the read-only text box in the lower section of the webpage as shown in Figure 21.
4.4.4.8 Example of VLAN Configuration

See Figure 20 where only the first three Groups have been defined as follows:

- **Group 1** consists of ports 2, 3, 4 and the “Management Port”.
- **Group 2** consists of ports 4, 7 and 8 (“Management Port” omitted).
- **Group 3** consists of ports 1, 6, 7 and the “Management Port”.

For the Groups listed above (and assuming VLANs are enabled), note the following:

Groups 1 and 3 include the “Management Port” — therefore, ports 1, 2, 3, 4, 6 and 7 will have full management functionality when their Groups are “Enabled”.

**Group 3**, however, will not currently function because it is “Disabled”. Also, because ports 1 and 6 are included only in Group 3, these two ports cannot communicate whatsoever as long as their Group is “Disabled”.

**Group 2** is “Enabled”, but it does not include the “Management Port” — so ports 4, 7 and 8 seem to have no access to management functions. However, port 4 is an **overlapping port** and still has management due to its membership in **Group 1**. Port 8 will be unmanaged as long as it is defined only in a VLAN that excludes the “Management Port” — even if that VLAN is enabled. **NOTE:** If **Group 2** were disabled, its members could be managed.

Finally, port 5 is not in any VLAN so it **cannot communicate** unless VLANs are disabled.

4.4.4.9 Configure VLAN Frame Drop Rules

Our managed switches support the ability to drop non-802.1Q frames (frames without VLAN tags) on a port-by-port basis. This is a useful feature for core switches because untagged frames could be received due to the improper configuration of an edge switch.

This can **add extra security** because a correct VID value does not guarantee a frame will travel through the switch — **the ingress port must also belong to the defined group** to pass the frame through the switch. When **Drop VID Violation Frame** is **Enabled** (for only the selected ports), this is what happens: When a frame arrives at the switch, its VID tag is examined to confirm that the port through which the frame enters is part of the group using this tag. If the port does not belong to the group, the frame will be dropped.

For an 8-port unit, the Drop Rule settings are shown in Figure 22, second panel. For models with more ports, they are displayed as atop Figure 23.

4.4.4.10 Configure 802.1Q VLAN Tag

For frames from a non-VLAN device to function in a VLAN, the default VID tag of the ingress port through which they pass **must match the VID of the group** to which the frames are destined. (The VLAN group must also be enabled.)

For an 8-port unit, Default Tags can be set as shown in Figure 22, third panel. For models with more ports, Default Tags are shown in the second panel of Figure 23.
**Example:** Assume *Group 3* in Figure 20 has been enabled. Because the *Group* uses a VID value of “3”, a member port *will not pass frames* to fellow ports *unless* the port’s *Default Tag* has also been set to “3” as in Figure 22.

---

**Note:** Ensure the settings are correct before enabling or some ports may become inaccessible.

*Figure 22 — VLANs Settings Page 2 for 8-port Models*
### 4.4.4.11 VLAN Status

The final step in VLAN configuration is to *activate global VLAN functionality* for the switch using the bottom panel of Page 2. The default setting is *Disabled*.

**Figure 23 — VLANs Settings Page 2 for 24-port Models**

(The 16-port model webpage is similar except that ports 17–24 are not present.)
4.4.4.12 Port VLAN Security Example

Suppose that 3 computers on ports 1, 2 and 3 must talk to a printer on port 4, but not with each other — and none of these devices is VLAN-aware. One way to accomplish this is to define 4 VLANs, assign each included port the option “MF” (enabling its Tag Filter) and match the Default Tags to the VIDs as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>VID</th>
<th>Member Ports</th>
<th>Default Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1 &amp; 4</td>
<td>Port 1 = 1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2 &amp; 4</td>
<td>Port 2 = 2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3 &amp; 4</td>
<td>Port 3 = 3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>1, 2, 3 &amp; 4</td>
<td>Port 4 = 4</td>
</tr>
</tbody>
</table>

Ports 1, 2 and 3 do not talk to each other because each port uses a different tag. However, each port’s tag is shared with port 4. The printer on port 4 can still talk to ports 1, 2 and 3 using its own tag (4).
4.4.5 Configure Filtering and Forwarding Table

An Ethernet switch learns which devices are tied to which ports by monitoring the traffic carried through the switch. This information (MAC addresses and the ports to which they are attached) is stored in the **address table** which holds up to 4000 address/port associations. The switch will only transmit traffic destined for a registered address via the specific port associated with that address. The table behaviour follows.

During frame reception, the frame’s destination address is compared with table entries for a possible match. If a match is found, the port associated with the address is noted from the table and the frame is directed to that port only. If no match is found, the frame is flooded (transmitted) to all ports.

During the reception of a **unicast** frame, the frame’s source address is also compared with table entries for a match. If a match is not found, the unregistered address (and the port by which it arrived) will be added to the table. However, the address will NOT be saved if the frame is from the Management Port or if the frame has an error or is illegal in length — or if the table has no room for the new entry.

If a port-device association is not refreshed within the address table’s “MAC aging time”, its information will be discarded. Figure 24 displays the typical MAC aging time of 300 seconds, but this can be set as high as 1048575 seconds (over 12 days).

<table>
<thead>
<tr>
<th>MAC Aging Time (seconds)</th>
<th>300</th>
<th>(Default = 300, Max = 1048575)</th>
</tr>
</thead>
</table>

**Figure 24 — Configure Filtering and Forwarding Table**

The screen of Figure 24 also provides options to display the two additional screens of the **Configure Filtering and Forwarding Table**: **Configure Multicast Filtering Table** (Section 4.2.5.5.1) and **Configure Static Forwarding Table** (Section 4.2.5.5.2).
4.4.6 Configure Multicast Filtering

A multicast message is one destined for two or more Ethernet devices. By default, the switch transmits such a message over all of its ports. However, the switch can filter up to ten multicast addresses so that messages sent to these addresses will only exit the switch via certain designated ports. The switch also supports IGMP Snooping which allows automatic filtering of multicast messages for devices that support multicasting as described in Section 4.4.12. The screen of Figure 25 is for an 8-port switch. A screen for a 16- or 24-port model would function the same but display more ports. The user must enter the multicast MAC Address to represent each multicast group, the Ports that will carry messages to that group and the Priority of those messages. By default, each address is assigned a Priority of “Low”.

![Multicast Filtering and Forwarding Table]

When defining or editing a group, the “Apply” button must be clicked to register settings for that group — before editing another group or refreshing the screen — or the edits will be lost. When editing many addresses per session, many browser screens will accumulate in the browser’s history — thus, proceeding to another switch function is best done with the onscreen navigation links, instead of the browser’s “back” button.

For an address to be accepted as a valid multicast address, its second digit must be odd. If the second digit is even, the error screen of Figure 26 will result.

![Not a Multicast Address]
4.4.6.1 Configure Static Forwarding

The forwarding (address) table (Figure 27) can hold not only learned addresses, but also up to 30 static unicast addresses (on two screens, each of 15 addresses). Static addresses perform as if learned, but are not subject to the aging process. *Priority* is applied to messages sent to each defined MAC address via its specified *Egress Port*.

When defining or editing a group, the “Apply” button must be clicked to register settings for that group — **before** editing another group or refreshing the screen — or the edits will be lost. When editing many addresses per session, many browser screens will accumulate in the browser’s history — hence, proceeding to another switch function is best done with the onscreen navigation links, instead of the browser’s “back” button.

![Configure Filtering and Forwarding Table](image)

*Figure 27 — Static Forwarding Table*
4.4.7 Configure Quality of Service (QoS)

In addition to the MAC-based priority applied in multicast filtering and static forwarding, the switch can assign other types of priority to its traffic to achieve various levels in what is known as Quality of Service (QoS). It can do this regardless of frame content (Port QoS) or by examining the content of every frame received by a port and assigning priority based on the port of origin. The default screen displayed in Figure 28, shows that QoS Status must be enabled before any (or all) of these methods can be applied. At the bottom of the screen there are links to three configuration subscreens — one for each type of QoS.

![Configure Quality of Service (QoS)](image)

Although not recommended, all types of priority can be active simultaneously — giving rise to conflicts. The following hierarchy shows how these conflicts are resolved:

1. If Port QoS is enabled, apply its rules — otherwise,

2. If TOS/DiffServ Priority is enabled, apply its rules — otherwise,

3. If 802.1p Priority is enabled, apply its rules — otherwise,

4. Apply the MAC-based priority used in multicast filtering and static forwarding.
4.4.7.1 Configure Port QoS

When QoS is enabled, *Flow Control* for each port can be enabled or disabled and two levels of *Port Priority* applied. This is the highest method of priority and it is known as *Port QoS*. For QoS to be most effective, it is recommended that each port have its flow control disabled (the default setting). When a port is operating in half-duplex mode, flow control is accomplished with backpressure. But in full-duplex mode, flow control is accomplished using the PAUSE protocol. Either method of flow control can affect the ability of a port to deliver messages and can cause some messages to be delayed.

In the 24-port switch example of Figure 29, Port 2 has been configured for “High” priority while all other ports are set to “Normal”. But Port 1 (set to “Normal” priority) is the only port on which Flow Control will function — because only it has had *Flow Control* enabled.

At the bottom of the screen there are two links to the other types of QoS.

![Configure Port QoS](image)

*Figure 29 — Configure Port QoS for a 24-port Switch*
4.4.7.2 Configure 802.1 Priority

The IEEE 802.1p extension of IEEE 802.1Q prioritises traffic at the data-link/MAC layer through a 3-bit header field which was never articulated in the original VLAN standard. IEEE only suggests 802.1p definitions; it does not mandate them.

The upper panel of Figure 30 shows an 8-port switch example in which 802.1p priority can be applied individually to ports. (For 16- and 24-port models, the screen would function the same but with more ports shown.) The lower panel shows that the switch provides 4 priority queues to which the 8 tags can be mapped in various schemes.

