

**SmartSTACK 100
ELS100-24TXG
ETHERNET SWITCH**

INSTALLATION
AND
USER GUIDE

CABLETRON
SYSTEMS



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Part Number: 9032947 January 1999

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Application of Council Directive(s):	89/336/EEC 73/23/EEC
Manufacturer's Name:	Cabletron Systems, Inc.
Manufacturer's Address:	35 Industrial Way PO Box 5005 Rochester, NH 03867
European Representative Name:	Mr. J. Solari
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Conformance to Directive(s)/ Product Standards:	EC Directive 89/336/EEC EC Directive 73/23/EEC EN 55022 EN 50082-1 EN 60950
Equipment Type/Environment:	Networking Equipment, for use in a Com- mercial or Light Industrial Environment.

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<u>Principal Compliance Engineer</u>	<u>Managing Director - E.M.E.A.</u>
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PREFACE

Purpose

This guide provides information about the features and applications of the Cabletron ELS100-24TXG switch as well as instructions for configuring and monitoring the switch.

Audience

This guide is intended for Ethernet local area network (LAN) administrators and Management Information Systems (MIS) personnel with the following background:

- Working knowledge of Ethernet LANs
- Familiarity with Transmission Control Protocol/Internet Protocol (TCP/IP) and Simple Network Management Protocol (SNMP)

Conventions

This section describes the conventions used in this guide.

Message Formats

Two types of messages, identified by icons, appear in the text:



A note informs you of special circumstances.



A caution indicates the possibility of equipment damage.

Keyboard Entries

This guide uses the following conventions for keyboard entries:

- When you read “enter,” type the text and press the [Enter] key.
- Example: Enter the Gateway IP address and press the [Enter] key.
- When you read “select,” type the letter associated with the parameter.
Example: Select **a** from the System Configuration Menu to view the SNMP Configuration Menu.

Other Conventions

This guide uses the following typographical conventions:

- Initial Caps Menu titles and console menu selections.
- [Enter] Used to designate the Enter or Return key.
- ALL CAPS Used to designate fields within the console menus (Example: CONNECTION).
- `courier font` Screen messages and user prompts.
- Selection Describes a user-configurable user interface item.
- Field Describes a read-only information item.

Organization

Chapter 1. Product Overview: Describes the features of the switch, front and rear panel components and application examples.

Chapter 2. Installation: Describes the content of your switch shipment, lists site requirements, and provides mounting instructions. Instructions for making connections and powering up the switch are provided as well.

Chapter 3. ELS100-24TXG User Interface: Describes the user interface console menus and lists the factory defaults for system settings. Each of the console menus are presented along with a description of the selections/fields available within each menu.

Chapter 4. Configuring and Monitoring the Switch: Describes common tasks and associated steps required to configure the switch, and covers common switch and network considerations required to ensure system integrity.

Chapter 5. SNMP Management: Describes how the Simple Network Management Protocol (SNMP) communication protocol is used to manage the switch, and provides a description of industry standard and proprietary Managed Information Bases (MIBs) supported by the switch.

Appendix A. Technical Specifications: Provides a list of standards compliance and certifications as well as physical and operational specifications.

Appendix B. Spanning Tree Concepts: Describes the operation of the Spanning Tree Protocol and how it is used to resolve the problems of physical loops in a network.

Appendix C. Flow Control: Describes how the flow control features are used to provide a mechanism for protecting the switch from overload conditions and to keep additional traffic off the network.

Appendix D. Virtual LANs (VLANs): Describes how the switch uses VLANs to create isolated network domains, and provides illustrations of VLAN switch configurations.

Appendix E. Class of Service: Describes how the traffic Class of Service features can be used to assign mission-critical data a higher priority through the switch by delaying less critical traffic during periods of congestion.

Appendix F. Acronyms and Abbreviations: Provides definitions for a list of common acronyms and abbreviations used within the user guide and the networking industry.

1. PRODUCT OVERVIEW

Description

This installation and user guide describes the Cabletron ELS100-24TXG Ethernet switch. The switch is IEEE 802.1D-compliant and supports 24 IEEE 802.3u 100Base-TX Fast Ethernet ports. Each port can alternatively operate as an IEEE 802.3i 10Base-T port. Additionally, the switch features 2 Gigabit Ethernet ports which operate at 1 Gbps. These ports support the various physical media transceiver flavors of IEEE 802.3z Gigabit Ethernet through the use of modular Gigabit Interface Converters (GBICs). Supported media includes multi-mode fiber, single mode fiber, and twinax copper.

The Cabletron ELS100-24TXG switch automatically learns end-station addresses from the network and stores them in a Media Access Control (MAC) address forwarding table. Incoming packets are then forwarded to the appropriate output port based on the addresses in the packet. Each port on the switch operates at full wire speed with full address and frame filtering.

The Cabletron ELS100-24TXG switch contains advanced features such as Remote Monitoring (RMON), IEEE 802.1Q virtual LANs (VLANs), IEEE 802.1p Class of Service, flow control and broadcast throttling. For network management, the ELS100-24TXG switch includes a standards-compliant Simple Network Management Protocol (SNMP) agent. This agent allows network management station applications to collect and present status and performance information about a switch as well as providing the ability to configure and control functions on the device.

Network management can also be performed in-band using the popular TCP/IP application, Telnet. In addition, a serial console port allows out-of-band management using a PC or a terminal. The ELS100-24TXG switch is desktop or rack-mountable. LEDs on the front panel provide information about the operating status of the switch. The back panel of the switch contains the power connector and a power switch. Two fans maintain ventilation and cooling for internal switch components.

This chapter provides the following information:

- Product Description
- Features
- Front and Rear Panel Component Descriptions
- Feature Summaries
- Application Examples

Features

- Ports:
 - 24 dual-speed 10Base-T/100Base-TX ports using RJ-45 connectors (MDI-X)
 - 2 1000Base-X Gigabit Ethernet ports using modular GBIC transceivers
- Architecture:
 - 8-port 10/100 and 1-port Gigabit Ethernet switch ASICs in a distributed switching architecture
 - 4.2 Gbps internal switching fabric
 - 12 MB packet buffering (512 KB/port) for 10/100 ports
 - 16 MB packet buffering (8 MB/port) for Gigabit Ethernet ports
 - 4096 MAC address forwarding table per port; up to 16,384 addresses per system
 - IEEE 802.3u auto-negotiation for full/half duplex and 10/100 Mbps speed operation on all RJ-45 10/100 ports
 - High performance store-and-forward switching
- Performance:
 - Forwarding: over 6 million packets-per-second (64 byte packets)
 - Filtering: 6.5 million packets-per-second (64 byte packets)
- Traffic Management:
 - Tag and port-based VLANs per the IEEE 802.1Q draft standard - 4094 VLAN IDs recognized per switch
 - Class of Service support per the IEEE 802.1p draft standard
 - Flow control per port: IEEE 802.3x frame-based for full duplex; back-pressure for half duplex
 - Broadcast throttling for broadcast storm control
- Network Management:
 - SNMP compliant agent: MIB II (RFC 1213); Bridge MIB (RFC 1493); Ethernet MIB (RFC 1398); RMON - Statistics, History, Alarm and Event groups per port (RFC 1757); private MIB extensions
 - Port mirroring for network monitoring and analysis
 - Telnet
 - Console port, RS-232, female DB-9 connector, null modem
 - BootP/DHCP for IP address configuration
- LED Indicators
 - 10Base-T/100Base-TX Ethernet ports: Link, Activity, 100Mbps Speed, Full Duplex
 - 1000Base-X Gigabit Ethernet ports: Link and Activity
 - System: Power, Test

- Software:
 - Extensive diagnostics for product testing and troubleshooting
 - Upgrades using the front panel console port or in-band with TFTP

Front Panel

Figure 1-1 shows the front panel of the Cabletron ELS100-24TXG. Table 1-1 defines the ELS100-24TXG front panel components.

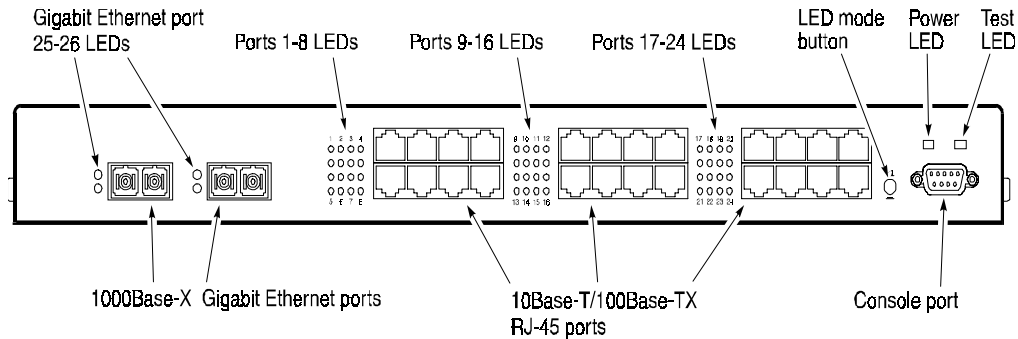


Figure 1-1. ELS100-24TXG Front Panel

Table 1-1. Front Panel Components

Name	Function
Gigabit Ethernet ports 25 and 26 LEDs	Indicates Link and Activity information (see Table 1-2 for details).
1000Base-X Gigabit Ethernet ports	Gigabit Ethernet ports using GBIC modules.
Ports 1-24 LEDs	Indicates Link, Activity, Speed and Duplex information (see Table 1-2 for details).
10Base-T/100Base-TX RJ-45 ports	Copper ports using RJ-45 port connectors. These ports are wired MDI-X.
LED mode button	Button used to switch RJ-45 port LEDs between Link/Activity mode and 100M/Full Duplex mode. This button has no affect on Gigabit Ethernet port LEDs.
Power LED	Lights steady green to indicate power is supplied to the switch. Off indicates no power is supplied to the switch.
Test LED	Lights steady green after a reset and remains on until successful completion of power-on self tests. Off indicates a successful completion of the power-on self tests.
Console port	Female DB-9 connector configured as a null modem connection for serial out-of-band management using the console menus.

Figure 1-2 shows the Link and Activity LEDs for the 2 1000Base-X Gigabit Ethernet ports. The LEDs are positioned to the left of their associated port.

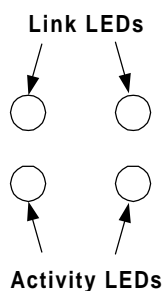


Figure 1-2. 1000Base-X Gigabit Ethernet Port LEDs

Figure 1-3 shows the Link and Activity port LEDs for 24 10Base-T/100Base-TX ports (default configuration).

Pressing the front panel LED mode button changes the operation of the RJ-45 LEDs to show Speed and Full Duplex operation, as shown in Figure 1-4.



The numbers above and below the port LEDs identify the LEDs associated with a specific RJ-45 port.

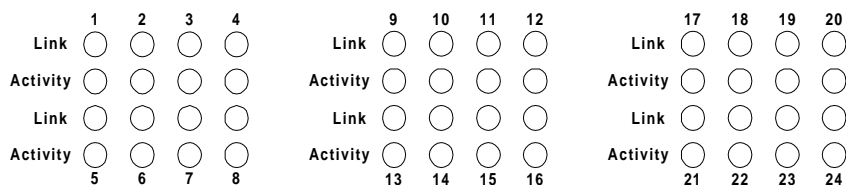


Figure 1-3. Port LEDs Default Configuration

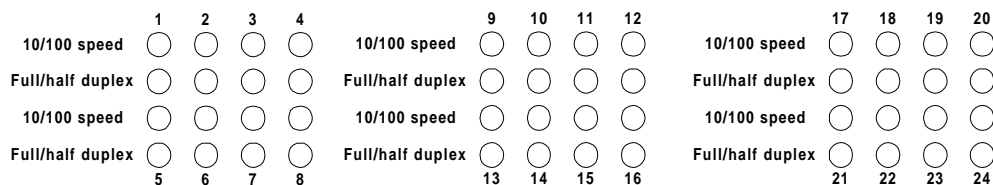


Figure 1-4. Port LEDs LED Mode Button Pressed

The port LEDs are grouped to the left of their corresponding RJ-45 ports. Table 1-2 defines the performance of the port LEDs for the 10Base-T/100Base-TX ports in both the default configuration and with the LED mode button pressed.

Table 1-2. Port LEDs Defined

Name	Function
Gigabit Ethernet Ports	Link LED On: Indicates a valid connection (link) on the associated port. Link LED Off: Indicates no link on the associated port. Activity LED flashing: Indicates the presence of transmit and/or receive activity. Activity LED Off: Indicates the absence of transmit or receive activity.
RJ-45 Ports Default Configuration	Link LED On: Indicates a valid connection (link) on the associated port. Link LED Off: Indicates no link on the associated port. Activity LED flashing: Indicates the presence of transmit and/or receive activity. Activity LED Off: Indicates the absence of transmit or receive activity.
RJ-45 Ports LED mode button pressed	Speed LED On: Indicates the port is in the 100Base-TX mode. Speed LED Off: Indicates the port is in the 10Base-T mode. Duplex LED On: Indicates the port is in the full duplex mode. Duplex LED Off: Indicates the port is in the half duplex mode.