### Configure 802.1p Priority:

<table>
<thead>
<tr>
<th>Port</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>2</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>3</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>4</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>5</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>6</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>7</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
<tr>
<td>8</td>
<td>[ ] <strong>Enable</strong> [ ] <strong>Disable</strong></td>
</tr>
</tbody>
</table>

[Apply]

### Map 802.1p Priority:

<table>
<thead>
<tr>
<th>Tag</th>
<th>Priority Queue</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Normal</td>
</tr>
<tr>
<td>3</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>High</td>
</tr>
</tbody>
</table>

[Apply]

Configure Port QoS | Configure TOS/DiffServ Priority

*Figure 30 — Configure 802.1p Priority*
4.4.7.3 Configure TOS/DiffServ Priority

When configuring the TOS/DiffServ priority, a detailed screen of three tables appears. Each table — upper, middle and lower — is discussed and illustrated individually in turn. At the bottom of the screen there are two links to the other types of QoS.

Upper Table — Configure TOS/DiffServ Priority

The user must first decide which service to be used: TOS or DiffServ. This choice is made in the top-right portion of the upper table shown in the default screen of Figure 31 which displays a screen for an 8-port model. Screens for 16- and 24-port models function the same — but simply display more ports.

The IP header contains an eight-bit field originally known as the Type of Service (TOS) field — but TOS priority had little acceptance. Subsequently, these eight bits were redefined to become the more popular Differentiated Services (DiffServ) field.

Regardless of the type of QoS chosen, each port (disabled by default) must be individually enabled to establish its QoS service.

After the choice of service has been made and the port behaviours determined, these parameters must be registered by clicking the “Apply” button immediately below the table before editing the other tables or leaving this screen or refreshing this screen. Otherwise, the upper-table settings will be lost.

![Configure TOS/Diff Serv Priority:](image)

*Figure 31 — Configure TOS/DiffServ Priority for an 8-port Switch*
Middle Table — Map TOS Precedence and Priority Queue

Although TOS priority is supported by few TCP/IP implementations, it is provided as a QoS option in managed switches from Contemporary Controls. One of the earliest methods of QoS for Internet Protocol, TOS uses the second octet (the TOS field) of the IP frame header — as described in RFC791 and RFC1349. The first three bits of this octet set the priority (*Precedence*). The next four bits (known as the TOS bits) define the tradeoffs among these four service objectives:

- minimize monetary cost (*M-Type Priority*) *
- maximize reliability (*R-Type Priority*)
- maximize throughput (*T-Type Priority*)
- minimize delay (*D-Type Priority*)

* This is sometimes referred to as “C-Type” priority or type of service.

The final bit of the TOS field was unused until DiffServ was defined.

---

**Map TOS Precedence and Priority Queue:**

<table>
<thead>
<tr>
<th>M-Type Priority</th>
<th>R-Type Priority</th>
<th>T-Type Priority</th>
<th>D-Type Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Low</td>
<td>0 Low</td>
<td>0 Low</td>
<td>0 Low</td>
</tr>
<tr>
<td>1 Low</td>
<td>1 Low</td>
<td>1 Low</td>
<td>1 Low</td>
</tr>
<tr>
<td>2 Normal</td>
<td>2 Normal</td>
<td>2 Normal</td>
<td>2 Normal</td>
</tr>
<tr>
<td>3 Normal</td>
<td>3 Normal</td>
<td>3 Normal</td>
<td>3 Normal</td>
</tr>
<tr>
<td>4 Medium</td>
<td>4 Medium</td>
<td>4 Medium</td>
<td>4 Medium</td>
</tr>
<tr>
<td>5 Medium</td>
<td>5 Medium</td>
<td>5 Medium</td>
<td>5 Medium</td>
</tr>
<tr>
<td>6 High</td>
<td>6 High</td>
<td>6 High</td>
<td>6 High</td>
</tr>
<tr>
<td>7 High</td>
<td>7 High</td>
<td>7 High</td>
<td>7 High</td>
</tr>
</tbody>
</table>

*Apply*

*Figure 32 — Map TOS Precedence and Priority Queue*
Sometimes called the “second generation of Internet QoS”, Differentiated Services (DiffServ) was first described by RFC2474 which redefines the TOS octet to allocate its first six bits as the Differentiated Services Code Point (DSCP). The DSCP field selects the per-hop behaviour (PHB) which defines how packets are queued at network nodes. RFC 2475 describes DiffServ methods for implementing scalable differentiated services on the Internet.

<table>
<thead>
<tr>
<th>DSCP</th>
<th>Priority</th>
<th>DSCP</th>
<th>Priority</th>
<th>DSCP</th>
<th>Priority</th>
<th>DSCP</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>16</td>
<td>Normal</td>
<td>32</td>
<td>Medium</td>
<td>48</td>
<td>High</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>17</td>
<td>Normal</td>
<td>33</td>
<td>Medium</td>
<td>49</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>18</td>
<td>Normal</td>
<td>34</td>
<td>Medium</td>
<td>50</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Low</td>
<td>19</td>
<td>Normal</td>
<td>36</td>
<td>Medium</td>
<td>51</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Low</td>
<td>20</td>
<td>Normal</td>
<td>36</td>
<td>Medium</td>
<td>52</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Low</td>
<td>21</td>
<td>Normal</td>
<td>37</td>
<td>Medium</td>
<td>53</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Low</td>
<td>22</td>
<td>Normal</td>
<td>38</td>
<td>Medium</td>
<td>54</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Low</td>
<td>23</td>
<td>Normal</td>
<td>39</td>
<td>Medium</td>
<td>55</td>
<td>High</td>
</tr>
<tr>
<td>8</td>
<td>Low</td>
<td>24</td>
<td>Normal</td>
<td>40</td>
<td>Medium</td>
<td>56</td>
<td>High</td>
</tr>
<tr>
<td>9</td>
<td>Low</td>
<td>25</td>
<td>Normal</td>
<td>41</td>
<td>Medium</td>
<td>57</td>
<td>High</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>26</td>
<td>Normal</td>
<td>42</td>
<td>Medium</td>
<td>58</td>
<td>High</td>
</tr>
<tr>
<td>11</td>
<td>Low</td>
<td>27</td>
<td>Normal</td>
<td>43</td>
<td>Medium</td>
<td>59</td>
<td>High</td>
</tr>
<tr>
<td>12</td>
<td>Low</td>
<td>28</td>
<td>Normal</td>
<td>44</td>
<td>Medium</td>
<td>60</td>
<td>High</td>
</tr>
<tr>
<td>13</td>
<td>Low</td>
<td>29</td>
<td>Normal</td>
<td>45</td>
<td>Medium</td>
<td>61</td>
<td>High</td>
</tr>
<tr>
<td>14</td>
<td>Low</td>
<td>30</td>
<td>Normal</td>
<td>46</td>
<td>Medium</td>
<td>62</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Low</td>
<td>31</td>
<td>Normal</td>
<td>47</td>
<td>Medium</td>
<td>63</td>
<td>High</td>
</tr>
</tbody>
</table>

Configure Port QoS | Configure 802.1p Priority

Figure 33 — Map DiffServ DSCP and Priority Queue
4.4.8 Configure Fault Relay

The switch has a relay output that can be used to signal the occurrence of one or more events. The screen of Figure 34 has two panels — one for relay Settings and one to Monitor Fault Condition — and shows that the relay can indicate the loss of a link or presence of a link on one or many ports.

4.4.8.1 Settings

Port Monitoring (link monitoring of specific ports) can be either Enabled or Disabled.

Relay State determines the behaviour of the relay. By selecting “Make on Fault”, it will close its contacts once a fault is detected. “Break on Fault” will cause the relay to normally keep its contacts closed and open them upon detection of a fault. A fault is active when the condition of a monitored link or port matches its monitored state (see 4.4.8.2).

Relay Automation Time After Startup specifies a port-monitoring delay which allows the switch to stabilize for 1 to 999 seconds after startup. This is provided because, after startup, several seconds may be required for the switch to complete auto-negotiation of the data rate and duplex mode for each port. If the relay were not inhibited during this time, it could repeatedly activate without a true fault existing.

Relay Reset Method is “Automatic” by default, but can be set to ”Manual”. In “Manual” mode, clicking on “Clear Relay” will reset the relay.

4.4.8.2 Monitor Fault Condition

As displayed in Figure 34, the user can monitor three conditions on a port-by-port basis:

Ignore (the default) removes the port from link monitoring.

No Link (read only) reports a fault, (relay activated) if the link for the port has been lost.

Link Present (read only) reports a fault (relay activated) if a link has been detected on the port. This option is commonly used as a security feature to detect unauthorized connections to the switch.

Current Faults (read only) displays conditions when the screen first appears. While on screen, this report is static; it will only be updated if the refresh option is selected.

After relay activation is noted, the fault should be corrected. If No Link monitoring is in force, this will require restoration of a broken link or repair of the defective device to which the switch is connected. On the other hand, if Link Present monitoring is in use, removing the offending cable or end device will be required.

The Status LED on the switch front panel displays a heartbeat blink every 5 seconds during normal operation. If a fault occurs, it blinks every second — except that EIDX models maintain the 5-second heartbeat and the LED turns red to indicate a fault.

The example of Figure 34 is for an 8-port model. Screens for 16- and 24-port models would Function the same — but display more ports.
**Figure 34 — Configure Fault Relay for an 8-port Model**

<table>
<thead>
<tr>
<th>Settings:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Monitoring</td>
<td>Enable</td>
<td>Disable</td>
</tr>
<tr>
<td>Relay State</td>
<td>Break on Fault</td>
<td>Make on Fault</td>
</tr>
<tr>
<td>Relay Automation Time After</td>
<td>1</td>
<td>(1-999 seconds)</td>
</tr>
<tr>
<td>Power Up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relay Reset Method</td>
<td>Automatic</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Clear Relay</td>
<td></td>
</tr>
</tbody>
</table>

**Monitor Fault Condition:**

<table>
<thead>
<tr>
<th>Port</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Link</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Link Present</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Faults</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
</tbody>
</table>

**Apply**
4.4.9 Configure Redundancy

Each managed switch from Contemporary Controls offers you a choice between the standard protocols known as Spanning Tree Protocol or Rapid Spanning Tree Protocol and the proprietary redundancy protocol known as RapidRing®. By default, the screen of Figure 35 displays RSTP and its basic parameter values for this switch.

To choose RapidRing as your redundancy scheme, select the RapidRing® button in the upper panel of the screen. Once this is done, a new screen appears with the options of Figure 38 — but before adjusting these values as described in Section 4.4.9.3.4, you should be familiar with all of the material discussed in Section 4.4.9.3.

4.4.9.1 Rapid Spanning Tree Protocol

Rapid Spanning Tree Protocol (RSTP) provides network path redundancy but without data loops that are prohibited. If more than one active path exists between two stations, a confused forwarding algorithm could transmit duplicate frames — one along each path.