Rear Panel

Figure 1-5 shows the ELS100-24TXG rear panel and Table 1-3 defines the rear panel components.

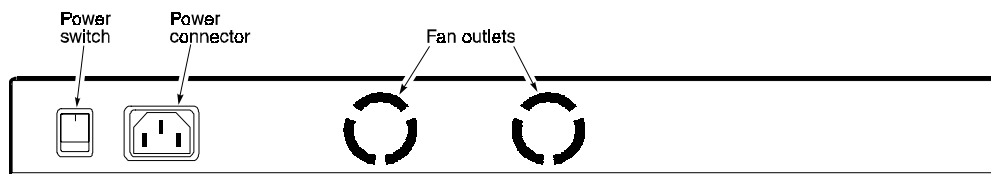


Figure 1-5. ELS100-24TXG Rear Panel

Table 1-3. Rear Panel Components

Name	Function
Power Connector	Provides AC power to the switch.
Power Switch	Allows you to turn the switch power on and off.
Fan Outlets	Air exit vents through which internal fans discharge air for ventilation purposes.

Feature Summaries

The following summaries provide a brief description of ELS100-24TXG features in areas such as standards compliance, functionality, performance, and options.

IEEE 802.1D Bridge

The ELS100-24TXG switch is fully compliant with IEEE 802.1D transparent bridging specifications. An aggregate address table, containing 4096 entries per 8 10/100 ports and per Gigabit Ethernet port, is provided for learning, filtering, and forwarding. The switch can support up to a maximum of 16,384 addresses. Addresses are automatically learned by the switch, and can be individually assigned specific forwarding treatment by the network administrator if desired. Forwarding table configuration can be made out-of-band via the console interface or in-band via SNMP or Telnet. Static and dynamic addresses are both stored in this table. One static address is assigned per port by default. The Forwarding Table Configuration screen in the console menus allows you to assign additional static addresses if required.

Spanning Tree Protocol

The ELS100-24TXG switch supports the IEEE 802.1D Spanning Tree Protocol. This protocol allows redundant connections to be created between different LAN segments for purposes of fault tolerance. Two or more physical paths between different segments can be created through the switch, with the Spanning Tree Protocol choosing a single path at any given time and disabling all others. If the chosen path fails for any reason, a disabled alternative is activated, thereby maintaining the connection. This prevents network traffic from circulating in an endless loop formed by multiple connections to the same LAN segment.

Spanning Tree parameters are configurable in the Spanning Tree Configuration Menu using the console menus or via SNMP (see Appendix B, "Spanning Tree Concepts," for more information).

Frame Buffering and Frame Latency

The ELS100-24TXG switch is a store-and-forward switching device. Each frame is copied into switch memory before being forwarded to another port. This method ensures that all forwarded frames conform to a standard Ethernet frame size and have a correct cyclic redundancy check (CRC) for data integrity. This switching method prevents bad frames from traversing the network and using up valuable network bandwidth, as with cut-through switching technology.

To minimize the possibility of dropping frames on congested ports, the ELS100-24TXG switch provides 512 KB per 10/100 port and 8 MB per Gigabit Ethernet port of dynamically allocated frame buffering. This buffer space is used to queue packets for transmission on congested networks. This is an additional advantage over cut-through switching technology, which drops packets immediately when experiencing collisions.

Software Download

The ELS100-24TXG switch supports the industry-standard Trivial File Transfer Protocol (TFTP) for downloading software to the switch. All switch software is stored in a 2 MB sectorized flash ROM. The download feature allows you to easily install software upgrades to the unit. Software can alternatively be downloaded via the serial console port using the XMODEM protocol.

A TFTP or XMODEM software download is invoked via the Download Software Menu using the console menus. A TFTP download can also be invoked via SNMP.

Non-volatile Parameter Storage

Important operating parameters such as IP addresses, Spanning Tree configuration, and management security parameters, are stored in non-volatile Flash memory. These values are retained when the switch experiences power interruptions or is powered down for normal maintenance.

Configuration and Management Interfaces

The ELS100-24TXG switch can be managed using any of the following three methods:

- Serial console, out-of-band

An RS-232 connection, using a DB-9 connector, is supported for out-of-band switch management. Serial console management is performed using a terminal, or computer system running communications software. See Chapter 3, “ELS100-24TXG User Interface,” for more detailed information on managing the ELS100-24TXG switch via the serial console.

- Telnet, in-band (over Ethernet)

The switch supports management through a Telnet connection using the TCP/IP protocols. Telnet is performed using a terminal or computer system running communications software. See Chapter 3, “ELS100-24TXG User Interface,” for more detailed information on managing the switch via the serial console. Global password protection for changing the operating parameters of the switch is provided.

- SNMP-based network manager, in-band

The switch can be managed using SNMP, the most common protocol used today for network management. Standard agent MIBs embedded in the switch provide basic SNMP management through industry-standard SNMP applications.

Management security protection is provided based on SNMP community names. See Chapter 5, “SNMP Management,” for more information.

RMON

RMON (Remote Monitoring) is a facility used to manage networks remotely while providing multi-vendor interoperability between monitoring devices and management stations. RMON is defined by an SNMP MIB. This MIB is divided into nine different groups, each gathering specific statistical information or performing a specific function. RMON-capable devices gather network traffic data and then store them locally until downloaded to an SNMP management station.

The ELS100-24TXG supports four of the nine groups of RMON defined for Ethernet networks on a per port basis. Specifically, these are:

- **Statistics:** a function that maintains counts of network traffic statistics such as number of packets, broadcasts, collisions, errors, and distribution of packet sizes.
- **History:** a function which collects historical statistics based on user-defined sampling intervals. The statistical information collected is the same as the Statistics group, except on a time stamped basis.
- **Alarm:** a function that allows managers to set alarm thresholds based on traffic statistics. Alarms trigger other actions through the Event group.
- **Event:** a function that operates with the Alarm group to define an action that will be taken when an alarm condition occurs. The event may write a log entry and/or send a trap message.

RMON Statistics group information is displayed on the Port Statistics Screen in the console menus. Additional RMON functionality is available via SNMP.

Port Mirroring

The ELS100-24TXG switch includes the ability to mirror the traffic being switched on any 10/100 port for purposes of network traffic analysis and connection integrity. When this feature is enabled, a protocol analyzer or RMON probe is connected to any port in a group of eight. This port is configured to mirror the traffic from any other port in the same group of ports. The groupings are ports 1-8, 9-16 and 17-24. You can only mirror one port to another port at one time. Port mirroring occurs at the same speed configured for the port (10Mbps-to-10Mbps or 100Mbps-to-100Mbps). Port mirroring is configurable in the Switch Configuration Menu using the console menus or via SNMP.

Auto-negotiation

Auto-negotiation is a process that permits the switch to automatically select the operational mode of its ports. For 10/100 ports, the switch automatically detects and selects the speed (10Mbps or 100Mbps) and duplex mode (full duplex or half duplex) of a port upon being connected to the network. For Gigabit Ethernet ports, the switch automatically detects and selects the flow control mode of the port. The ports are then automatically set by the switch to operate in the proper mode, without user intervention. It is not required that the network device being

connected to the switch supports auto-negotiation as the ELS100-24TXG switch automatically adjusts to the network device's communication settings. Auto-negotiation is configurable in the Port Configuration Menu of the console menus or via SNMP.

Broadcast Throttling

The ELS100-24TXG has the capability to throttle (or limit) the flooding of packets through the switch. Broadcast, multicast, and unknown destination address unicast packets received by the switch are typically flooded to all ports on the switch or on a given VLAN. When the number of these types of packets being forwarded is large, the performance of the switch in forwarding packets of other types may suffer. A programmable broadcast cutoff rate parameter allows a rate threshold to be set in the switch for the forwarding of broadcast and unknown destination address packets. If the cutoff rate is exceeded, further packets of these types are dropped. This capability helps to alleviate broadcast storms, a problem often encountered in Ethernet networks. Broadcast throttling is configurable in the Switch Configuration menu of the console menus or via SNMP.

BootP/DHCP

The Bootstrap Protocol (BootP) and the Dynamic Host Configuration Protocol (DHCP) provide for the capability of passing configuration information to hosts on a TCP/IP network. Using this process, network devices do not need to be configured before they can communicate using the TCP/IP protocol suite. The ELS100-24TXG switch uses BootP and DHCP to automatically configure IP address information without requiring access to the console menus. BootP/DHCP operation is configurable using the BootP/DHCP Enable option in the System Configuration Menu of the console menus or via SNMP.

LEDs

The switch port LEDs provide a quick and accurate display of the integrity of switch connections and port mode. The default operation of the 10/100 LEDs indicates Link (L) and Activity (A) for each of the ports. The operation of these LEDs can be changed by use of the LED mode button on the switch front panel. When the LED mode button is pressed (pressed and held in), the operation of the 10/100 LEDs changes to indicate 10/100 Mbps speed and full/half duplex operation, respectively. The Gigabit Ethernet port LEDs indicate Link (L) and Activity (A) for each of the ports. The Gigabit Ethernet port LEDs are not affected by the LED mode button.

Full Duplex Mode

The full duplex mode of operation on a port can double the throughput of switch connections. This mode disables the collision detection portion of the Ethernet Carrier Sense Multiple Access with Collision Detection

(CSMA/CD) protocol, allowing for two-way traffic. Full duplex is configurable using the Duplex Mode parameter in the Port Menu of the console menus or via SNMP.

Flow Control

Flow control allows you to manage network traffic during congestion periods and to prevent the loss of packets when port buffer thresholds are exceeded. Flow control also serves to deny access to additional traffic that could add to a congestion condition. The ELS100-24TXG switch supports flow control per the IEEE 802.3x standard. See Appendix C, “Flow Control,” for more information on this feature.

Virtual LANs (VLANs)

VLANs allow you to connect users to a specific LAN segment regardless of their physical location. The ELS100-24TXG switch supports tagged VLANs per the IEEE 802.1Q draft standard. With frame tagging, a short tag is appended to every frame that crosses the network backbone. The tag identifies which VLAN the frame belongs to. See Appendix D, “Virtual LANs,” for more information.

Class of Service

Class of Service support allows you to assign a higher priority to selected traffic passing through the switch. The ELS100-24TXG switch supports Class of Service attributes per the IEEE 802.1p draft standard using a priority queuing mechanism. This feature ensures that traffic during congestion periods will not interfere with traffic assigned a higher priority. Traffic assigned a lower priority is subject to discard when memory is in short supply. See Appendix E, “Class of Service,” for more information.

Application Examples

The exploding popularity of the Internet and of corporate intranets, as well as new, high-bandwidth desktop applications, are driving the demand for Fast Ethernet. The increase in multimedia traffic and the need to support legacy protocols alongside new, data intensive applications is driving the need for network segmentation and traffic prioritization.

The ELS100-24TXG switch is ideal for meeting the needs of today’s high performance networks. The switch’s low cost and high port count makes it attractive and affordable for dedicated 10/100Mbps connections to the desktop. In addition, extensive features, including redundant links, traffic Class of Service and VLAN capability, provide the management needed for the workgroup and local backbone.

The following sections illustrate the ELS100-24TXG switch employed in application examples:

- Client/Server Network
- Local Backbone

Client/Server Network Application

To improve workstation performance in a client/server environment, the ELS100-24TXG switch can be configured to provide 200 Mbps full duplex Fast Ethernet connections to servers by connecting each to a dedicated switch port (Figure 1-6). Users can be accommodated through connections to hubs, both at 10Mbps and 100Mbps speeds, through 10Mbps switches with 100Mbps uplinks, or through direct connections. The Gigabit Ethernet uplinks (1000Mbps) can be used to aggregate traffic on the switch to the campus or corporate backbone, whether on another building floor or in a separate building.