RSTP constructs a tree of all RSTP-compliant switches in the network. To avoid loops, it forces each redundant path into an inactive state. If a segment is interrupted, an algorithm reconfigures the tree by quickly activating a normally unused link to substitute for the failed link.

By the exchange of messages, each switch in the tree collects information on all other switches. This information includes switch and port priorities, Media Access Control (MAC) addresses and path merit figures called "port costs". This exchange results in the election of one switch to perform as the root switch (the logical centre of the tree) and also defines how ports are to be used on all other switches. The root port on a switch will send traffic to the root switch along the most efficient path. If the root port is disrupted, a backup port is activated as the substitute. A designated port provides the best path for root-bound traffic from outlying switches. If the designated port is disrupted, an alternate port is activated as the substitute.

If all RSTP-compliant switches in the network are enabled with default settings, the switch with the lowest MAC address is elected the root switch. But due to network traffic and architecture issues, the elected switch might not be the best to serve as the root device. You can manually force the switch of your choice to serve as the root device by increasing its priority so that the root-election algorithm chooses it as the root.

In general, you should configure your RSTP network so that the paths with the greatest bandwidth are those which support traffic for the root switch. For conveying root traffic, a fibre optic link would be preferred over a copper link and a 100 Mbps link would serve better than one operating at 10 Mbps. Also, the tree should consist of only of devices that are RSTP-compliant — non-compliant switches and hubs, if used at all, should only occupy the periphery of the tree because they will not forward the special messages needed for the construction and maintenance of the tree.
4.4.9.2 Configure Spanning Tree Protocol

The second panel of Figure 35 (Configure STP) allows you to either Disable (the default) or Enable the protocol.

The third panel (Bridge Settings) is explained in Section 4.4.9.2.1.
The fourth panel (STP Port Settings) is explained in Section 4.4.9.2.2.
The fifth panel (STP Port Settings) is explained in Section 4.4.9.2.3.

Figure 35 — Configure Spanning Tree Protocol for 8-port Models

TD020851-0MG
4.4.9.2.1 Bridge Settings  (Figure 35, third panel)

Hello Time
This is the interval at which the root device transmits a configuration message. The default value is 2 seconds, and can be set from 1–10 seconds. But if the result of the equation

\[(\text{Max Age} / 2) - 1\]

is less than 10, the maximum Hello Time will be the calculated value.

Version
The original 1990 link-management specification in IEEE802.1D, Clause 8, described path redundancy via the Spanning Tree Protocol (STP). In 1999 STP was superseded by the Rapid Spanning Tree Protocol (RSTP) of IEEE802.1D, Clause 17. The RSTP interoperates with STP, but if RSTP-compliant switches are used in the same network with legacy STP-compliant switches, rapid reconfiguration may not be possible. RSTP is the default selection for managed switches from Contemporary Controls.

Priority
You can adjust the switch priority in steps of 4096 (the default is 32768) as follows:

0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440.

Max Age
This is the maximum number of seconds a device waits to receive a configuration frame before attempting to reconfigure. The default value is 20 seconds, and it can be set from 6–40 seconds. However, actual minimum and maximum limits may be imposed by calculations based on the Hello Time and Forward Time as follows:

If the result of the equation

\[2 \times (\text{Hello Time} + 1)\]

is more than 6, the minimum Max Age will be the calculated value.

If the result of the equation

\[2 \times (\text{Forward Time} - 1)\]

is less than 40, the maximum Max Age will be the calculated value.

Forward Delay
This is the time a device will wait before changing states. Each device must receive topology information before it forwards frames and each port needs time to listen for any information that might force it to a discarding state. The default value is 15 seconds, and can be set from 4–30 seconds. But if the result of the equation

\[(\text{Max Age} / 2) + 1\]

is more than 4, the minimum Forward Delay will be the calculated value.

Root ID
This read-only value is the MAC Address of the root switch. However, if the switch under consideration is the root switch, it reports as “Self”.

NOTE: The value limits for Hello Time, Max Age and Forward Delay will only be imposed if the RSTP/STP field has been Enabled.
4.4.9.2.2 **STP Port Settings**  (Figure 35, fourth panel)

The example shows the screen for an 8-port unit. The screen for a 16- or 24-port device would extend the panel to include all appropriate ports. In this panel you can adjust:

**Priority** (of an individual port)

With the Priority field, you can modify the priorities of individual ports to affect RSTP path choices in the local vicinity of the switch. A lower value means a higher priority. Priority settings differ from path costs which are cumulative in calculating a total path from periphery to root. The Priority value only acts locally so you can force RSTP to favour a certain path emerging from the switch in question when two paths from the switch are otherwise equal. This field’s default value is 128 and its value can be toggled in 16 steps from 0–240 where each increment has a value of 16.

**Path Cost**

In determining the most efficient path for conveying messages between the periphery of the tree and its root, one of the factors RSTP relies on is “path costs”. A typical link operates at either 10 or 100 Mbps and a port sending traffic to that link is assigned a “cost” derived from the link data rate. The default for the Path Cost field is 19 (the nominal RSTP port cost for a 100 Mbps link). Nominal values of port path costs and the suggested ranges through which these values might vary in most networks are listed in Table 1. Path Cost can be set from 1–65535. When should you set a port path cost to a very high value? Although the associated link might operate at 10 Mbps, for example, the non-RSTP end of the link might have a very slow device such as a dial-up modem that could slow traffic drastically. In such a situation, you would likely want to raise this port path cost value to force RSTP to only use this path as a last resort.

<table>
<thead>
<tr>
<th>Data Rate</th>
<th>Cost Range</th>
<th>Cost Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Mbps</td>
<td>100 – 1000</td>
<td>250</td>
</tr>
<tr>
<td>10 Mbps</td>
<td>50 – 600</td>
<td>100</td>
</tr>
<tr>
<td>16 Mbps</td>
<td>40 – 400</td>
<td>62</td>
</tr>
<tr>
<td>100 Mbps</td>
<td>10 – 60</td>
<td>19</td>
</tr>
</tbody>
</table>

*Table 1 — Port Path Costs*
4.4.9.2.3 **STP Port Settings**  (Figure 35, fifth panel)

The example shows the screen for an 8-port switch. The screen for a 16- or 24-port device would merely extend the panel to include all appropriate ports.

**Admin Edge State**

This option (set to *Off* by default) can be set *On* if the attached device falls outside the RSTP tree. Such a device could be an operator work station or a server. In this case, the port affected by the **Admin Edge** would be at the *edge* of RSTP *administration*. End nodes cannot cause loops, so they can pass directly into the *Forwarding* state. Setting this value to *On* provides several benefits:

- gives faster RSTP algorithm solution (convergence)
- reduces flooding needed for rebuilding address tables during reconfiguration
- eliminates an RSTP reconfiguration if the port changes state
- improves other RSTP-related timeout issues

**Non STP State**

By default, each port has this parameter set to *Off* so the port can participate in RSTP. Setting this value to *On* will remove the port from RSTP, making the port immediately and constantly available for packet switching — regardless of any RSTP-related activities.
4.4.9.3 RapidRing®

4.4.9.3.1 Characteristics of RapidRing

RapidRing technology from Contemporary Controls provides high speed redundancy in Ethernet networks. It allows recovery in under 300 ms.

RapidRing is wired in a simple ring structure (see Figure 36) using the two RapidRing Ports (RRPs) on each switch. For EICP_M, EISK_M and EISX_M models, these are ports 7 and 8. For EIDX_M models, these are ports 1 and 2. Every link in the ring must connect by one RRP of one switch to the alternate RRP on the adjacent switch. Thus, port 7 ties to port 8 — or for the EIDX_M, port 1 ties to port 2. A properly constructed ring will never have a link between identical ports of adjacent switches. The ring ports can be wired with copper or fibre optic cable — depending on the model of switch.

As shown in Figure 36, one switch must be selected as the “master” that activates the backup link if a ring failure occurs. For EICP_M, EISK_M and EISX_M models, the backup link must tie to the master through port 8 which remains inactive during normal network activity. For EIDX_M models, the backup link of the master is port 2. If a cable failure is detected, the master will activate its backup port to maintain communications.

**NOTE:** Upon enabling RapidRing, the switch will automatically reboot.

Fault relays and status LEDs work independent of RapidRing. If RapidRing is enabled and the RRPs are being monitored, the following applies: When a break occurs, each switch losing connectivity will flash its Status LED and activate its Fault Relay (and regardless of port monitoring, it will transmit a link-down SNMP trap). The break is thus located to the link between the two fault-reporting switches. Once the cable is repaired by the user, the fault relays will disengage and the status LEDs will glow solid to indicate the ring network is properly connected.

**NOTE:** A flashing Status LED and Fault Relay activation do not necessarily indicate a ring failure. If you are monitoring non-ring ports, the failure report might indicate a non-ring issue. However, ring failure in a properly constructed ring will be reported by two adjacent ring switches — a situation that will not occur for non-ring switch issues.
4.4.9.3.2 **RapidRing and Other Management Features**

As a rule, when the RRP\s are used for the RapidRing, they should not be involved with other management features. Specific issues are described below.

**Port Parameters** — If RapidRing is enabled, port options (Figure 11, upper panel) are not available for the RRP\s. That is, the ring ports cannot be disabled nor can their configuration be changed.

**Trunking** — RapidRing and trunking cannot use the same ports. If a ring port exists as part of a trunk, the ring cannot be enabled. Either remove the ring port(s) from the trunk or disable the trunk that includes the ring port(s). Otherwise, the ring cannot be established. Once a ring is enabled, its ports cannot be added to a trunk.

**Mirroring** — RapidRing ports may be mirrored like any other port, but neither RRP should be designated as the Mirror Port (see Section 4.4.3).

**VLANs** — The RRP\s must be included in the same VLAN or in none at all.

**Multicast Filtering and Static Forwarding** — RRPs may be used for these functions, but the backup RRP (of the ring master) is normally unavailable.

**QoS** — RRPs do support QoS.

4.4.9.3.3 **Multiple RapidRings**

RapidRing will also support up 100 interconnected rings (each having its own ID number) — allowing greater flexibility of wiring and network styles. Figure 37 shows two rings connected via two redundant network links — thus protecting against failure of a single cable within the trunk. (However, the two rings could be connected by just one link, if inter-ring redundancy were not required.) The two switches providing the inter-ring connection may be either master or slave and may use any available non-RRP.

![Figure 37 — Dual RapidRings](image)

To set up the RapidRing, select **System Configuration**, then Configure Redundancy (described in Section 4.4.9) then select the RapidRing\(^\text{®}\) option. Also, if the two rings are to have redundant lines between them, configure a trunk between the two switches that connect the rings together. (See Section 4.4.2 for configuring a trunk).
4.4.9.3.4 Configure RapidRing

Each switch in a ring must be configured for ring operation. The screen of Figure 38 displays the default screen settings. There are four parameters to consider:

*Ring Status* enables or disables RapidRing functionality. Every switch in a ring must have this option enabled. Otherwise, the presumed backup protection will not exist because a link failure might not be reported to the master.

*Ring State* sets the master/slave status of the switch being configured. Only one master is defined per ring. Otherwise, the ring will not be established, some signal paths may not exist and messages could be lost.

*Ring ID* must be the range of 1–100. The default value of 1 assumes that only one ring exists. If more rings are defined, each switch must be properly assigned to its Ring — otherwise, messages might be lost. When configuring multiple rings, all switches in a particular ring must have matching Ring ID values.

In addition to the three options described above, a *Network Status* field reports the condition of the ring. The three following conditions are reported:

“Ring Not Available” is displayed when RapidRing is not enabled.

“Ring Incomplete” is displayed when RapidRing is enabled, but the master has invoked the backup link due to a primary ring failure.

“Ring Complete” is displayed when RapidRing is enabled and all links are intact.
4.4.10 Configure Rate Control

Figure 39 shows how ingress and egress port traffic can be controlled for the traffic rate and the traffic type. The default condition is for all messages to pass at 100 Mbps. At the top of the screen, select the traffic types for rate limiting (applies to both ingress and egress traffic). With rate control, bandwidth allocation can be finely controlled.

The example shows the screen for an 8-port switch. The screen for a 16- or 24-port device would merely extend the panel to include all appropriate ports.

The selected Max Bit Rate is the maximum bandwidth level for the types of messages selected. The types that are not selected will be allowed to use 100% of the port’s bandwidth. By selecting all the types, the full bandwidth of the port can be controlled. Selecting broadcast only creates a broadcast storm control with a selectable maximum bandwidth setting.

Rate control can be a useful feature for limiting communications from an unknown network. For example, when interconnecting the office and control networks.

Figure 39 — Configure Rate Control for 8-port Models

The selected Max Bit Rate is the maximum bandwidth level for the types of messages selected. The types that are not selected will be allowed to use 100% of the port’s bandwidth. By selecting all the types, the full bandwidth of the port can be controlled. Selecting broadcast only creates a broadcast storm control with a selectable maximum bandwidth setting.

Rate control can be a useful feature for limiting communications from an unknown network. For example, when interconnecting the office and control networks.
4.4.11 Configure Port Security

Figure 40 illustrates the **Configure Port Security** default screen for an 8-port switch where each port has its security disabled. (The screens for 16- and 24-port models would function the same — but display more ports.) If security is enabled for a port, no further MAC addresses are learned for that port and future transmissions through the port will only succeed if the destination is listed in the address look-up table. Because static MAC addresses are not learned (aged out of the table), they are not affected by the applied security. A convenient link to **Add Static MAC Addresses** is provided at the bottom of the screen.

![Configure Port Security Table]

**Figure 40 — Configure Port Security for 8-port Models**

This is a useful feature when connecting to an unknown network — such as connecting the office network to the control network — and can be used to limit the office devices that can access the control network.
4.4.12 Configure IGMP Snooping

Traditionally, IP messages are either unicast or broadcast, but *multicasting* can deliver messages to a select group of devices on the network. IGMP (Internet Group Multicast Protocol) is a session-layer protocol for defining membership in a multicast group. IGMP Group Destination Addresses (GDA) range from 224.0.0.0 to 239.255.255.255.

Managed switches from Contemporary Controls support IGMPv2 and can provide the *querier function* in the event no router exists in the network. Our switches implement the *general* query function in which members of *all* multicast groups report.

With *IGMP Snooping*, managed switches can recognize packets that are for multicast groups and direct those packets to *only* the destination ports. These are ports which have received IGMP “join” messages from devices that seek membership in specific multicast groups. Figure 41 illustrates the Configure IGMP Snooping default screen for an 8-port switch. (Screens for 16- and 24-port models would simply display more ports.) The available controls are listed below.

**IGMP Snooping State** enables or disables IGMP Snooping.

**IGMP Querier Function** allows the switch to initiate a query to discover multicast group membership. Only one querier is allowed on a network at a time. If a query is transmitted by a device with a lower IP address than this switch, this switch relinquishes the role of querier to that device. If another LAN device is preferred for the query function, then this option can be disabled.

**IGMP Forwarding Map** specifies the ports that will forward IGMP *join* or *leave* messages to other querying devices. Disabling ports that do not connect to querying devices can improve bandwidth.

**IGMP Query Interval (secs)** specifies how often querying occurs. This setting is meaningless if the IGMP Query Function is disabled.

**Multicast Filtering Age Out (secs)** specifies how long the switch waits before deleting an entry from its multicast group list. If no member of a group responds within this time, the group is deemed inactive and removed from the list. This time should exceed the Query Interval or else the entry may be deleted before another query occurs. The switch can accommodate up to 100 multicast groups.

![Configure IGMP Snooping](image)

*Figure 41 — Configure IGMP Snooping for 8-port Models*
4.4.13 Configure Username/Password

Both Username and Password are case sensitive and can be any combination of alphanumeric characters. The number of characters in each string can range from 0 (the default blank string) through 10 — and the two strings can match each other, if desired.

Once modified, future access will be denied unless the correct information is entered at Login — otherwise, a blank Login screen will remain on screen. After modification, the Username and Password must be saved by clicking the Apply button to overwrite old values. If you do not click the Apply button, the previous strings will still be in effect.

![Figure 42 — Configure Username/Password](image)

**NOTE:** On models having a Console Port, Username and Password can only be modified by a terminal-emulation program communicating via a null-modem cable and the Console Port. If this is not done, web browser secure access cannot be achieved.
4.5 **SNMP Configuration.**

In a large network, a Network Management System (NMS) based on the Simple Network Management Protocol (SNMP) is often used to keep track of operations. SNMP, created in 1988, is the standard protocol for managing network devices. Over TCP/IP, SNMP usually uses UDP ports 161 (SNMP) and 162 (SNMP-traps).

An SNMP implementation involves three areas of functionality: managed devices, SNMP agents and the NMS. SNMP agents reside in network devices where they use MIBs (information specific to the device) to interface the devices with the NMS — which then monitors and controls devices via these agents.

SNMP manages devices via a very small command set described in Section 5.2.6.

All models are managed via SNMP. Figure 43 displays 3 panels where users can set **SNMP Configuration, Community** and **Trap Receivers**.

---

**SNMP Configuration:**

| System Name: | Managed Switch V4.16 |
| System Location: | (Type switch location here.) |
| System Contact: | (Type contact’s name here.) |

**Community:**

<table>
<thead>
<tr>
<th>Community String</th>
<th>Access</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>public</td>
<td>Read Only</td>
<td>Valid</td>
</tr>
<tr>
<td>private</td>
<td>Read Write</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Read Only</td>
<td>Invalid</td>
</tr>
<tr>
<td></td>
<td>Read Only</td>
<td>Invalid</td>
</tr>
</tbody>
</table>

**Trap Receivers:**

<table>
<thead>
<tr>
<th>IP Address</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0.0.138</td>
<td>Valid</td>
</tr>
<tr>
<td>0.0.0.0</td>
<td>Invalid</td>
</tr>
<tr>
<td>0.0.0.0</td>
<td>Invalid</td>
</tr>
<tr>
<td>0.0.0.0</td>
<td>Invalid</td>
</tr>
</tbody>
</table>

*Figure 43 — SNMP Configuration*
4.5.1 Configure System Information (Figure 43, upper panel)

In this panel, users can set three of the MIBs listed in Section 5.2.1.1:

- **System Name** (1.3.6.1.2.1.1.5.0)
- **System Location** (1.3.6.1.2.1.1.6.0)
- **System Contact** (1.3.6.1.2.1.1.4.0)

4.5.2 Configure SNMP Community (Figure 43, middle panel)

Managed devices are grouped into “communities” wherein every device has the same "community string" (aka “community name”) to be able to communicate via SNMP. This string assures authorized access to SNMP. Community strings can provide two types of access, read-only and read-write. Read-only access allows only `get` and `get-next` commands. Read-write access allows `get`, `get-next` and `set` commands.

Up to four SNMP community names can be defined — each specifying either read-only access or read/write access. Before an access can be used, it must be set to `Valid`.

Each community has three parameters to be configured:

- **Community String** is the name (up to 10 characters) created by the user. It functions as a password to be used by any SNMP management software which accesses the switch.
- **Access** is chosen by the user to be either “Read Only” or "Read Write”.
- **Status** is chosen to be either “Valid” (string enabled) or “Invalid” (string disabled).

Figure 43 shows that two community strings are, by default, pre-defined and valid: “public” (set for read-only access) and “private” (set for read-write access). (Several commonly-available SNMP manager applications use `public` and `private` as default strings.)

4.5.3 Configure SNMP Trap Receivers (Figure 43, lower panel)

An SNMP Trap is a message that is transmitted when a trap event occurs. The menu in Figure 43 allows up to four trap receiver IP addresses to be defined and each must be marked `Valid` for it to be used. Each valid trap receiver will receive a trap message upon a trap event occurring. The switch supports traps for:

- `link-up`
- `link-down`
- `authentication failure`
- `cold start`
- `warm start`

The example of Figure 43 defines an **IP Address** for only one trap receiver — which will function because its status parameter has been set to `Valid`.

**NOTE:** For more information on SNMP support within the switch, see *Appendix 5.2.*
4.6 Performance Monitoring

Switch performance can be monitored via SNMP, web page and console menus. The Performance Monitoring options of Figure 44 are discussed below.

![Performance Monitor](image)

**Figure 44 — Performance Monitoring**

4.6.1 Browse Address Table

The **Browse Address Table** appears in Figure 45. The entire table (up to 512 entries) can be displayed or a particular MAC address can be located. In the Sort By field, select the type of search (Sequence or MAC Address) then click the Display button.