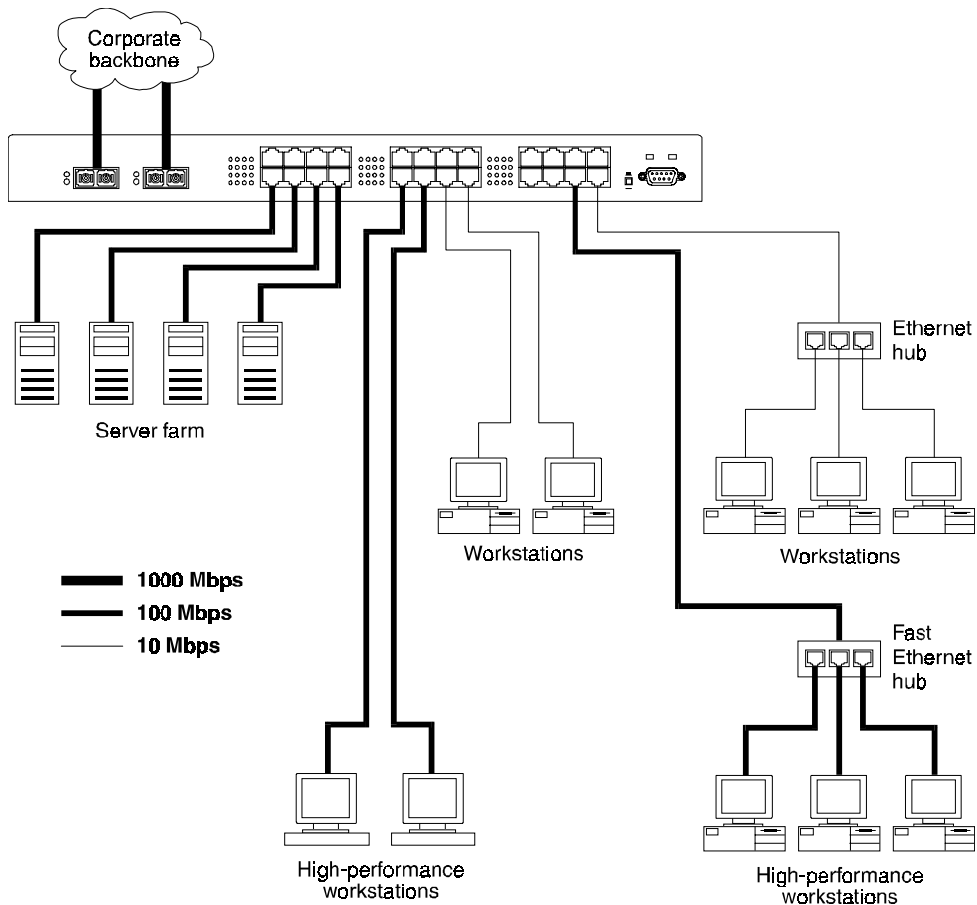


Figure 1-6. Client/Server Network Application

Local Backbone Application

The ELS100-24TXG switch can be used in a local backbone application, connecting network segments together and providing file-server access (Figure 1-6). Workgroup hubs are provided with a single connection to the switch while servers are put on dedicated 100Mbps ports. Routers and other networking devices can connect off of the switched backbone as well. The Gigabit Ethernet uplinks (1000Mbps) can be used to connect to the corporate backbone and provide access to high performance servers.

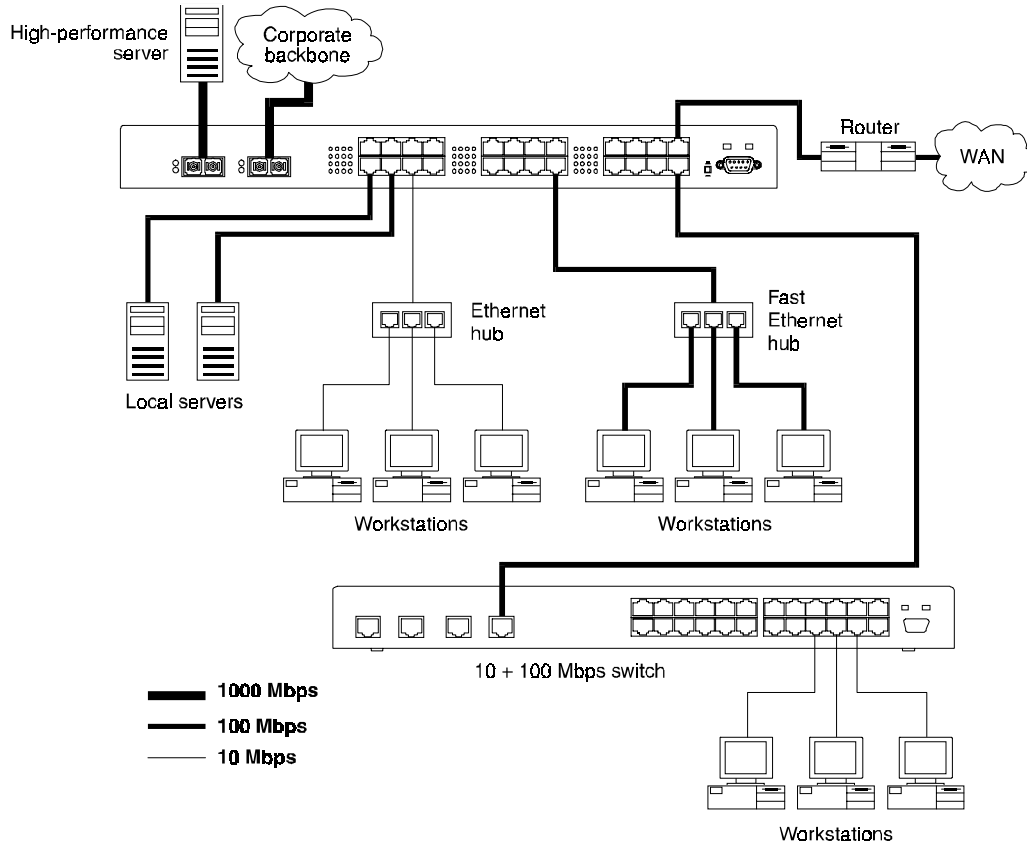


Figure 1-7. Local Backbone Application

2. INSTALLATION

Inspecting Your Shipment

When you receive the shipment of your switch, check the package contents and make sure you have the following items:

- ELS100-24TXG Fast Ethernet switch
- Mounting ears and mounting screws
- Power cord
- This document

Site Requirements

Before you install the switch, make sure the site meets the following requirements:

- **Mounting**
Provide a flat table, wall or shelf surface, or an optional 19 in. (48.3 cm) equipment rack.
Use an EIA standard equipment rack that is grounded and physically secure.
- **Power source**
Provide a power source within six feet (1.8 m) of the installation location. This source must provide 100 VAC to 240 VAC, and 50 Hz to 60 Hz power, with a 100 VA minimum. Power specifications for the switch are shown in Appendix A, "Technical Specifications."



Primary voltage selection within the above ranges is automatic and requires no user action.

- **Environmental**
Install the ELS100-24TXG switch in a dry area, with adequate air circulation. Avoid placing the switch in direct sunlight or near other heat sources, such as hot-air vents. For temperature and humidity specifications, see Appendix A, "Technical Specifications."
- **Ventilation**
Do not restrict airflow by covering or obstructing air inlets on the side of the switch or the rear panel internal air fan exits.

Mounting the Switch on a Table or Shelf

Mount the switch on a table or shelf in a position which allows access to the front panel RJ-45 ports, visibility of the port LEDs, and access to the power cord. Make sure that the mounting surface can safely support the switch and that there is adequate space around the switch for ventilation and cooling.

Mounting the Switch on a Wall

The switch ships with two (2) multi-position mounting ears and four (4) mounting screws.



The mounting screws are used to attach the mounting ears to the switch. Once the ears are attached to the switch, you will need to provide appropriate screws to mount the switch to the wall.

Figure 2-1 shows the orientation of the mounting ears for attaching the ears to the switch for a wall mount application. Be sure that the wall surface can safely support the switch.

Do the following:

1. Mount one of the ears to the switch using two (2) of the supplied screws. Repeat this step for the other side of the switch.
2. Mount the switch to the wall using appropriate screws.

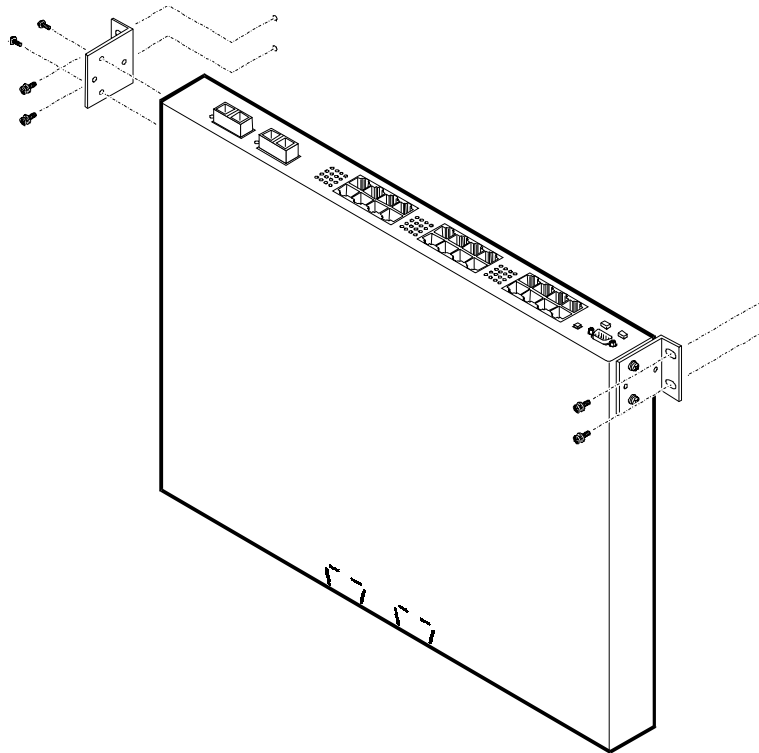


Figure 2-1. Mounting the Switch on a Wall

Mounting the Switch in a Rack

The switch ships with two (2) multi-position mounting ears and four (4) mounting screws.



The mounting screws are used to attach the mounting ears to the switch. Once the ears are attached to the switch, you will need to provide appropriate screws to mount the switch in a rack.

Figure 2-2 shows the orientation of the mounting ears for attaching the ears to the switch for a rack mount application. Mount the switch with the front panel facing forward. Do the following:

1. Mount one of the ears to the switch using two (2) of the supplied screws. Repeat this step for the other side of the switch.
2. Slide the switch into the rack and align the holes in the rack mounting ears with the holes in the rack rails.
3. Insert and tighten appropriate rack-mounting screws (not provided).

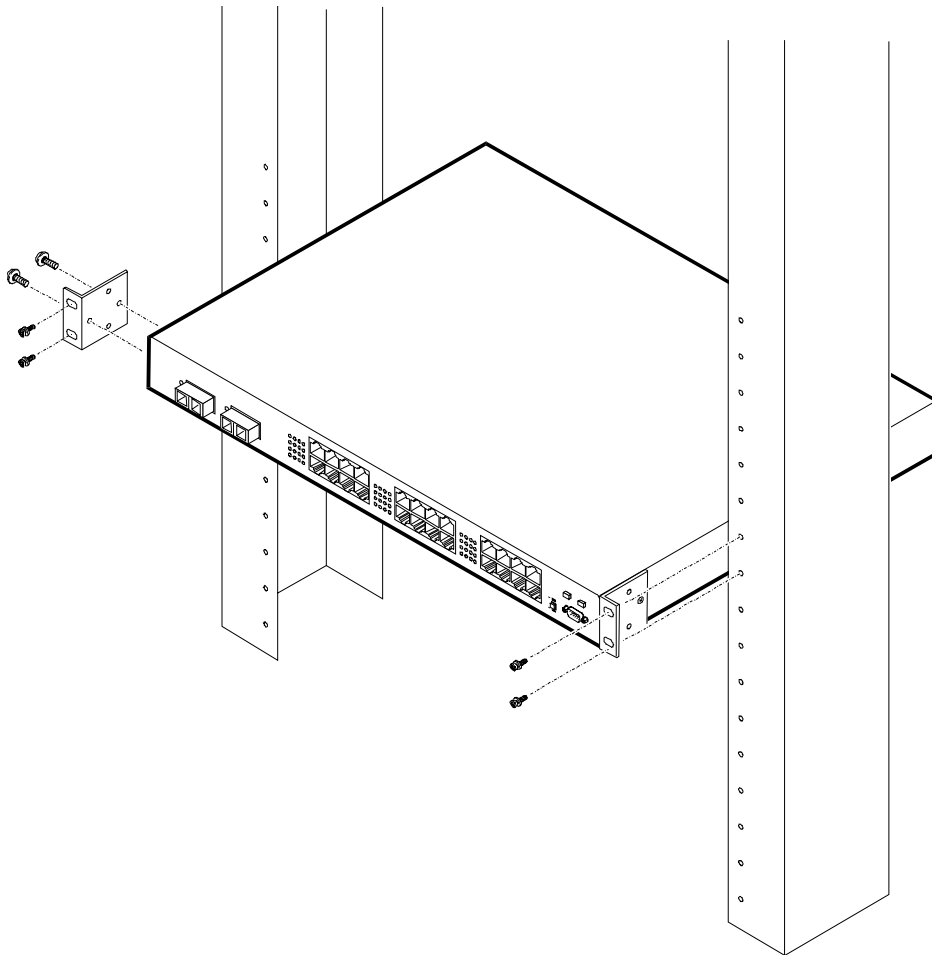


Figure 2-2. Mounting the Switch in a Rack

Connecting a Terminal to the Console Port

The console port is a serial RS-232 interface port that enables a connection to a terminal for performing switch monitoring and configuration functions. The terminal may be a PC or workstation running terminal emulation software, or a dumb terminal configured as a Data Terminal Equipment (DTE) connection. Alternatively, this port can be connected to an external modem to enable remote dial-in management.