If many screens are needed, scroll bars allow viewing all located MAC addresses by the MAC Address and its associated port. Under Status, “VALID” means the entry has not been aged from the table, “INVALID” means it has been aged or deleted by the user and may be replaced when a new entry is added, “STATIC” means it is controlled by the management CPU and automatic learning and aging of the entry will not occur.

![Browse Address Table](image)

**Figure 45 — Browse Address Table**
4.6.2 Traps Log

The **Traps Log** of Figure 46 reports SNMP traps sent since the last Cold Start and the number of seconds that have passed since the Cold Start occurred (at time zero).

| Traps Log: |
|---|---|---|
| **Secs Since Startup** | **Type** | **Port** |
| 0 | Cold Start | |
| 56711 | Link Down | 4 |
| 56712 | Link Up | 4 |
| 60886 | Link Down | 5 |
| 60892 | Link Up | 5 |

*Figure 46 — Traps Log*

4.6.3 Monitor STP Port Status

The screens of Figure 47 (where STP is enabled) or that of Figure 48 (where STP is disabled) report the **STP State**, **Link Status** and **Port Speed/Duplex** for each port. These show an 8-port switch. A screen for a 16- or 24-port device would extend the panel to display the proper number of ports. The significance of the reported information is discussed on the next page.

**Monitor STP Port Status:**

<table>
<thead>
<tr>
<th>Port</th>
<th>STP State</th>
<th>Link Status</th>
<th>Port Speed/Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>2</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>3</td>
<td>Discarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>5</td>
<td>Discarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>6</td>
<td>Discarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>Discarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
</tbody>
</table>

*Figure 47 — Monitor STP Port Status (STP Enabled) for 8-port Models*

**Monitor STP Port Status:**

<table>
<thead>
<tr>
<th>Port</th>
<th>STP State</th>
<th>Link Status</th>
<th>Port Speed/Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>2</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>3</td>
<td>Forwarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>5</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
<tr>
<td>6</td>
<td>Forwarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>Forwarding</td>
<td>Down</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Forwarding</td>
<td>Up</td>
<td>100Mbps Full Duplex</td>
</tr>
</tbody>
</table>

*Figure 48 — Monitor STP Port Status (STP Disabled) for 8-port Models*
**STP State** may report any of three states:

*Forwarding* indicates the RSTP port is up and actively participating in the tree — that is, it is not currently a backup or alternate port. The port forwards frames, and continues to learn new addresses. If RSTP is **disabled** as in Figure 53, each port is reported to be in the *Forwarding* state (whether the port is *Up* or *Down*) — but this has no meaning since the tree is disabled.

*Learning* is the brief port state (as it begins to learn addresses) before its forwarding delay expires. Actually, this state is rarely reported on screen, but could be if you happen to refresh the monitor screen while a port is transitioning from *Discarding* to *Forwarding*. The *Learning* state only occurs as the tree is being restructured.

*Discarding* is reported if the port is not active in the tree. The port receives STP frames, but it does not forward frames. If the tree is stable and port states are consistent throughout the network, every root port and designated port will quickly transition through its *Learning* state to the *Forwarding* state. At the same time, all alternate and backup ports will stay in the *Discarding* state since they are not active in the tree — as is the case in Figure 47 with port 5, which is *Up* but not active.

Only RSTP port states (which superseded STP states) are shown in the monitor screen. If you wish to compare the port states of RSTP versus STP, refer to Table 2.

<table>
<thead>
<tr>
<th>Status</th>
<th>STP State</th>
<th>RSTP State</th>
<th>Active In Tree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Blocking</td>
<td>Discarding</td>
<td>No</td>
</tr>
<tr>
<td>Enabled</td>
<td>Listening</td>
<td>Discarding</td>
<td>No</td>
</tr>
<tr>
<td>Enabled</td>
<td>Learning</td>
<td>Learning</td>
<td>Yes</td>
</tr>
<tr>
<td>Enabled</td>
<td>Forwarding</td>
<td>Forwarding</td>
<td>Yes</td>
</tr>
<tr>
<td>Disabled</td>
<td>Disabled</td>
<td>Discarding</td>
<td>No</td>
</tr>
</tbody>
</table>

*Table 2 — STP & RSTP Port States Compared*

The **Link Status** column of the Monitor STP Port Status screen simply reports if a port is *Up* or *Down*. The **Port Speed/Duplex** column reports the data rate and duplex state of any port that is up — but displays no information for any port that is down. These last two columns report their information even if the RSTP/STP function is disabled — as is the case in Figure 48.

Note that for a port to be in the *Forwarding* state with RSTP enabled, its port must be *Up*.
5 Appendix

5.1 Finding an Unknown IP Address with SwitchInfo

Sometimes it can be challenging to find a switch that has had its address assigned by a DHCP server. On the Internet you can find many tools that can discover unknown devices on an IP network. We recommend our free tool: SwitchInfo available at:  

www.ccontrols.com/support/managedswitches.htm

Procedure

1. When you first access the switch — and before you change the switch’s default IP address — record its MAC address that appears on the main screen (and is found nowhere else).

2. Install the SwitchInfo application.

3. Follow the SwitchInfo instructions to scan the range of possible IP addresses that could have been assigned by DHCP. The result will display a list of all responding IP devices in the specified range. Since all managed switches made by Contemporary Controls (CC) support SNMP, examine the list for lines that begin with SNMP. The line reporting your switch will appear similar to the following sample, but will specify the particular IP address of your switch, the product series to which it belongs, its firmware version and its MAC address:

   SNMP:  10.0.0.223  Contemporary Controls EISX8M Managed Switch V5.0.8b  00:50:DB:00:13:3D

4. If the switch you are investigating is the only CC managed switch in your network, there will be only one CC found by SwitchInfo and its IP address will now be known. But if there are more CC managed switches in the network, you will need to find the line that ends with the MAC address that you recorded in Step 1 — and so the IP address reported in that line will be the one that has been assigned to your switch.

CAUTION:

- When dealing with Windows Firewall, some equipment may not be found unless firewall exceptions have been allowed. You may wish to disable the firewall until your use of SwitchInfo is complete.

- Only use SwitchInfo on networks for which you have permission. It can be deemed invasive — and subject you to disciplinary action. In some jurisdictions it might even be considered illegal — unless you have permission.
5.2 SNMP

All models provide an SNMP interface for management of the device. The switches currently support:

RFC 1157 — SNMP protocol
RFC 1213 — MIB-2
RFC 1215 — Traps for SNMP
RFC 1493 — Bridge MIB
RFC 1573 — MIB-2 Extension (IF-MIB)
RFC 1643 — Ethernet-like Interface MIB

The following MIBs are supported.

5.2.1 Managed Objects for TCP/IP Based Internet (MIB-II) — From RFC 1213

5.2.1.1 ‘System’ group 1.3.6.1.2.1.1.1.0

oid = "1.3.6.1.2.1.1.1.0"
  sysDescr: A textual description of the switch
             Access: read-only

oid = "1.3.6.1.2.1.1.2.0"
  sysObjectID: The vendor’s authoritative identification
              Access: read-only

oid = "1.3.6.1.2.1.1.3.0"
  sysUpTime: The time since the last re-initialisation
             Access: read-only

oid = "1.3.6.1.2.1.1.4.0"
  sysContact: The identification of the contact person
              Access: read-write

oid = "1.3.6.1.2.1.1.5.0"
  sysName: An administratively assigned name
            Access: read-write

oid = "1.3.6.1.2.1.1.6.0"
  sysLocation: The physical location of this node
              Access: read-write

oid = "1.3.6.1.2.1.1.7.0"
  sysServices: Indicates the set of services that this switch primarily offers
              Access: read-only
5.2.1.2 ‘Interfaces’ group 1.3.6.1.2.1.2

oid = "1.3.6.1.2.1.2.1.0"

  ifNumber: The number of network interfaces (regardless of their current state) present on this system
  Access: read-only

5.2.1.2.1 The Interfaces Table — ‘ifTable’ 1.3.6.1.2.1.2.2

oid = "1.3.6.1.2.1.2.2.1.1.ifIndex"

  ifIndex: A unique value, greater than zero, for each interface
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.2.ifIndex"

  ifDescr: Interface string contains information about the interface
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.3.ifIndex"

  ifType: Interface type = 6 if Ethernet
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.4.ifIndex"

  ifMtu: The size of the largest datagram that can be sent/received
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.5.ifIndex"

  ifSpeed: Interface speed = 100000000 for 100Base-TX
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.6.ifIndex"

  ifPhysAddress: Ethernet (MAC) address (only used for designated management port on a switch)
  Access: read-only

oid = "1.3.6.1.2.1.2.2.1.7.ifIndex"

  ifAdminStatus: The desired state of the interface
  1 = up (ready to pass packets)
  2 = down
  3 = testing
  Access: read-write

oid = "1.3.6.1.2.1.2.2.1.8.ifIndex"

  ifOperStatus: The current operational state of the interface
  1 = up (ready to pass packets)
  2 = down
  3 = testing
  4 = unknown
  5 = dormant
  Access: read-only
oid = "1.3.6.1.2.1.2.2.1.9.ifIndex"
    ifLastChange: The value of sysUpTime at the time the interface entered its current operational state
                Access: read-only
oid = "1.3.6.1.2.1.2.2.1.10.ifIndex"
    ifInOctets: the total number of octets received on the interface, 32 bit
                Access: read-only
oid = "1.3.6.1.2.1.2.2.1.11.ifIndex"
    ifInUcastPkts: The number of unicast packets received, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.12.ifIndex"
    ifInNUcastPkts: The number of non-unicast packets received, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.13.ifIndex"
    ifInDiscards: The number of inbound packets discarded with no error detected, 32 bit
                  Access: read-only
oid = "1.3.6.1.2.1.2.2.1.14.ifIndex"
    ifInErrors: The number of inbound packets with errors, 32 bit
                 Access: read-only
oid = "1.3.6.1.2.1.2.2.1.15.ifIndex"
    ifInUnknowProtos: The number of packets received via the interface which were discarded because of unknown or unsupported protocol. Returns 0.
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.16.ifIndex"
    ifOutOctets: The total number of packets transmitted, 32 bit
                  Access: read-only
oid = "1.3.6.1.2.1.2.2.1.17.ifIndex"
    ifOutUcastPkts: The number of packets transmitted to a unicast address, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.18.ifIndex"
    ifOutNUcastPkts: The number of packets transmitted to a non-unicast address, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.19.ifIndex"
    ifOutDiscards: The number of outbound packets discarded with no error detected, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.20.ifIndex"
    ifOutErrors: The number of outbound packets with errors, 32 bit
                    Access: read-only
oid = "1.3.6.1.2.1.2.2.1.22.ifIndex"
    ifSpecific: A reference to MIB definition specific to the particular media being used to realize the interface
                 Access: read-only
5.2.1.3 ‘IP’ group 1.3.6.1.2.1.4

oid = "1.3.6.1.2.1.4.1.0"