If you connect a terminal to the console port prior to powering the switch, you can observe the progress and results of the power-up diagnostics as the switch goes through its initialization process.

The console port connector is configured as a female null modem connection using a female DB-9 (see Table A-1 for pinouts). A standard straight-through wired RS-232 cable is typically all that is needed to connect to this interface. Any cable connected to the console port must be shielded to comply with emissions regulations and requirements.

To connect the ELS100-24TXG console port to a terminal, do the following:

1. Connect a terminal to the console port using an interface cable (Figure 2-3).

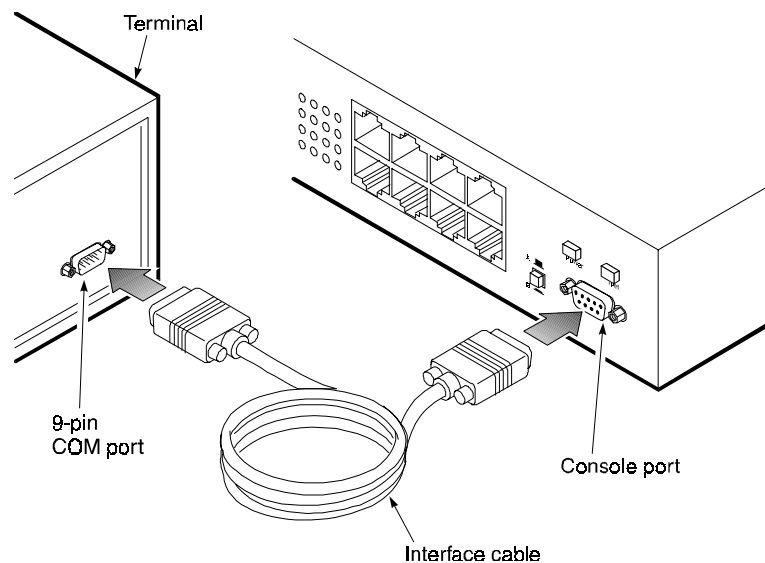


Figure 2-3. Connecting a Terminal to the Console Port

2. Connect the male connector of the interface cable directly to the switch console port and tighten the captive retaining screws.
3. Connect the other end of the interface cable to a terminal (in some instances, an adapter may be required to make this connection).
4. From your terminal, start the terminal emulation program.
5. Configure the terminal to the following communication settings: 9600 baud, no parity, 8 data bits, 1 stop bit, no hardware flow control, ASCII character set.

Powering the Switch

To supply power to the switch, do the following:

1. Connect the power cord to the switch and to a grounded three-prong wall outlet (Figure 2-4). See Appendix A, “Power Cord Set Requirements,” for more information regarding specific international power cord requirements.

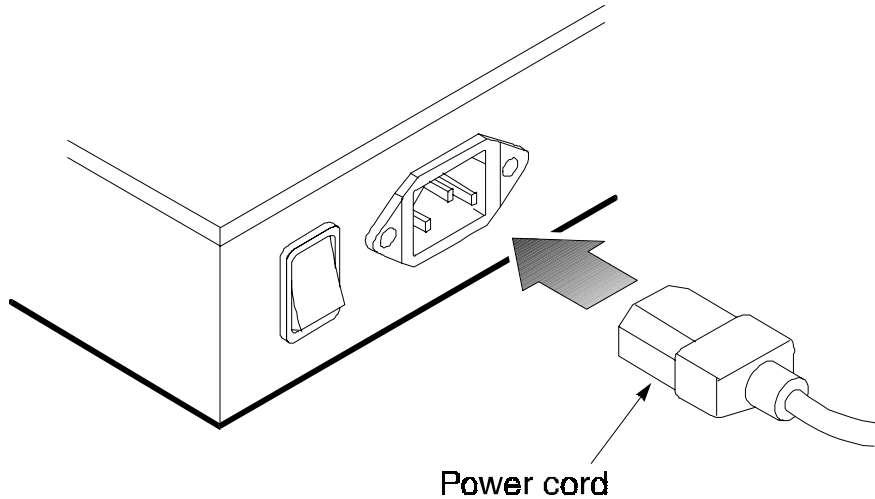


Figure 2-4. Connecting the Power Cord to the Switch

2. Turn on the power switch.

The Power LED lights green (see Figure 1-1). If it does not, check to make sure that the power cable is plugged in correctly and that the power source is good.

Power-Up

When you turn the power on, the switch conducts a series of hardware and software tests to verify correct operation. If a terminal or computer is connected to the console port, the results of the tests are displayed on the screen. If you want to display the results of the tests after the switch has already been turned on, turn the power switch off and then back on.

The switch performs two basic types of tests at power-up. During this time, the Test LED (see Figure 1-1) lights steady green. These tests are:

- Serial port

The serial console port test is the first test performed. If the switch fails this test, no further tests are performed, and the console displays no information.

- Memory

Memory tests on the CPU RAM are performed after the serial port test. No results are displayed on the console.

After these two tests are performed, the operational software of the switch is loaded. A series of more extensive diagnostic tests are then conducted during which the Test LED remains lit. The results of the tests are displayed on the terminal. If all tests pass, the Test LED turns off. When all tests are complete, the system is functional and the user interface is ready to receive commands at the console.

Network Cable Requirements

Copper

Table 2-1 specifies the cable types and length constraints for the various copper interfaces on the ELS100-24TXG.

Table 2-1. Copper Cable Specifications

Interface Type	Cable Requirement	Maximum Length
10Base-T	Category 3 or 5 Unshielded Twisted Pair (UTP)	100m (328 ft.)
100Base-TX	Category 5 UTP	100m (328 ft.)
1000Base-CX	150 ohm, shielded balanced	25m (82 ft.)

Fiber

Table 2-2 specifies the fiber types, bandwidth requirements, and length constraints for the various Gigabit Ethernet fiber interfaces on the ELS100-24TXG. The type of GBIC module installed determines the interface type. The GBIC, along with the type of fiber installed, determines the distance support.

Table 2-2. Gigabit Ethernet Fiber Specifications

Interface Type	Fiber Type	Fiber Diameter (microns)	Modal Bandwidth (MHz * km)	Maximum Length (m)
1000Base-SX	multi-mode	62.5	160	220
	multi-mode	62.5	200	275
	multi-mode	50	400	500
	multi-mode	50	500	550
1000Base-LX	multi-mode	62.5	500	550
	multi-mode	50	400	550
	multi-mode	50	500	550
	single-mode	9	N/A	5000

10Base-T/100Base-TX Ports

The 10Base-T/100Base-TX ports use RJ-45 connectors. Figure 2-5 shows an RJ-45 connector being inserted into a port.

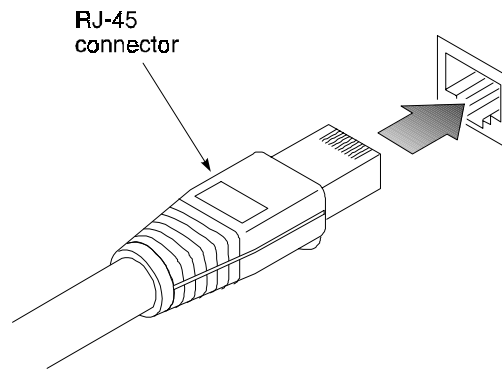


Figure 2-5. Inserting an RJ-45 Connector into a Port

The 10Base-T/100Base-TX ports interface to UTP cabling for connection to 10Base-T or 100Base-TX network segments or end-stations. These UTP connections meet the requirements of ISO 8877, specified by 10Base-T, Section 14 of the IEEE 802.3 specification. The ports are wired with the MDI-X function implemented. Workstations or servers can be connected to the ELS100-24TXG switch using standard straight-through wired cables.

For connections to hubs or other switches, a crossover cable may be necessary (refer to the “MDI/MDI-X Crossover Cable Wiring” section in Appendix A). See Table A-2 for 10Base-T/100Base-TX connector pin assignments.

1000Base-X Gigabit Ethernet Ports

The fiber optic Gigabit Ethernet GBICs use dual SC connectors. Figure 2-6 shows a dual SC connector being inserted into a Gigabit Ethernet port on the ELS100-24TXG.

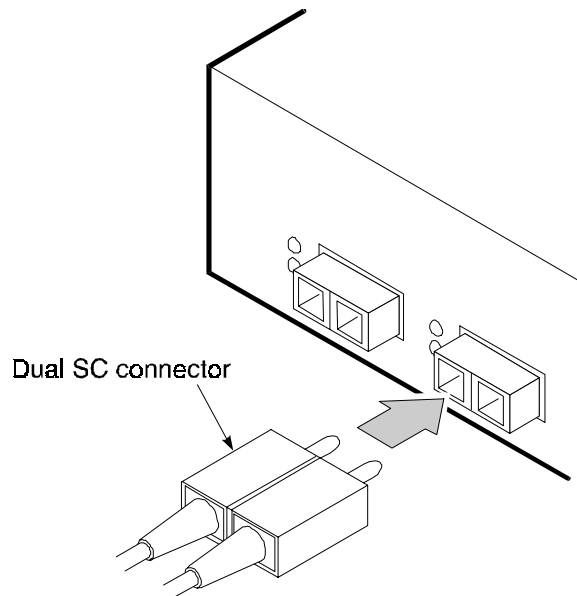


Figure 2-6. Inserting a Dual SC Connector into a Port

The 1000Base-X Gigabit Ethernet ports interface to different media types depending on the GBIC module installed. The 1000Base-SX standard over multi-mode fiber uses dual SC fiber connectors. The 1000Base-LX standard over single mode or multi-mode fiber also uses dual SC fiber connectors. The dual SC connectors are configured as a receive(RX)/transmit(TX) pair with the RX connector positioned on the left side of the port and the TX connector on the right side of the port.

Copper connections are also supported on the Gigabit Ethernet ports. The 1000Base-CX standard over shielded, balanced copper uses High Speed Serial Data Connectors (HSSDCs).

3. ELS100-24TXG USER INTERFACE

Overview

When you have connected a terminal to the console port, or used Telnet to access the switch over the network, access is gained to the console menus. These menus allow you to reconfigure the switch from its factory default settings, as well as to monitor switch status and performance. The menus have a layout similar to the sample Main Menu shown in Figure 3-1. The information is divided into the following parts:

- Menu Identification (includes model number)
- Menu Name (includes access privileges)
- Selectable Items listed by letters
- Screen Prompt for menu selections and entry of field parameters, and Message Area for display of next entry option, parameters, or error messages.

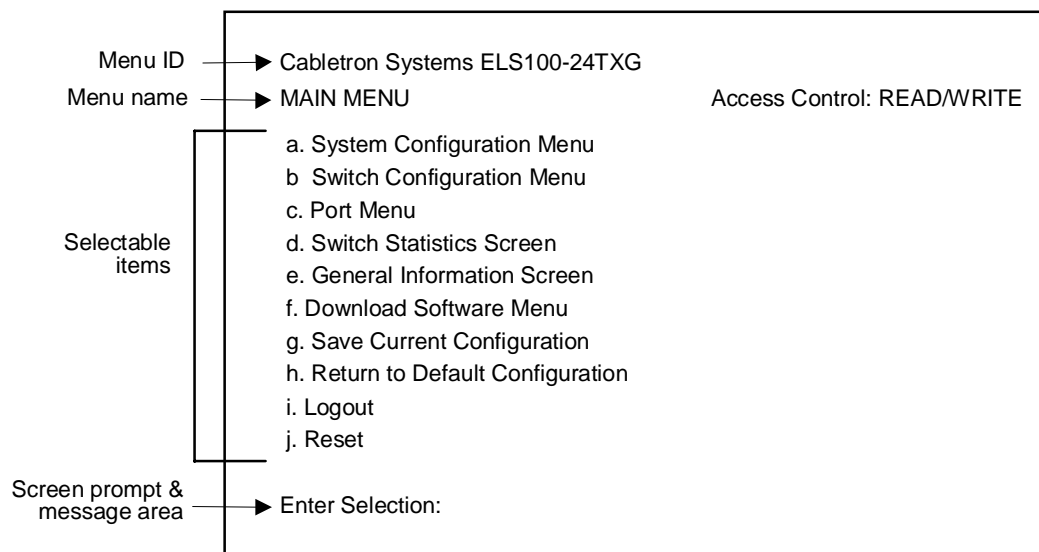


Figure 3-1. Sample Main Menu

User Access

There are two modes of access to the user interface: READ-ONLY and READ/WRITE. READ-ONLY access allows you to view switch information, but not modify any operating parameters. READ/WRITE access allows you to both read and modify switch information. You are required to login with a password before obtaining READ/WRITE access. If no password is entered (press only the [Enter] key), you are logged in with READ-ONLY access. No password is configured in the factory default settings, allowing full READ/WRITE access until a password is set.