- **ipForwarding**: The indication of whether this switch is acting as an IP gateway in respect to the forwarding of datagrams received by, but not addressed to, this switch
  1 = forwarding
  2 = not forwarding
  Access: read-write

oid = "1.3.6.1.2.1.4.2.0"

- **ipDefault**: The default value inserted into the Time-To-Live field of the IP header of datagrams originated at this switch, whenever a TTL value is not supplied by the transport layer protocol
  Access: read-only

oid = "1.3.6.1.2.1.4.3.0"

- **ipInReceives**: The total number of input datagrams received from interfaces, including those received in error
  Access: read-only

oid = "1.3.6.1.2.1.4.9.0"

- **ipInDelivers**: The total number of input datagrams successfully delivered to IP user-protocols (including ICMP)
  Access: read-only

oid = "1.3.6.1.2.1.4.10.0"

- **ipOutRequests**: The total number of IP datagrams which local IP user-protocols (including ICMP) supplied to IP in requests for transmission
  Access: read-only

oid = "1.3.6.1.2.1.4.15.0"

- **ipReasmOKs**: The number of IP datagrams successfully re-assembled
  Access: read-only

oid = "1.3.6.1.2.1.4.17.0"

- **ipFragOKs**: The number of IP datagrams that have been successfully fragmented at this switch
  Access: read-only

5.2.1.3.1 The IP Address Table — ‘ipAddrTable’ 1.3.6.1.2.1.4.20

When IP address is used as input, its format should be 4 decimal fields.

oid = "1.3.6.1.2.1.4.20.1.1.<ipAdEntAddr>"

- **ipAdEntAddr**: The IP address
  Access: read-only

oid = "1.3.6.1.2.1.4.20.1.2.<ipAdEntAddr>"

- **ipAdEntIfIndex**: Physical port number associated with this particular subnet by IP address
  Access: read-only

oid = "1.3.6.1.2.1.4.20.1.3.<ipAdEntAddr>"

- **ipAdEntNetMask**: Subnet mask associated with this particular subnet by IP address
  Access: read-only
oid = "1.3.6.1.2.1.4.20.1.4.< ipAdEntAddr >"

**ipAdEntBcastAddr:** The value of the least-significant bit in the IP broadcast address = 1 for Internet standard all-ones broadcast address
    Access: read-only

oid = "1.3.6.1.2.1.4.20.1.5.< ipAdEntAddr >"

**ipAdEntReasmMaxSize:** The size of the largest IP datagram which this switch can re-assemble from incoming IP fragments
    Access: read-only

### 5.2.1.4 ‘ICMP’ group 1.3.6.1.2.1.5

oid = “1.3.6.1.2.1.5.1.0”

**icmpInMsgs:** The total number of ICMP messages which the switch received
    Access: read-only

oid = “1.3.6.1.2.1.5.2.0”

**icmpInErrors:** The number of ICMP messages which the switch received but determined as having ICMP-specific errors (bad ICMP checksums, bad length, etc.)
    Access: read-only

oid = “1.3.6.1.2.1.5.8.0”

**icmpInEchos:** The number of ICMP Echo (request) messages received
    Access: read-only

oid = “1.3.6.1.2.1.5.9.0”

**icmpInEchoReps:** The number of ICMP Echo Reply messages received
    Access: read-only

oid = “1.3.6.1.2.1.5.14.0”

**icmpOutMsgs:** The total number of ICMP messages which this switch attempted to send
    Access: read-only

oid = “1.3.6.1.2.1.5.15.0”

**icmpOutErrors:** The number of ICMP messages which this switch did not send due to problems discovered within ICMP
    Access: read-only

### 5.2.1.5 ‘TCP’ group 1.3.6.1.2.1.6

oid = “1.3.6.1.2.1.6.10.0”

**tcpInSegs:** The total number of segments received, including those received in error
    Access: read-only

oid = “1.3.6.1.2.1.6.11.0”

**tcpOutSegs:** The total number of segments sent, including those on current connections but excluding those containing only retransmitted octets
    Access: read-only

oid = “1.3.6.1.2.1.6.12.0”

**tcpRetransSegs:** The total number of segments retransmitted
    Access: read-only
5.2.1.6 ‘UDP’ group 1.3.6.1.2.1.7

5.2.1.6.1 The UDP Listener Table — ‘udpTable’ 1.3.6.1.2.1.7.5

When an IP address is used as input, its format should be 4 decimal fields.

oid = “1.3.6.1.2.1.7.5.1.1.< udpLocalAddress >.< udpLocalPort >”

  udpLocalAddress: The local IP address for this UDP listener.
  Access: read-only

oid = “1.3.6.1.2.1.7.5.1.2.<Local IP address as 4 decimal fields>.<LocalPort>”

  udpLocalPort: The local port number for this UDP listener.
  Access: read-only

5.2.1.7 ‘Transmission’ group 1.3.6.1.2.1.10

Based on the transmission media underlying each interface on a system, the corresponding portion of the Transmission group is mandatory for that system.

In this switch all interfaces are Ethernet-based — hence, the Ethernet-like interface is used.

5.2.1.8 ‘SNMP’ group 1.3.6.1.2.1.11

oid = “1.3.6.1.2.1.11.1.0”

  snmpInPkts: The total number of Messages delivered to the SNMP switch from the transport service
  Access: read-only

oid = “1.3.6.1.2.1.11.2.0”

  snmpOutPkts: The total number of SNMP Messages which were passed from the SNMP protocol switch to the transport service
  Access: read-only

oid = “1.3.6.1.2.1.11.3.0”

  snmpInBadVersions: The total number of SNMP Messages which were delivered to the SNMP protocol switch and were for an unsupported SNMP version
  Access: read-only

oid = “1.3.6.1.2.1.11.4.0”

  snmpInBadCommunityNames: The total number of SNMP Messages delivered to the SNMP protocol switch that used an SNMP community name not known to said switch
  Access: read-only

oid = “1.3.6.1.2.1.11.5.0”

  snmpInBadCommunityUses: The total number of SNMP messages delivered to the SNMP protocol switch and representing an SNMP operation that was not allowed by the SNMP community named in the message
  Access: read-only

oid = “1.3.6.1.2.1.11.6.0”

  snmpInASNParseErrs: The total number of ASN.1 or BER errors encountered by the SNMP protocol switch when decoding received SNMP Messages
  Access: read-only

oid = “1.3.6.1.2.1.11.8.0”

  snmpInTooBigs: The total number of SNMP PDUs which were delivered to the SNMP protocol switch and for which the value of the error-status field is ‘tooBig’
  Access: read-only
oid = “1.3.6.1.2.1.11.9.0”

*snmpInNoSuchNames*: The total number of SNMP PDUs which were delivered to the SNMP protocol switch and for which the value of the error-status field is 'noSuchName'
Access: read-only

oid = “1.3.6.1.2.1.11.10.0”

*snmpInBadValues*: The total number of SNMP PDUs which were delivered to the SNMP protocol switch and for which the value of the error-status field is 'badValue'
Access: read-only

oid = “1.3.6.1.2.1.11.11.0”

*snmpInReadOnlys*: The total number valid SNMP PDUs which were delivered to the SNMP protocol switch and for which the value of the error-status field is 'readOnly'
Access: read-only

oid = “1.3.6.1.2.1.11.12.0”

*snmpInGenErrs*: The total number of SNMP PDUs which were delivered to the SNMP protocol switch and for which the value of the error-status field is 'genErr'
Access: read-only

oid = “1.3.6.1.2.1.11.13.0”

*snmpInTotalReqVars*: The total number of MIB objects which have been retrieved successfully by the SNMP protocol switch as the result of receiving valid SNMP Get-Request and Get-Next PDUs
Access: read-only

oid = “1.3.6.1.2.1.11.14.0”

*snmpInTotalSetVars*: The total number of MIB objects that have been altered successfully by the SNMP protocol switch as the result of receiving valid SNMP Set-Request PDUs
Access: read-only

oid = “1.3.6.1.2.1.11.15.0”

*snmpInGetRequests*: The total number of SNMP Get-Request PDUs that have been accepted and processed by the SNMP protocol switch
Access: read-only

oid = “1.3.6.1.2.1.11.16.0”

*snmpInGetNexts*: The total number of SNMP Get-Next PDUs that have been accepted and processed by the SNMP protocol switch
Access: read-only

oid = “1.3.6.1.2.1.11.17.0”

*snmpInSetRequests*: The total number of SNMP Set-Request PDUs that have been accepted and processed by the SNMP protocol switch
Access: read-only

oid = “1.3.6.1.2.1.11.18.0”

*snmpInGetResponses*: The total number of SNMP Get-Response PDUs that have been accepted and processed by the SNMP protocol switch
Access: read-only

oid = “1.3.6.1.2.1.11.19.0”