To use the console menus, do the following:

1. Type the letter associated with the desired option.

If the selected item is a submenu title, the submenu is displayed when you enter the letter.

2. Enter the parameter requested by the screen prompt.

If the selected item is a parameter, the system displays a prompt for the entry of a new parameter value. If the value entered is invalid, a beep sounds, or a message displays, requesting you to enter a valid value.

Factory Defaults

Table 3-1 lists the factory default settings for the switch configuration parameters. Each of these parameters can be changed via the console menus or Telnet.

Table 3-1. Factory Default Settings

Parameter	Default Value
Active Aging Time	300
Auto-negotiation Enable	Yes
Broadcast Cutoff Rate	500000
BootP/DHCP Enable	Yes
Bridge Priority	32768
Class of Service Enable	No
Class of Service Port Priority	0
Class of Service Priority Threshold	4
Flow Control Enable	No
Forward Delay	15
Full Duplex	Yes
Hello Time	2
Max Age	20
Password	<none>
Path Cost	100 for 10Mbps speed ports 10 for 100Mbps speed ports 1 for 1Gbps speed ports
Port Enable	Yes
Port Priority	128
Port Speed	100 for 10/100 ports
Port Mirroring Enable	No
Screen Timeout	10
SNMP Private Community Name	private
SNMP Public Community Name	public
Spanning Tree Protocol Enable	Yes
Terminal Baud Rate	9600
Terminal Hardware Flow Control	No
VLAN Enable	No
VLAN Port Type	Access

Menu Hierarchy

Figure 3-2 shows the ELS100-24TXG switch user interface menu hierarchy.

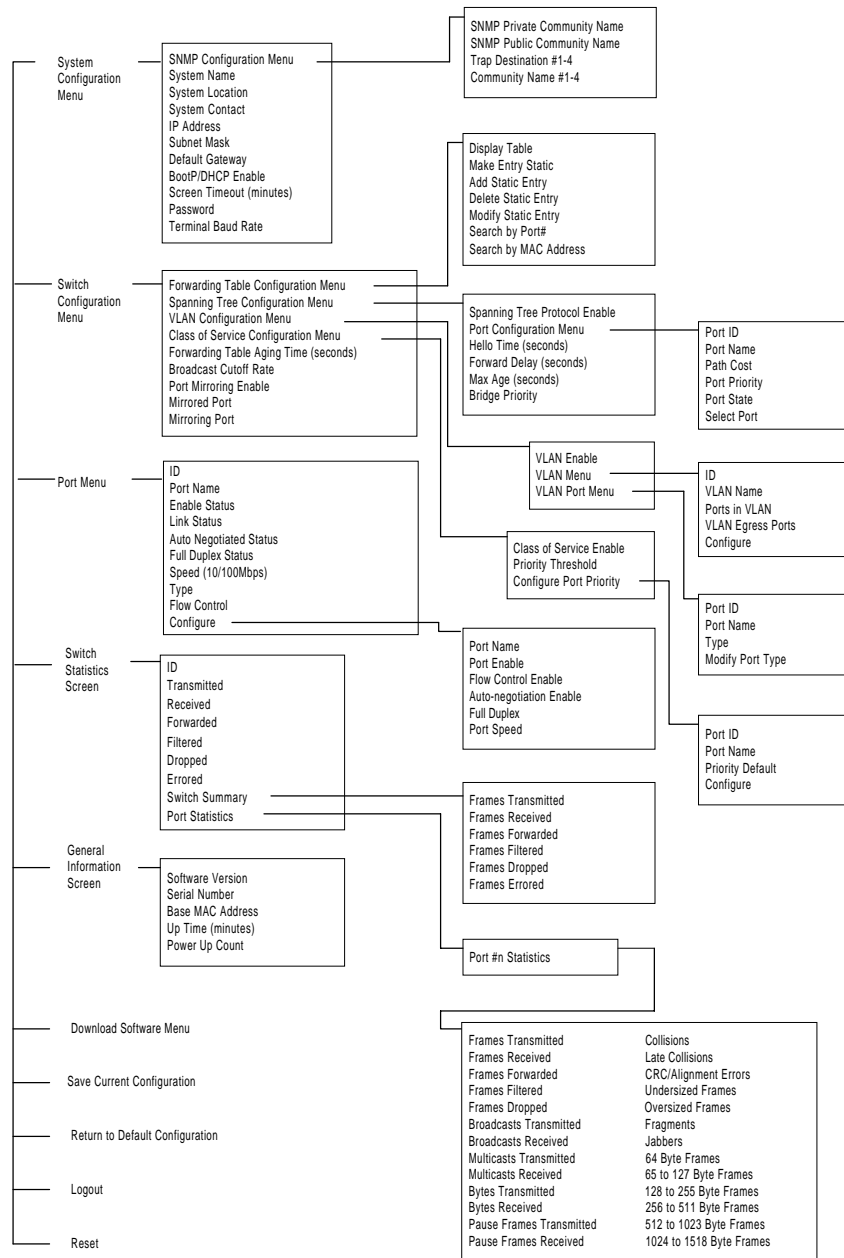


Figure 3-2. ELS100-24TXG User Interface Menu Hierarchy

Main Menu

The Main Menu is the first screen seen after successfully logging in to the system. Figure 3-3 shows the Main Menu and the accompanying table describes the Main Menu.

MAIN MENU	Access Control: READ/WRITE
a. System Configuration Menu	
b. Switch Configuration Menu	
c. Port Menu	
d. Switch Statistics Screen	
e. General Information Screen	
f. Download Software Menu	
g. Save Current Configuration	
h. Return to Default Configuration	
i. Logout	
j. Reset	
x. Previous Menu	
Enter Selection:	

Figure 3-3. Main Menu

Selection	Description
System Configuration Menu	Contains commands and parameters that reflect the global configuration of the switch related to management.
Switch Configuration Menu	Provides access to information and parameters affecting the function of the switch, i.e. the movement of packets through the switch. For example, you can configure Forwarding Table, Spanning Tree, and virtual LANs (VLANs).
Port Menu	Shows the configuration of the individual ports on the switch and allows you to modify switch port operation.
Switch Statistics Screen	Presents switch-level and port-level statistics.
General Information Screen	Displays the system software version, switch serial number, base MAC address, system up time and power-up count.
Download Software Menu	Contains parameters and commands for initiating a software download to upgrade the switch operating software.
Save Current Configuration	Saves current switch operating parameters to non-volatile memory.
Return to Default Configuration	Restores switch operating parameters to factory defaults. You must reset the switch for activate default parameters.
Logout	Logs out of the console interface. Once you logout, you must enter a password before you can access the console interface again.
Reset	Performs a software reset of the switch by restarting the system software and reloading all operating parameters.

System Configuration Menu

The System Configuration Menu enables modification of system-level switch configuration parameters. Select **a** from the Main Menu to view the System Configuration Menu. Figure 3-4 shows the System Configuration Menu and the accompanying table describes the System Configuration Menu.

SYSTEM CONFIGURATION		Access Control: READ/WRITE
a. SNMP Configuration Menu		
b. System Name		
c. System Location		
d. System Contact		
e. IP Address		000.000.000.000
f. Subnet Mask		000.000.000.000
g. Default Gateway		000.000.000.000
h. BootP/DHCP Enable		Yes
i. Screen Timeout (minutes)		0
j. Password		None
k. Terminal Baud Rate		9600
l. Terminal Hardware Flow Control		No
x. Previous Menu		
Enter Selection:		

Figure 3-4. System Configuration Menu

Selection	Description
SNMP Configuration Menu	Menu for configuring SNMP-related parameters.
System Name	The switch administrative name (1-36 character range).
System Location	The physical switch location (1-36 character range).
System Contact	The switch contact person (1-36 character range).
IP Address	The IP address of the switch.
Subnet Mask	Subnet mask associated with the switch IP address.
Default Gateway	The default gateway (or router) to which the switch sends IP packets destined for a different subnet.
BootP/DHCP Enable	Allows you to enable (Yes) or disable (No) the BootP and DHCP protocols for automatically configuring the switch's IP address information.
Screen Timeout (minutes)	The duration of time before a serial console or Telnet session terminates due to user inactivity (0-65535 numeric range). A value of "0" means that the screen will not terminate at any time.
Password	Allows "read/write" access to the user interface, via the serial console or Telnet (1-10 character range).
Terminal Baud Rate	Serial console baud rate (2400, 9600 or 19200).
Terminal Hardware Flow Control	Allows you to enable (Yes) or disable (No) hardware flow control on serial console interface. Signals DTR, RTS and CTS are used for this purpose. Flow control should be enabled if using external modem.

SNMP Configuration Menu

The SNMP Configuration Menu allows you to modify SNMP-related configuration parameters. Select **a** from the System Configuration Menu to view the SNMP Configuration Menu. Figure 3-5 shows the SNMP Configuration Menu and accompanying table describes the SNMP Configuration Menu.

SNMP CONFIGURATION		Access Control: READ/WRITE
a. SNMP Private Community Name	private	
b. SNMP Public Community Name	public	
c. Trap Destination #1	000.000.000.000	
d. Community Name #1	public	
e. Trap Destination #2	000.000.000.000	
f. Community Name #2	public	
g. Trap Destination #3	000.000.000.000	
h. Community Name #3	public	
i. Trap Destination #4	000.000.000.000	
j. Community Name #4	public	
x. Previous Menu		
Enter Selection:		

Figure 3-5. SNMP Configuration Menu

Selection	Description
SNMP Private Community Name	The community name for read/write SNMP access to the device (1-10 character range; the default name is: "private").
SNMP Public Community Name	The community name for read only SNMP access to the device (1-10 character range; the default name is: "public").
Trap Destination #1	The IP address of trap destination #1 where SNMP trap messages are forwarded.
Community Name #1	The SNMP community name to use for traps forwarded to trap destination #1.
Trap Destination #2	The IP address of trap destination #2 where SNMP trap messages are forwarded.
Community Name #2	The SNMP community name to use for traps forwarded to trap destination #2.
Trap Destination #3	The IP address of trap destination #3 where SNMP trap messages are forwarded.
Community Name #3	The SNMP community name to use for traps forwarded to trap destination #3.
Trap Destination #4	The IP address of trap destination #4 where SNMP trap messages are forwarded.
Community Name #4	The SNMP community name to use for traps forwarded to trap destination #4.

Switch Configuration Menu

The Switch Configuration Menu allows you to modify switching-related configuration parameters. Select **b** from the Main Menu to view the Switch Configuration Menu. Figure 3-6 shows the Switch Configuration Menu and the accompanying table describes the Switch Configuration Menu.

SWITCH CONFIGURATION		Access Control: READ/WRITE
a. Forwarding Table Configuration Menu		
b. Spanning Tree Configuration Menu		
c. VLAN Configuration Menu		
d. Class of Service Configuration Menu		
e. Forwarding Table Aging Time(seconds)	300	
f. Broadcast Cutoff Rate	500000	
g. Port Mirroring Enable	No	
h. Mirrored Port	2	
i. Mirroring Port	1	
j. Transmit Data Mirror Enable	Yes	
k. Receive Data Mirror Enable	No	
x. Previous Menu		
Enter Selection:		

Figure 3-6. Switch Configuration Menu

Selection	Description
Forwarding Table Configuration Menu	Menu for configuring the switch forwarding table.
Spanning Tree Configuration Menu	Menu for configuring the switch Spanning Tree operation.
VLAN Configuration Menu	Menu for configuring the VLAN operation of the switch.
Class of Service Configuration Menu	Menu for configuring Class of Service for the switch.
Forwarding Table Aging Time	Time in seconds until entries in the forwarding table are aged out if not accessed (10-1,000,000 second range).
Broadcast Cutoff Rate	Per second rate past which broadcast and destination unknown unicast frames are not flooded on each group of 8 ports on the switch (100-500,000 frames per second range).
Port Mirroring Enable	Allows you to enable (Yes) or disable (No) port mirroring.
Mirrored Port	The source port for the data to be mirrored.
Mirroring Port	The destination port for the data to be mirrored.
Transmit Data Mirror Enable *	Allows you to enable (Yes) or disable (No) the mirroring of data transmitted out the mirrored port.
Receive Data Mirror Enable *	Allows you to enable (Yes) or disable (No) the mirroring of data received by the mirrored port.
* Only one of these options can be enabled at any given time. Changing the setting of one of these options automatically changes the setting of the other option.	

Forwarding Table Configuration Menu

The Forwarding Table Configuration Menu allows you to view and modify forwarding table parameters. The MAC address of each forwarding table entry is displayed along with its type, disposition, and associated port number. Select **a** from the Switch Configuration Menu to view the Forwarding Table Configuration Menu. Figure 3-7 shows the Forwarding Table Configuration Menu and the accompanying table describes the Forwarding Table Configuration Menu.

FORWARDING TABLE CONFIGURATION			Access Control: READ/WRITE	
MAC ADDRESS	TYPE	DISPOSITION	PORT ID	PORT NAME
0a0a0a0a0a0a	DYNAMIC	FORWARD	1	
0a0a0a0a0a0b	DYNAMIC	FORWARD	2	
0a0a0a0a0a0c	DYNAMIC	FORWARD	3	
0a0a0a0a0a0d	DYNAMIC	FORWARD	4	
0a0a0a0a0a0e	DYNAMIC	FORWARD	5	
0a0a0a0a0a0f	DYNAMIC	FORWARD	6	
0a0a0a0a0a10	DYNAMIC	FORWARD	7	
0a0a0a0a0a11	DYNAMIC	FORWARD	8	
n. Next Page p. Previous Page f. First Page l. Last Page				
a. Display Table b. Make Entry Static				
c. Add Static Entry d. Delete Static Entry e. Modify Static Entry				
s. Search by Port # m. Search by MAC Address x. Previous Menu				
Enter Selection:				

Figure 3-7. Forwarding Table Configuration Menu

Field	Description
MAC Address	MAC address for the listed port.
Type	Displays the type of address entry: system, dynamic or static.
Disposition	Displays disposition of the address entry: local, forward or discard.
Port ID	Displays the port number associated with the MAC address entry.
Port Name	Displays the administrative name assigned to the port.
Selection	Description
Next Page	Displays the next page of the forwarding table.
Previous Page	Displays the previous page of the forwarding table.
First Page	Displays the first page (top) of the forwarding table.
Last Page	Displays the last page of the forwarding table.

continued on next page

Forwarding Table Configuration Menu (continued)

Selection	Description
Display Table	Redisplays the forwarding table.
Make Entry Static	Makes a dynamic entry in the forwarding table static.
Add Static Entry	Adds a static entry to the forwarding table.
Delete Static Entry	Deletes a static entry from the forwarding table.
Modify Static Entry	Modifies a static entry from the forwarding table.
Search by Port #	Performs a search by port number and posts the search results at the top of the screen.
Search by MAC Address	Performs a search by MAC Address and posts the search results at the top of the screen.

Spanning Tree Configuration Menu

The Spanning Tree Configuration Menu allows you to view and modify Spanning Tree parameters. Select **b** from the Switch Configuration Menu to view the Spanning Tree Configuration Menu. A letter identifies selections that can be modified. All other fields are read-only. Figure 3-8 shows the Spanning Tree Configuration Menu and the accompanying table describes the Spanning Tree Configuration Menu.

SPANNING TREE CONFIGURATION		Access Control: READ/WRITE
Bridge ID	32768-000000000000	
Designated Root		
Root Path Cost	0	
Root Port	NO PORT	
Topology Change Count	0	
a. Spanning Tree Protocol Enable	No	
b. Port Configuration Menu		
c. Hello Time (seconds)	2	
d. Forward Delay (seconds)	15	
e. Max Age (seconds)	20	
f. Bridge Priority	32768	
x. Previous Menu		
Enter Selection:		

Figure 3-8. Spanning Tree Configuration Menu

Field	Description
Bridge ID	A unique identifier for the bridge (switch) in the Spanning Tree. The ID is a combination of the bridge priority and port 1 MAC address.
Designated Root	The bridge in the Spanning Tree with the lowest Bridge ID value, designated as the root bridge.
Root Path Cost	The cost of the path to the root bridge.
Root Port	The port identifier of the port that offers the lowest cost path to the root bridge.
Topology Change Count	The count of the number of times the network topology has changed from a Spanning Tree reconfiguration.

continued on next page

Spanning Tree Configuration Menu (continued)

Selection	Description
Spanning Tree Protocol Enable	Allows you to enable (Yes) or disable (No) the global Spanning Tree operation on the switch.
Port Configuration Menu	Provides access to the Spanning Tree Port Configuration Menu.
Hello Time (seconds)	The time interval between the sending of Configuration BPDUs by the bridge, if it is root (1-10 second range).
Forward Delay (seconds)	The time interval delay before a port transfers into the forwarding state, if it is root (4-30 second range).
Max Age (seconds)	The maximum age of received protocol information before it is discarded (6-40 second range).
Bridge Priority	A relative priority of bridges, with the lowest value bridge ID indicating the highest priority (0-65535 range).

Spanning Tree Port Configuration Menu

The Spanning Tree Port Configuration Menu allows you to view Spanning Tree Configuration information for all of the ports in a table format. Select **b** from the Spanning Tree Configuration Menu to view the Spanning Tree Port Configuration Menu. Figure 3-9 shows the Spanning Tree Port Configuration Menu and the accompanying table describes the Spanning Tree Port Configuration Menu.

SPANNING TREE PORT CONFIGURATION				Access Control: READ/WRITE
PORT ID	PORT NAME	PATH COST	PORT PRIORITY	PORT STATE
1		10	128	FORWARDING
2		10	128	FORWARDING
3		10	128	FORWARDING
4		10	128	FORWARDING
5		10	128	FORWARDING
6		10	128	FORWARDING
7		10	128	FORWARDING
8		10	128	FORWARDING
9		10	128	FORWARDING
10		10	128	FORWARDING
n. Next Page p. Previous Page f. First Page l. Last Page				
a. Select Port r. Refresh x. Previous Menu				
Enter Selection:				

Figure 3-9. Spanning Tree Port Configuration Menu

Field	Description
Port ID	A unique identifier for a port on the bridge (switch).
Port Name	The administrative name assigned to the port.
Path Cost	The contribution of the path through this port, when it is the root port, to the total path cost from this bridge to the root bridge. 10 for 100Mbps ports, 100 for 10Mbps ports, 1 for 1Gbps ports.
Port Priority	The relative priority of the port on the bridge.
Port State	The current Spanning Tree state of the port on the bridge, either disabled, listening, learning, forwarding, or blocking.
Selection	Description
Next Page	Displays the next page of the table.
Previous Page	Displays the previous page of the table.
First Page	Displays the first page (top) of the table.
Last Page	Displays the last page of the table.
Select Port	Allows you to enter a port number to view and modify port parameters in the Spanning Tree Port #n Configuration Menu.
Refresh	Refreshes the screen to reflect latest system conditions.

Spanning Tree Port #n Configuration Menu

The Spanning Tree Port #n Configuration Menu allows you to view Spanning Tree Port Configuration information for an individual port. Select **a** from the Spanning Tree Port Configuration Menu to view the Spanning Tree Port #n Configuration Menu. Figure 3-10 shows the Spanning Tree Port #n Configuration Menu and the accompanying table describes the Spanning Tree Port #n Configuration Menu. The “Port #n” designation represents the specific port number for configuration.

SPANNING TREE PORT #1 CONFIGURATION		Access Control: READ/WRITE
Port State	DISABLED	
MAC Address	000000000000	
Designated Cost	0	
Designated Port	0	
Designated Root		
Designated Bridge		
a. Path Cost	10	
b. Port Priority	32768	
x. Previous Menu		
Enter Selection:		

Figure 3-10. Spanning Tree Port Configuration Menu

Field	Description
Port State	The current Spanning Tree state of the port, either disabled, listening, learning, forwarding, or blocking.
MAC Address	The MAC address of the port.
Designated Cost	The cost of the path to the Root offered by the designated port for the LAN associated with the port.
Designated Port	The Port ID of the port believed to be the designated port for the LAN associated with the port.
Designated Root	The Bridge ID of the bridge recorded as the Root for the LAN associated with the port.
Designated Bridge	The Bridge ID of the bridge believed to be the designated bridge for the LAN associated with the port.

Selection	Description
Path Cost	The contribution of the path through this port, when it is the root port, to the total path cost from this bridge to the root bridge (1-65535 range).
Port Priority	The relative priority of the port on the bridge (0-255 range).

VLAN Configuration Menu

The VLAN Configuration Menu allows you to configure the operation of Virtual LANs (VLANs) in the switch. Select **c** from the Switch Configuration Menu to view the VLAN Configuration Menu. Figure 3-11 shows the VLAN Configuration Menu and the accompanying table describes the VLAN Configuration Menu. See Appendix D, “Virtual LANs (VLANs)” for more information about this feature.

VLAN CONFIGURATION		Access Control: READ/WRITE
a. VLAN Enable	No	
b. VLAN Menu		
c. VLAN Port Menu		
x. Previous Menu		
Enter Selection:		

Figure 3-11. VLAN Configuration Menu

Selection	Description
VLAN Enable	Allows you to enable (Yes) or disable (No) the global VLAN operation of the switch.
VLAN Menu	Allows you to open the VLAN Menu.
VLAN Port Menu	Menu for configuring VLAN information per port.

VLAN Menu

The VLAN Menu displays the configuration of VLANs in the switch and allows access to the VLAN #n Configuration Menu to create and configure VLANs. Select **b** from the VLAN Configuration Menu to view the VLAN Menu. Figure 3-12 shows the VLAN Menu and the accompanying table describes the VLAN Menu.

VLAN MENU		Access Control: READ/WRITE	
ID	VLAN NAME	PORTS IN VLAN	VLAN EGRESS PORTS

1	default	1-26	None
c. Configure d. Delete x. Previous Menu			
Enter Selection:			

Figure 3-12. VLAN Menu

Field	Description
ID	The identification number of the VLAN (1-4 character range).
VLAN Name	The administrative name assigned to the VLAN (1-14 character range; entering a VLAN name is not required).
Ports in VLAN	The ports assigned to the VLAN.
VLAN Egress Ports	The egress (exit) ports which link the ELS100-24TXG to other devices which also include members of the same VLAN.

Selection	Description
Configure	Allows you to configure an existing VLAN listed in the VLAN table, create a new VLAN (1-4094 numerical range), and to open the VLAN #n Configuration Menu.
Delete	Allows you to delete a specific VLAN.

VLAN #n Configuration Menu

The VLAN #n Configuration Menu allows you to configure a name for a specific VLAN, add or remove a port in the VLAN, and add or remove an egress port in the VLAN. Select **c** from the VLAN Menu to view the VLAN #n Configuration Menu. Figure 3-13 shows the VLAN #n Configuration Menu and the accompanying table describes the VLAN #n Configuration Menu.



1. The designation “#n” represents the number of the specific VLAN to be configured.
2. When configuring ports using the Ports in VLAN parameter, they will be moved to that selected VLAN, and automatically removed from their previous VLAN.

VLAN #n CONFIGURATION		Access Control: READ/WRITE
Ports in VLAN	1-26	
VLAN Egress Ports	None	
a. VLAN Name	default	
b. Add Port in VLAN		
c. Remove Port In VLAN		
d. Add VLAN Egress Port		
e. Remove VLAN Egress Port		
x. Previous Menu		
Enter Selection:		

Figure 3-13. VLAN #n Configuration Menu

Field	Description
Ports in VLAN	Lists the ports in the specific VLAN.
VLAN Egress Ports	Lists the VLAN Egress Ports for the specific VLAN.

Selection	Description
VLAN Name	Allows you to enter an administrative name for the VLAN (1-14 character range; entering a VLAN name is not required).
Add Port in VLAN	Allows you to enter a port in the VLAN.
Remove Port in VLAN	Allows you to remove a port in the VLAN.
Add VLAN Egress Port	Allows you to add a VLAN Egress Port.
Remove VLAN Egress Port	Allows you to remove a VLAN Egress Port.

VLAN Port Menu

The VLAN Port Menu displays a table of VLAN configuration information on a per port basis and allows you to modify the VLAN Port Type. Select **c** from the VLAN Configuration Menu to view the VLAN Port Menu. Figure 3-14 shows the VLAN Port Menu and the accompanying table describes the VLAN Port Menu.

VLAN PORT MENU		Access Control: READ/WRITE	
PORT ID	PORT NAME	TYPE	

1		ACCESS	
2		ACCESS	
3		ACCESS	
4		ACCESS	
5		ACCESS	
6		ACCESS	
7		ACCESS	
8		ACCESS	
9		ACCESS	
10		ACCESS	
n. Next Page	p. Previous Page	f. First Page	l. Last Page
a. Modify Port Type		x. Previous Menu	
Enter Selection:			

Figure 3-14. VLAN Port Configuration Menu

Field	Description
Port ID	The number assigned to the port.
Port Name	The administrative name assigned to the port
Type	The VLAN type for each port (either Hybrid or Access). Hybrid ports accept tagged and non-tagged frames while Access ports only allow non-tagged frames.

Selection	Description
Next Page	Displays the next page of the table.
Previous Page	Displays the previous page of the table.
First Page	Displays the first page of the table.
Last Page	Displays the last page of the table.
Modify Port Type	Allows you to modify the port type (either Hybrid or Access).

Class of Service Configuration Menu

The Class of Service Configuration Menu allows you to configure Class of Service settings for the system as well as to set the Class of Service for VLAN tagged frames. Select **d** from the Switch Configuration Menu to view the Class of Service Configuration Menu. Figure 3-15 shows the Class of Service Configuration Menu and the accompanying table describes the Class of Service Configuration Menu.