*snmpInTraps*: The total number of SNMP Trap PDUs that have been accepted and processed by the SNMP protocol switch
Access: read-only
oid = “1.3.6.1.2.1.11.20.0”
  **snmpOutTooBigs:** The total number of SNMP PDUs that were generated by the SNMP protocol switch and for which the value of the error-status field is ‘tooBig’
  Access: read-only

oid = “1.3.6.1.2.1.11.21.0”
  **snmpOutNoSuchNames:** The total number of SNMP PDUs that were generated by the SNMP protocol switch and for which the value of the error-status is ‘noSuchName’
  Access: read-only

oid = “1.3.6.1.2.1.11.22.0”
  **snmpOutBadValues:** The total number of SNMP PDUs that were generated by the SNMP protocol switch and for which the value of the error-status field is ‘badValue’
  Access: read-only

oid = “1.3.6.1.2.1.11.24.0”
  **snmpOutGenErrs:** The total number of SNMP PDUs that were generated by the SNMP protocol switch and for which the value of the error-status field is ‘genErr’
  Access: read-only

oid = “1.3.6.1.2.1.11.25.0”
  **snmpOutGetRequests:** The total number of SNMP Get-Request PDUs that have been generated by the SNMP protocol switch
  Access: read-only

oid = “1.3.6.1.2.1.11.26.0”
  **snmpOutGetNexts:** The total number of SNMP Get-Next PDUs that have been generated by the SNMP protocol switch
  Access: read-only

oid = “1.3.6.1.2.1.11.27.0”
  **snmpOutSetRequests:** The total number of SNMP Set-Request PDUs that have been generated by the SNMP protocol switch
  Access: read-only

oid = “1.3.6.1.2.1.11.28.0”
  **snmpOutGetResponses:** The total number of SNMP Get-Response PDUs that have been generated by the SNMP protocol switch
  Access: read-only

oid = “1.3.6.1.2.1.11.29.0”
  **snmpOutTraps:** The total number of SNMP Trap PDUs that have been generated by the SNMP protocol switch
  Access: read-only

oid = “1.3.6.1.2.1.11.30.0”
  **snmpEnableAuthenTraps:** Indicates whether the SNMP agent process is permitted to generate authentication-failure traps
    1 = enabled
    2 = disabled
  Access: read-write
5.2.2 Managed Objects for Bridges — From RFC 1493

Bridge MIB — ‘dot1dBridge’ 1.3.6.1.2.1.17

5.2.2.1 ‘dot1dBase’ group 1.3.6.1.2.1.17.1

oid = “1.3.6.1.2.1.17.1.1.0"
   dot1dBaseBridgeAddress: The MAC address used by this bridge
      Access: read-only

oid = “1.3.6.1.2.1.17.1.2.0"
   dot1dBaseNumPorts: The number of ports controlled by this bridging switch
      Access: read-only

oid = “1.3.6.1.2.1.17.1.3.0"
   dot1dBaseType: Indicates what type of bridging this bridge can perform
      1 = unknown
      2 = transparent-only
      3 = sourceroute-only
      Access: read-only

5.2.2.1.1 ‘dot1dBasePortTable’ 1.3.6.1.2.1.17.1.4

oid = “1.3.6.1.2.1.17.1.4.1.1.port"
   dot1dBasePort: The port number of the port for which this entry contains bridge
      management information
      Access: read-only

oid = “1.3.6.1.2.1.17.1.4.1.2.port"
   dot1dBasePortIfIndex: The value of instance of ifIndex object defined in Interface
      group of MIB-2 for the interface corresponding to this port
      Access: read-only

oid = “1.3.6.1.2.1.17.1.4.1.3.port"
   dot1dBasePortCircuit: For a port which has the same value of dot1BasePortIfIndex as
      another port on the same bridge, this object contains the name of an object instance
      unique to this port. For a port which has a unique value of dot1dBasePortIfIndex, this
      object can have the value {0}.
      Access: read-only

oid = “1.3.6.1.2.1.17.1.4.1.4.port"
   dot1dBasePortDelayExceededDiscards: The number of frames discarded by this port
      due to excessive transmit delay through the bridge. Returns 0.
      Access: read-only

oid = “1.3.6.1.2.1.17.1.4.1.5.port"
   dot1dBasePortMtuExceededDiscards: The number of frames discarded by this port
      due to an excessive size
      Access: read-only
5.2.2.1.2 ‘dot1dStp’ group 1.3.6.1.2.1.17.2

oid = “1.3.6.1.2.1.17.2.1.0”

**dot1dStpProtocolSpecification:** Spanning Tree Protocol (STP) being run

1 = unknown(1)
2 = decLb100
3 = ieee8021d

Access: read-write

oid = “1.3.6.1.2.1.17.2.2.0”

**dot1dStpPriority:** Value of the write-able portion (first two octets) of the Bridge ID

Access: read-write

oid = “1.3.6.1.2.1.17.2.3.0”

**dot1dStpTimeSinceTopologyChange:** Time (in hundredths of a second) since the last time a topology change was detected by the bridge entity

Access: read-write

oid = “1.3.6.1.2.1.17.2.4.0”

**dot1dStpTopChanges:** Total number of topology changes detected by this bridge since the management entity was last reset or initialised

Access: read-write

oid = “1.3.6.1.2.1.17.2.5.0”

**dot1dStpDesignatedRoot:** Bridge identifier of the spanning tree root determined by the STP as executed by this node

Access: read-write

oid = “1.3.6.1.2.1.17.2.6.0”

**dot1dStpRootCost:** Path cost from this bridge to the root bridge

Access: read-write

oid = “1.3.6.1.2.1.17.2.7.0”

**dot1dStpRootPort:** Port number of the port with the lowest cost path from this bridge to the root bridge

Access: read-write

oid = “1.3.6.1.2.1.17.2.8.0”

**dot1dStpMaxAge:** Maximum age (hundredths of a second) of STP information learned from the network on any port before it is discarded

Access: read-write

oid = “1.3.6.1.2.1.17.2.9.0”

**dot1dStpHelloTime:** Interval (hundredths of a second) between transmissions of Configuration bridge PDUs by this node on any port when it is the root bridge or trying to become the root bridge

Access: read-write
oid = "1.3.6.1.2.1.17.2.10.0"

**dot1dStpHoldTime:** Interval (hundredths of a second) during which no more than two Configuration bridge PDUs shall be transmitted by this node

Access: read-write

oid = "1.3.6.1.2.1.17.2.11.0"

**dot1dStpForwardDelay:** Duration (in hundredths of a second) of a port’s Listening and Learning states preceding the Forwarding state. This value is also used to age all Forwarding Database dynamic entries when a topology change has been detected and is underway.

Access: read-write

oid = "1.3.6.1.2.1.17.2.12.0"

**dot1dStpBridgeMaxAge:** MaxAge for all bridges when this bridge is the root

Access: read-write

oid = "1.3.6.1.2.1.17.2.13.0"

**dot1dStpBridgeHelloTime:** HelloTime for all bridges when this bridge is the root

Access: read-write

oid = "1.3.6.1.2.1.17.2.14.0"

**dot1dStpBridgeForwardDelay:** ForwardDelay for all bridges if this bridge is the root

Access: read-write

5.2.2.1.2.1  'dot1dStpPortTable' 1.3.6.1.2.1.17.2.15

oid = "1.3.6.1.2.1.17.2.15.1.1.port"

**dot1dStpPort:** Port number of the port for which this entry contains STP management information

Access: read-only

oid = "1.3.6.1.2.1.17.2.15.1.2.port"

**dot1dStpPortPriority:** Value of the priority field contained in the first octet (in network byte order) of the 2 octet Port ID

Access: read-only

oid = "1.3.6.1.2.1.17.2.15.1.3.port"

**dot1dStpPortState:** Port's current STP state

1 = disabled
2 = blocking
3 = listening
4 = learning
5 = forwarding
6 = broken

Access: read-only
oid = “1.3.6.1.2.1.17.2.15.1.4.port”
   **dot1dStpPortEnable:** Port status
   1 = enabled
   2 = disabled
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.5.port”
   **dot1dStpPortPathCost:** Contribution of this port to the path cost of any paths toward the root bridge that include this port
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.6.port”
   **dot1dStpPortDesignatedRoot:** Unique Bridge Identifier of the Root Bridge recorded in the Configuration BPDUs transmitted by the Designated Bridge for the segment to which the port is attached
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.7.port”
   **dot1dStpPortDesignatedCost:** Path cost of the Designated Port of the segment connected to this port
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.8.port”
   **dot1dStpPortDesignatedBridge:** Bridge Identifier of the Designated Bridge for this port's segment
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.9.port”
   **dot1dStpPortDesignatedPort:** Port Identifier of the port on the Designated Bridge for this port's segment
   Access: read-only

oid = “1.3.6.1.2.1.17.2.15.1.10.port”
   **dot1dStpPortForwardTransitions:** Number of times this port has transitioned from the Learning state to the Forwarding state
   Access: read-only
5.2.2.2 ‘dot1dTp’ group 1.3.6.1.2.1.17.4

oid = “1.3.6.1.2.1.17.4.2.0"
  
  dot1dTpAgingTime: The timeout period in seconds for aging out dynamically learned forwarding information
  Access: read-write

5.2.2.3 ‘dot1dTpFdbTable’ 1.3.6.1.2.1.17.4.3

oid = ”1.3.6.1.2.1.17.4.3.1.1.<MAC address as 6 decimal fields>”
  
  dot1dTpFdbAddress: A unicast MAC address for which the bridge has forwarding and/or filtering information
  Access: read-only

oid = ”1.3.6.1.2.1.17.4.3.1.2.<MAC address as 6 decimal fields>”
  
  dot1dTpFdbPort: The port number where this MAC has been ‘learned’ and stored in the switch lookup table
  Access: read-only

oid = ”1.3.6.1.2.1.17.4.3.1.3. <MAC address as 6 decimal fields>”
  
  dot1dTpFdbStatus: The status of this entry.
  1 = other
  2 = invalid
  3 = learned
  4 = self
  5 = mgmt
  Access: read-only

5.2.2.4 ‘dot1dTpPortTable’ 1.3.6.1.2.1.17.4.4

oid = “1.3.6.1.2.1.17.4.4.1.1.port”
  
  dot1dTpPort: The port number of the port for which this entry contains transparent bridging management information
  Access: read-only

oid = “1.3.6.1.2.1.17.4.4.1.2.port”
  
  dot1dTpPortMaxInfo: The maximum size of the INFO (non-MAC) field that this port will receive or transmit
  Access: read-only

oid = “1.3.6.1.2.1.17.4.4.1.3.port”
  
  dot1dTpPortInFrames: The number of frames received by this port
  Access: read-only

oid = “1.3.6.1.2.1.17.4.4.1.4.port”
  
  dot1dTpPortOutFrames: The number of frames transmitted by this port
  Access: read-only

oid = “1.3.6.1.2.1.17.4.4.1.5.port”
  
  dot1dTpPortInDiscards: The number of valid frames received which were discarded by the forwarding process
  Access: read-only
5.2.3 Managed Objects for Ethernet-like Interface Types  
— From RFC 1643

Ethernet-like Interface MIB — ‘dot3’ 1.3.6.1.2.1.10.7

5.2.3.1 Ethernet-like Statistics Group — ‘dot3StatsTable’ 1.3.6.1.2.1.10.7.2

oid = “1.3.6.1.2.1.10.7.2.1.1.dot3StatsIndex”
  dot3StatsIndex: An index that identifies an interface, same value as ifIndex
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.2.dot3StatsIndex”
  dot3StatsAlignmentErrors: The number of frames received on the interface that are not an integral number of octets in length and do not pass the FCS check. This count is incremented when the alignmentError status is returned by the MAC service to the LLC.
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.3.dot3StatsIndex”
  dot3StatsFCSErrors: The number of frames received on the interface that are not an integral number of octets in length and do not pass the FCS check. This count is incremented when the frameCheckError status is returned by the MAC service to the LLC.
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.4.dot3StatsIndex”
  dot3StatsSingleCollisionFrames: The number of successfully transmitted frame on the interface for which transmission is inhibited by one collision
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.5.dot3StatsIndex”
  dot3StatsMultipleCollisionFrames: The number of successfully transmitted frame on the interface for which transmission is inhibited by more than one collision
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.6.dot3StatsIndex”
  dot3StatsSQETestErrors: The number of times that the SQE TEST ERROR message is generated by the PLS sublayer for this interface. Returns 0.
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.7.dot3StatsIndex”
  dot3StatsDeferredTransmissions: The number of frames for which the first transmission attempt on the interface is delayed because the medium is busy
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.8.dot3StatsIndex”
  dot3StatsLateCollisions: The number of times that a collisions is detected on the interface later than 512 bit-times into the transmission of a packet
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.9.dot3StatsIndex”
  dot3StatsExcessiveCollisions: The number of frames for which transmission on the interface fails due to excessive collisions
  Access: read-only
oid = “1.3.6.1.2.1.10.7.2.1.10.dot3StatsIndex”
  dot3StatsInternalMacTransmitErrors: The number of frames for which transmission
  on the interface fails due to an internal MAC sublayer transmit error
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.11.dot3StatsIndex”
  dot3StatsCarrierSenseErrors: The number of frames that the carrier sense condition
  was lost or never asserted in attempting to transmit a frame on this interface. Returns 0.
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.13.dot3StatsIndex”
  dot3StatsFrameTooLong: The number of frames received on a particular interface that
  exceed the maximum permitted frame size
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.16.dot3StatsIndex”
  dot3StatsInternalMacReceiveErrors: The number of frames for which reception on the
  interface fails due to an internal MAC sublayer transmit error
  Access: read-only

oid = “1.3.6.1.2.1.10.7.2.1.17.dot3StatsIndex”
  dot3StatsEthernetChipSet: This object contains an OBJECT IDENTIFIER that identifies
  the chipset used to realize the interface.
  Access: read-only
5.2.4  Evolution of the Interface Group of MIB-II — From RFC 1573

**MIBs for generic objects for network Interface sub-layers — ‘ifMIB’ 1.3.6.1.2.1.31**

- **MIB Objects — ‘ifMIBObjects’ 1.3.6.1.2.1.31.1**
- **Extension to the Interface Table — ‘ifXTable’ 1.3.6.1.2.1.31.1.1**

oid = “1.3.6.1.2.1.31.1.1.1.1.ifIndex”
  **ifName:** The textual name of the interface
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.2.ifIndex”
  **ifInMulticastPkts:** The number of multicast packets received, 32 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.3.ifIndex”
  **ifInBroadcastPkts:** The number of broadcast packets received, 32 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.4.ifIndex”
  **ifOutMulticastPkts:** The number of multicast packets transmitted, 32 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.5.ifIndex”
  **ifOutBroadcastPkts:** The number of broadcast packets transmitted, 32 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.10.ifIndex”
  **ifHCInOctets:** The total number of octets received on the interface, 64 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.11.ifIndex”
  **ifHCOutOctets:** The total number of octets transmitted by the interface, 64 bit
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.14.ifIndex”
  **ifLinkUpDownTrapEnable:** Indicates whether or not linkup/linkDown traps should be generated for this interface
  1 = enabled
  2 = disabled
  Access: read-write

oid = “1.3.6.1.2.1.31.1.1.1.15.ifIndex”
  **ifHighSpeed:** An estimate of the interface current bandwidth in units of 1M bits/sec
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.16.ifIndex”
  **ifPromiscuousMode:** Indicates whether this interface only accepts packets/frames addressed to this station (false) or accepts all packets/frames transmitted on the media (true). The value does not affect broadcast and multicast packets/frames.
  1 = true
  2 = false
  Access: read-only

oid = “1.3.6.1.2.1.31.1.1.1.17.ifIndex”
  **ifConnectorPresent:** Indicates whether the interface has a physical connector
  1 = true
  2 = false
  Access: read-only
5.2.5 Private Managed Objects

*MIBs for Contemporary Controls — 1.3.6.1.4.1.17384*

- **Switch Family — 1.3.6.1.4.1.17384.1**
- **Switch Series — 1.3.6.1.4.1.17384.1.1**

oid = “1.3.6.1.4.1.17384.1.1.1.0”

  - **temperature**: Indicates the internal temperature of the switch in degrees Celsius
    - Type: string
    - Access: read-only

5.2.5.1 Relay Group – 1.3.6.1.4.1.17384.1.1.2

oid = "1.3.6.1.4.1.17384.1.1.2.1.0"

  - **switchFaultStatus**: The fault status of this switch
    - Type: integer
    - 1 = fault has occurred
    - 2 = no fault has occurred
    - Access: read-only

5.2.5.1.1 Fault Table – ‘faultTable’ 1.3.6.1.4.1.17384.1.1.2.2

oid = "1.3.6.1.4.1.17384.1.1.2.2.1.ifIndex"

  - **portMonitoringFaultStatus**: Fault status for each port
    - Type: integer
    - 1 = fault has occurred
    - 2 = no fault has occurred
    - Access: read-only

5.2.5.2 RapidRing Group – 1.3.6.1.4.1.17384.1.1.3

oid = “1.3.6.1.4.1.17384.1.1.3.1.0”

  - **ringEnableStatus**: The RapidRing is enabled or disabled
    - Type: integer
    - 1 = RapidRing is enabled
    - 2 = RapidRing is disabled

oid = “1.3.6.1.4.1.17384.1.1.3.2.0”

  - **switchMode**: The switch is a Master or a Slave
    - Type: integer
    - 1 = Master
    - 2 = Slave

oid = “1.3.6.1.4.1.17384.1.1.3.3.0”

  - **ringID**: The group number of the RapidRing
    - Type: integer
    - 1 = group number 1
    - 2 = group number 2

oid = “1.3.6.1.4.1.17384.1.1.3.4.0”

  - **networkStatus**: The network topology
    - Type: integer
    - 1 = Ring Not Available (because RapidRing is not enabled)
    - 2 = Ring Complete
    - 3 = Ring Incomplete
5.2.6 Message Format for SNMP Operations

Five SNMP operations are used in SNMP version 1: get, get-next, set, get-response, trap. The first four commands are used to send and receive information for managed objects and use the same message format. Trap uses a different format discussed in Section 5.2.6.2.

5.2.6.1 Format of Command Messages

Each command message contains a header and a protocol data unit (PDU).

5.2.6.1.1 Message Header

The fields in the message header contain:
- Version — 0, indicating SNMP version 1
- Community string — The community string, which authorizes NMS access to the switch

5.2.6.1.2 Message Protocol Data Unit (PDU)

SNMPv1 PDUs contain a specific command (get, set etc.) and operands that indicate the object instances involved in the transaction.

The fields in the PDU contain:
- PDU type — Indicates the command type: get(0xA0), get-next(0xA1), set(0xA3), get-response(0xA2)
- Request ID — A 4-octet integer used to match response to queries
- Error Status — A single octet integer containing a value of zero in a request and the following error status in a response
  - noError (0): No problem
  - tooBig (1): The response to your request was too big to fit into one response.
  - noSuchName (2): An agent was asked to get or set an OID that it can’t find; i.e., the OID doesn’t exist. It can be used for an unsupported object.
  - badValue (3): A read-write or write-only object was set to an inconsistent value.
  - readOnly (4): This error is generally not used.
  - genErr (5): None of the previous errors
- Error Index — A single octet integer that associates an error with a particular object identifier (OID). Only the response operation sets this field. Other operations set this field to zero.
- Variable binding — contains a sequence of OIDs and values
5.2.6.2 Traps for SNMPv1

5.2.6.2.1 Format of Trap Messages
Each trap message contains a header and a protocol data unit (PDU).

5.2.6.2.2 Trap Header
The fields in the trap message header contain:

- **Version** — 0, indicating SNMP version 1
- **Community string** — The community string, which authorizes NMS access to the Trap Protocol Data Unit (PDU)

The fields in the PDU contain:

- **PDU type** — 4 (indicates version 1 trap PDU)
- **Enterprise** — Identifies the type of managed object generating the trap. For switch traps, the value is as follows:
  - Generic Trap — value is SNMP (1.3.6.1.2.1.11)
- **Agent-address** — The IP address of the originating agent
- **Generic-trap** — 0 to 6, indicating the generic trap type. See Section 5.2.6.2.3 for descriptions of the generic-trap types.
- **Specific-trap** — Indicates the specific trap type. This field is only interpreted when the generic trap type is 6, `enterpriseSpecific`.
- **Time-stamp** — Seconds since last power cycle
- **Variable bindings** — One or more OIDs (object identifiers) paired with the corresponding values. A variable is an instance of a managed object. These pairings provide more information about the event.

![Figure 50 — Format of the Trap Message for SNMP Version 1](image)
5.2.6.2.3 SNMP Generic Traps

enterprise = 1.3.6.1.2.1.11

Generic-trap = 0
  coldStart: Signifies that the sending protocol switch is reinitialising itself such that the agent's configuration or the protocol switch implementation may be altered

Generic-trap = 1
  warmStart: Signifies that the sending protocol switch is reinitialising itself such that neither the agent configuration nor the protocol switch implementation is altered

Generic-trap = 2
  linkDown: Signifies that the sending protocol switch recognizes a failure in one of the communication links represented in the agent's configuration

Generic-trap = 3
  linkUp: Signifies that the sending protocol switch recognizes that one of the communication links represented in the agent's configuration has come up

Generic-trap = 4
  authenticationFailure: Signifies that the sending protocol switch is the addressee of a protocol message that is not properly authenticated
5.3 Linux License for EISK_M Series

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