CLASS OF SERVICE CONFIGURATION		Access Control: READ/WRITE
a. Class of Service Enable	No	
b. Priority Threshold	4	
c. Configure Port Priority		
x. Previous Menu		
Enter Selection:		

Figure 3-15. Class of Service Configuration Menu

Selection	Description
Class of Service Enable	Allows you to enable (Yes) or disable (No) Class of Service operation for the system.
Priority Threshold	Allows you to enter the global priority threshold level. The configurable range is 0-7 (0=low, 7=high). VLAN tagged frames with a priority level below this threshold level will be assigned normal priority level through the switch. VLAN tagged frames with a priority level equal to or greater than this threshold level will be assigned high priority through the switch.
Configure Port Priority	Allows you to open the Port Priority Menu for configuring Class of Service information per port.

Port Priority Menu

The Port Priority Menu allows you to modify and display a table which shows Class of Service configuration information on a per port basis. Select **c** from the Class of Service Configuration Menu to view the Port Priority Configuration Menu. Figure 3-16 shows the Port Priority Configuration Menu and the accompanying table describes the Port Priority Configuration Menu.

PORT PRIORITY		Access Control: READ/WRITE	
PORT ID	PORT NAME	PRIORITY DEFAULT	
1		0	
2		0	
3		0	
4		0	
5		0	
6		0	
7		0	
8		0	
9		0	
10		0	
n. Next Page		p. Previous Page	f. First Page
c. Configure		l. Last Page	
x. Previous Menu			
Enter Selection:			

Figure 3-16. Port Priority Configuration Menu

Field	Description
Port ID	The port number assigned to the port.
Port Name	The administrative name assigned to the port (1-14 character range).
Priority Default	The priority level assigned to non-tagged frames entering the associated port. The configurable range is 0-7 (0=low, 7=high). This value, compared to the Priority Threshold Value, determines the priority level assigned to all non-tagged frames.
Selection	Description
Next Page	Displays the next page of the table.
Previous Page	Displays the previous page of the table.
First Page	Displays the first page of the table.
Last Page	Displays the last page of the table.
Configure	Allows you to configure the priority default for a specific port (0-7 number range).

Port Menu

The Port Menu allows you to display information for each port in a table format, as well as to access the Port Configuration Menu. You can also refresh the screen information. Select **c** from the Main Menu to view the Port Menu. Figure 3-17 shows the Port Menu and the accompanying table describes the Port Menu.

PORT MENU			Access Control: READ/WRITE					
ID	PORT NAME	ENABLED	LINK STATUS	AUTO NEGOTIATED	FULL DUPLEX	SPEED	PORT TYPE	FLOW CONTROL
1		Yes	CONNECTED	No	Yes	100	100TX	No
2		Yes	CONNECTED	No	Yes	100	100TX	No
3		Yes	CONNECTED	No	Yes	100	100TX	No
4		Yes	CONNECTED	No	Yes	100	100TX	No
5		Yes	CONNECTED	No	Yes	100	100TX	No
6		Yes	CONNECTED	No	Yes	100	100TX	No
7		Yes	CONNECTED	No	Yes	100	100TX	No
8		Yes	CONNECTED	No	Yes	100	100TX	No
9		Yes	CONNECTED	No	Yes	100	100TX	No
10		Yes	CONNECTED	No	Yes	100	100TX	No
11		Yes	CONNECTED	No	Yes	100	100TX	No
12		Yes	CONNECTED	No	Yes	100	100TX	No
n. Next Page		p. Previous Page		f. First Page l. Last Page				
r. Refresh		c. Configure		x. Previous Menu				
Enter Selection:								

Figure 3-17. Port Menu

Field	Description
ID	The number assigned to the port.
Port Name	The administrative name assigned to the port (1-14 character range).
Enabled	The current "enabled" state of the port, either "Yes" or "No."
Link Status	The current link state of the port, either "Connected" or "Disconnected."
Auto Negotiated	The current state of auto-negotiation for the port, whether or not it has completed auto-negotiation, either "Yes" or "No".
Full Duplex	The current full duplex state of the port, either "Yes" or "No."
Speed	The current speed of the port, either 10Mbps, 100Mbps, or 1000Mbps.
Type	Current connection type: 10T=10Base-T, 100T=100Base-TX, 1000SX=1000Base-SX, 1000LX=1000Base-LX, 1000CX=1000Base-CX.
Flow Control	The current enable/disable flow control port state, either "Yes" or "No."
Selection	Description
Next Page	Displays the next page of the table.
Previous Page	Displays the previous page of the table.
First Page	Displays the first page (top) of the table.
Last Page	Displays the last page of the table.
Refresh	Refreshes the screen to reflect latest system conditions.
Configure	Opens up the Port Configuration Menu. From this menu you can configure an individual port or multiple ports (See Section 4).

Port Configuration Menu

The Port Configuration Menu allows you to configure port settings for a specific port. Select **c** from the Port Menu to view the Port Configuration Menu. Figure 3-18 shows the Port Configuration Menu and the accompanying table describes the Port Configuration Menu.

PORTS 1-5 CONFIGURATION		Access Control: READ/WRITE
a. Port Name		
b. Port Enable		Yes
c. Flow Control Enable		No
d. Auto-negotiation Enable		No
e. Full Duplex		Yes
f. Port Speed		100
x. Previous Menu		
Enter Selection:		

Figure 3-18. Port Configuration Menu

Selection	Description
Port Name	Allows you to assign an administrative name to the port (1-14 character range).
Port Enable	Allows you to enable (Yes) or disable (No) the port(s).
Flow Control Enable	Allows you to enable (Yes) or disable (No) flow control on the port(s).
Auto-negotiation Enable	<p>Allows you to enable (Yes) or disable (No) the auto-negotiation mode for the port(s). This parameter does not appear for the Gigabit Ethernet ports.</p> <p>For 10/100 ports, if Auto-negotiation Enable is set to "No", the Full Duplex and Port Speed fields display and are eligible for configuration. For Gigabit Ethernet ports, if Auto-negotiation Enable is set to "No", the Flow Control Enable field displays and is eligible for configuration.</p> <p>For 10/100 ports, if Auto-negotiation Enable is set to "Yes", the Full Duplex and Port Speed fields disappear and the system automatically manages these functions. For Gigabit Ethernet ports, if Auto-negotiation Enable is set to "Yes", the Flow Control Enable field disappears and the system automatically manages this function.</p>
Full Duplex	Allows you to enable (Yes) or disable (No) the full duplex mode for the port(s). This parameter cannot be changed for Gigabit Ethernet ports which always operate in full duplex mode.
Port Speed	Allows you to set the operational speed for the port(s). For 10/100 ports, this parameter can be set to either 10 or 100. This parameter cannot be changed for Gigabit Ethernet ports and is always set at 1000, corresponding to 1000Mbps.

Switch Statistics Screen

The Switch Statistics Screen provides a summary display of port-level statistics, and provides access to the Port Statistics screens. You can also clear or refresh the statistics. Select **d** from the Main Menu to view the Switch Statistics Screen. Figure 3-19 shows the Switch Statistics Screen and the accompanying table describes the Switch Statistics Screen.

SWITCH STATISTICS				Access Control: READ/WRITE		
ID	TRANSMITTED	RECEIVED	FORWARDED	FILTERED	DROPPED	ERRORED
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
n. Next Page p. Previous Page f. First Page l. Last Page s. Switch Summary d. Port Statistics r. Refresh c. Clear x. Previous Menu						
Enter Selection:						

Figure 3-19. Switch Statistics Screen

Field	Description
ID	The number assigned to the port.
Transmitted	Number of frames transmitted out the port.
Received	Number of frames received on the port.
Forwarded	Number of frames forwarded through the port.
Filtered	Number of frames filtered on the port.
Dropped	Number of frames received on the port that were dropped by the switch due to lack of resources.
Errored	Number of errored frames received on the port.
Selection	Description
Next Page	Displays the next page of the table.
Previous Page	Displays the previous page of the table.
First Page	Displays the first page of the table.
Last Page	Displays the last page of the table.
Switch Summary	Allows you to open the Switch Summary Screen.
Port Statistics	Allows you to open the Port Statistics Screen.
Refresh	Refreshes switch statistics.
Clear	Clears (or sets to zero) switch statistics.

Switch Summary Screen

The Switch Summary Screen allows you to display sum total statistics for all ports of the switch. You can also clear or refresh the statistics. Select **s** from the Switch Statistics Screen to view the Switch Summary screen. Figure 3-20 shows the Switch Summary Screen and the accompanying table describes the Switch Summary Screen.

SWITCH SUMMARY		Access Control: READ/WRITE
Frames Transmitted	0	
Frames Received	0	
Frames Forwarded	0	
Frames Filtered	0	
Frames Dropped	0	
Frames Errored	0	
r. Refresh c. Clear x. Previous Menu		
Enter Selection:		

Figure 3-20. Switch Summary Screen

Field	Description
Frames Transmitted	Total number of frames transmitted out all ports.
Frames Received	Total number of frames received on all ports.
Frames Forwarded	Total number of frames forwarded through the switch.
Frames Filtered	Total number of frames filtered on all ports.
Frames Dropped	Total number of frames dropped by the switch due to lack of resources.
Frames Errored	Total number of errored frames received from all ports.

Selection	Description
Refresh	Refreshes switch summary statistics.
Clear	Clears (or sets to zero) switch summary statistics.

Port Statistics Screen

The Port Statistics Screen allows you to display statistics for each port on the switch. Many of these statistics correspond to the Statistics group of RMON. You can also refresh or clear the statistics. Select **s** from the Switch Statistics Screen to view the Port Statistics screen. Figure 3-21 shows the Port Statistics Screen and the accompanying table describes the Port Statistics Screen.

PORT 1 STATISTICS		Access Control: READ/WRITE	
Frames Transmitted	0	Collisions	0
Frames Received	0	Late Collisions	0
Frames Forwarded	0	CRC/Alignment Errors	0
Frames Filtered	0	Undersized Frames	0
Frames Dropped	0	Oversized Frames	0
Broadcasts Transmitted	0	Fragments	0
Broadcasts Received	0	Jabbers	0
Multicasts Transmitted	0	64 Byte Frames	0
Multicasts Received	0	65 to 127 Byte Frames	0
Bytes Transmitted	0	128 to 255 Byte Frames	0
Bytes Received	0	256 to 511 Byte Frames	0
Pause Frames Transmitted	0	512 to 1023 Byte Frames	0
Pause Frames Received	0	1024 to 1518 Byte Frames	0
r. Refresh c. Clear x. Previous Menu			
Enter Selection:			

Figure 3-21. Port Statistics Screen

Field	Description
Frames Transmitted	Total number of frames transmitted on the port.
Frames Received	Total number of frames received on the port.
Frames Forwarded	Total number of frames received on the port which were forwarded to other ports.
Frames Filtered	Total number of frames received on the port which were filtered.
Frames Dropped	Total number of frames received on the port which were dropped by the switch due to lack of resources.
Broadcasts Transmitted	Total number of broadcast frames transmitted on the port.
Broadcasts Received	Total number of broadcast frames received on the port.

continued on next page

Figure 3-21 Port Statistics Screen (continued)

Field	Description
Multicasts Transmitted	Total number of multicast frames transmitted on the port.
Multicasts Received	Total number of multicast frames received on the port.
Bytes Transmitted	Total number of bytes transmitted on the port.
Bytes Received	Total number of bytes received on the port.
Pause Frames Transmitted	Total number of flow control pause frames transmitted on the port.
Pause Frames Received	Total number of flow control pause frames received on the port.
Collisions	Total number of collisions detected on the port.
Late Collisions	Total number of late collisions detected on the port.
CRC/Alignment Errors	Total number of frames received on the port which had either a CRC or an alignment error.
Undersized Frames	Total number of frames received on the port which were undersized.
Oversized Frames	Total number of frames received on the port which were oversized.
Fragments	Total number of frames received on the port which were fragments.
Jabbers	Total number of frames received on the port which were jabbers.
64 Byte Frames	Total number of frames received and transmitted on the port which were 64 bytes in length.
65 to 127 Byte Frames	Total number of frames received and transmitted on the port which were from 65 to 127 bytes in length.
128 to 255 Byte Frames	Total number of frames received and transmitted on the port which were from 128 to 255 bytes in length.
256 to 511 Byte Frames	Total number of frames received and transmitted on the port which were from 256 to 511 bytes in length.
512 to 1023 Byte Frames	Total number of frames received and transmitted on the port which were from 512 to 1023 bytes in length.
1024 to 1518 Byte Frames	Total number of frames received and transmitted on the port which were from 1024 to 1518 bytes in length.
Selection	Description
Refresh	Refreshes port statistics.
Clear	Clears (or sets to zero) port statistics.

General Information Screen

The General Information Screen allows you to view general system information. Select **e** from the Main Menu to view the General Information Screen. Figure 3-22 shows the General Information Screen and the accompanying table describes the General Information Screen.

GENERAL INFORMATION		Access Control: READ/WRITE
Software Version	1.00	
Serial Number	100	
Base MAC Address	00c0ba000000	
Up Time(minutes)	12	
Power Up Count	1	
x. Previous Menu		
Enter Selection:		

Figure 3-22. General Information Screen

Field	Description
Software Version	The version of system software currently operating on the switch.
Serial Number	The serial number of the switch.
Base MAC Address	The base MAC address of the switch (port 1 address).
Up Time (minutes)	The number of minutes the switch has been operational since the last power cycle or reset.
Power Up Count	The number of times the system has powered up or been reset since the switch was originally shipped from the factory.

Download Software Menu

The Download Software Menu allows you to set up and initiate a software download. Select **f** from the Main Menu to view the Download Software Menu. Figure 3-23 shows the Download Software Menu and the accompanying table describes the Download Software Menu.

DOWNLOAD SOFTWARE		Access Control: READ/WRITE
a. TFTP Server IP Address	1.2.3.4	
b. TFTP File Name		
c. Start TFTP Download		
d. Start XMODEM Download		
x. Previous Menu		
Enter Selection:		

Figure 3-23. Download Software Menu

Selection	Description
TFTP Server IP Address	The IP address of the TFTP server.
TFTP File Name	The file name to be downloaded from the TFTP server (maximum of 80 characters).
Start TFTP Download	Starts a TFTP download using TFTP Server IP Address and TFTP File Name information.
Start XMODEM Download	Starts an XMODEM (serial) download.

Save Current Configuration

The Save Current Configuration screen ensures that all changes made to the ELS100-24TXG switch via the console menus will be stored in the event of power outages or power cycles.

To save your current configuration, do the following:

1. Select **g** from the Main Menu to view the Save Current Configuration screen.

The following message prompt displays:

```
The current settings will become permanent.  
All the saved settings will be lost!
```

- ```
a. OK
x. Cancel and return to the Previous Menu
```

2. Select either **a** to confirm the process or **x** to cancel the process.

## Return to Default Configuration

The Return to Default Configuration screen allows you to restore the original factory default switch settings before changes were made via the user interface or SNMP.

To return to default configuration settings, do the following:

1. Select **h** from the Main Menu to view the Return to Default Configuration screen.

The following message prompt displays:

```
Switch will return to default settings.
All the current changes and settings will be lost!
```

- ```
a. OK  
x. Cancel and return to the Previous Menu
```

2. Select either **a** to confirm the process or **x** to cancel the process.

Logout

The Logout menu item allows you to log out of the user interface and return to the Login screen. Select **i** from the Main Menu to logout. After this command is entered, the system logout occurs automatically.

Reset

The Reset screen allows you to perform a switch hardware reset. You are first prompted as to whether or not to save the current switch configuration.

To reset the switch, do the following:

1. Select **j** from the Main Menu to view the Reset screen.

The following message prompt displays:

```
Switch will go through a hardware reset.  
All the current changes that have not been saved  
will be lost!
```

- ```
a. Save changes and Reset
b. Don't save changes and Reset

x. Cancel and return to the Previous Menu
```

2. Select either **a** or **b** to confirm the process or **x** to cancel the process.

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## 4. CONFIGURING & MONITORING THE SWITCH

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### Common Tasks

The switch console menus allow you to modify default switch settings and configure the switch for network management. They also allow you to monitor switch performance and status. See Section 3, “ELS100-24TXG User Interface,” for an overview of the menu hierarchy and a description of all menus. The following sections describe common tasks in setting up and operating the ELS100-24TXG switch using the console menus.

To begin, set operating parameters and make sure the network connections are correct by performing these tasks:

- Setting password protection for the switch to prevent unauthorized access to console menus
- Assigning an IP address for the switch if you plan to manage the switch using SNMP, or if you use Telnet to access the switch
- Checking network configuration status and verifying that network connections are correct

After the switch is installed and operating, you may want to perform any of the following tasks:

- Connecting via Telnet for in-band access to the console menus
- Setting SNMP parameters for management access
- Viewing switch statistics to monitor and evaluate switch performance and traffic patterns on the network
- Configuring port mirroring
- Downloading a software upgrade
- Configuring Spanning Tree parameters
- Configuring VLANs
- Configuring Class of Service
- Configuring port operation (enable/disable, port speed, full/half duplex and flow control)
- Configuring the forwarding table
- Configuring the broadcast cutoff rate
- Setting a default gateway
- Configuring BootP/DHCP

---

## Setting Password Protection

The ELS100-24TXG switch is factory-configured with access rights to the console menus set to READ/WRITE. This setting allows anyone to use the console menus to modify any operational parameter. To protect the configuration of the switch from unauthorized modification, you should enable password protection to the console menus.

To enter a password, do the following:

1. Select Password from the System Configuration Menu and press [Enter].
2. Enter a password containing one to eight alphanumeric characters.

The password is not case sensitive. For verification, you are asked to enter your password again. If both entries agree, the new password is stored.

By factory default, there is no password configured. This means that at the `login:` prompt, all you have to do is press [Enter] to gain READ/WRITE access to the console menus. When you configure the password parameter, the factory default setting is deactivated and the new password must be used to gain READ/WRITE access to the console menus. After a password has been configured, entering a different password, or pressing only [Enter] at the "`login:`" prompt will result in READ-ONLY access. The current access right level appears at the top of the management screen.

If you forget your password, contact your Cabletron System Support Representative.



**You are automatically logged out from the console menus due to inactivity based on the Screen Timeout setting in the System Configuration Menu. A setting of "0" permits the console menus to remain available indefinitely.**

## Assigning an IP Address

To assign an IP address to the switch, do the following:

1. Select System Configuration Menu from the Main menu.
2. Select IP address from the menu and enter the IP address. Press [Enter].

The IP address is now programmed. The subnet mask is automatically set to correspond to the class of the address entered. If a different mask is used on the network, select Subnet Mask from the menu and enter the appropriate mask.

---

## Checking Network Configuration Status

To check connection status for the network, do the following:

1. Select Port Menu from the Main Menu.  
If a network cable is properly connected to a port, the Link Status for the port reads CONNECTED. If no cable is connected to the port, or if the cable or port is faulty, the Link Status for the port reads DISCONNECTED.
2. If you see a DISCONNECTED status for a connected port, plug the cable into another port on the switch or try another cable.

## Connecting via Telnet

You can connect to the ELS100-24TXG switch from a remote location using the Telnet application. This application allows you to establish in-band access to the console menus.

To connect to the ELS100-24TXG switch via Telnet, do the following:

1. Assign an IP address using the System Configuration Menu.
2. Set a password using the System Configuration Menu.
3. Login to the ELS100-24TXG switch via Telnet using the configured IP address and the password.

## Setting SNMP Management Access

Access to the ELS100-24TXG switch through SNMP is controlled by community names. The community names set for the switch must match those used by the SNMP management station for successful communication to occur. The switch uses two community names. The "Public" community name allows read-only access to the device via SNMP. The "Private" community name allows read/write access.

The ELS100-24TXG switch can send SNMP messages called traps to SNMP management stations when an important event occurs with the switch. The switch allows up to four destinations to be configured for these trap messages to be sent.

To configure SNMP access for the switch, do the following:

1. Select System Configuration Menu from the Main Menu.
2. Select SNMP Configuration Menu.
3. Select SNMP Private Community Name from the menu and enter the desired read/write access community name (you are permitted to enter from one to 10 characters).
4. Select SNMP Public Community Name and enter the desired read-only community name (you are permitted to enter from one to 10 characters).

- 
5. Select one or more Trap Destination entries from the menu and enter the appropriate IP addresses.
  6. For each trap destination entered, a corresponding community name should be entered.

## Viewing Switch Statistics

To view switch statistics, do the following:

1. Select Switch Statistics Screen from the Main Menu.  
The screen lists the main statistical counts for all ports on the switch simultaneously.
2. Select Switch Summary from the Switch Statistics Screen.  
The screen lists a summary of sum total statistics for all ports on the switch.
3. Select Port Statistics from the Switch Statistics Screen.
4. Enter the port number. Press [Enter].  
The screen lists expanded port-level statistics for an individual port.
5. On any of the statistics screens, select Clear to clear (zero) the displayed statistical counts and Refresh to refresh (update) the displayed statistical counts.

## Configuring Port Mirroring

You can mirror the traffic being switched on any 10/100 port for the purposes of network traffic analysis and connection assurance. Port mirroring is not supported on the Gigabit Ethernet ports. When Port Mirroring is enabled, one port in each group of eight becomes a monitor port for any one of the other ports within the group.

To configure port mirroring, do the following:

1. Select Switch Configuration Menu from the Main Menu.
2. Turn the switch port mirroring operation on or off by toggling the Port Mirroring Enable option (pressing **g**).
3. Select Mirrored Port for the port to be mirrored (traffic information source) and enter the number of the port. Press [Enter].
5. Select Transmit Data Mirror Enable to mirror the data being transmitted out the mirrored port to the mirroring port. Alternatively, select Receive Data Mirror Enable to mirror the data being received on the mirrored port to the mirroring port. Only one of these parameters can be enabled at a given time.
6. Connect a traffic analyzer or RMON probe to the mirroring port.

---

## Downloading a Software Upgrade

You can upgrade the operational software in the ELS100-24TXG switch without physically opening the switch or being in the same location. The software storage sector in the flash memory of the switch is reprogrammable, allowing you to easily download software feature enhancements and problem fixes to the switch from a local or remote location.

Software can be downloaded to the switch in two ways:

- Via the serial port. This procedure is an out-of-band operation that copies the software through the serial port to the switch. This operation takes approximately 10 minutes and requires minimal configuration.
- Via TFTP download. This procedure uses a TFTP server connected to the network and downloads the software using the TFTP protocol. A TFTP download is much faster than a serial download, requiring only a few seconds, and can be used to upgrade an ELS100-24TXG switch that is not physically proximate. The disadvantage is that this method requires a TFTP server and additional setup.

### Downloading Via the Serial Port

A serial download is the easiest method to upgrade the ELS100-24TXG switch software, requiring the least amount of equipment and configuration.

To download switch software via the serial port, do the following:

1. Select Download Software Menu from the Main Menu.
2. Select Start XMODEM Download.

The following message prompt displays:

```
Software downloader is running.
```

```
Software downloader request: Please start XMODEM
transfer (9600, N, 1). (Please ignore any
characters that may appear on the next line).
```

3. Send the file using the XMODEM protocol from your computer application (the procedure varies depending upon the application used).

When the XMODEM procedure finishes, the following message prompt displays:

```
Software download successfully completed XMODEM
download. Please wait while program flash is being
written. Software downloader is exiting after
successful download to flash. Please wait while
system initializes.
```

The system software will reinitialize and display the login prompt.

---

## Downloading Via TFTP

To perform a TFTP download, you must first configure the ELS100-24TXG switch. This consists of programming the switch with an IP address, if this has not already been done, and entering the IP address of the TFTP server and the name of the upgrade file. To program the switch IP address, go to the System Configuration Menu which is accessible from the Main Menu screen.

To download switch software via TFTP, do the following:

1. Select TFTP Server IP Address from the Download Software Menu.
2. Enter the TFTP server IP address and press [Enter].
3. Select TFTP File Name and enter the file name to be downloaded from the TFTP server.



**For a TFTP download, the path to the file must be included in its name. For example, if the upgrade file name is filename.bin and it resides in the directory /usr/tftp on the TFTP server, then you must enter the TFTP file name as: "/usr/tftp/filename.bin".**

4. If necessary, configure the address of an IP gateway to reach the server from the switch using the Default Gateway field on the System Configuration Menu.
5. Configure the TFTP server by copying the download file to the appropriate directory and starting the server.
6. Select Start TFTP Download and press [Enter].

To verify that the TFTP download has been successfully completed, note the software version level displayed on the General Information screen accessible from the Main Menu. This number should match the version number of the downloaded file.

## Configuring Spanning Tree Parameters

The ELS100-24TXG switch supports the IEEE 802.1D Spanning Tree Protocol. This protocol allows redundant connections to be created between LAN segments for purposes of fault tolerance. Two or more physical paths between different segments can be created through the switch, with the Spanning Tree Protocol choosing a single path at any given time and disabling all others.

If the chosen path fails for any reason, a disabled alternative is activated, thereby maintaining the connection. See Appendix B, "Spanning Tree Concepts," for further information on using the Spanning Tree Protocol in a network.



---

To configure Spanning Tree Parameters, do the following:



**Configuring Spanning Tree parameters from their default can cause serious deterioration of network performance.**

1. Select Switch Configuration Menu from the Main Menu.
2. Select Spanning Tree Configuration Menu.
3. Turn the switch Spanning Tree operation on or off by toggling the Spanning Tree Protocol Enable option by pressing **a**.
4. Change the main Spanning Tree operational parameters as desired. The parameters on this screen affect the operation of Spanning Tree on the switch as a whole.
5. Select Port Configuration.

The Spanning Tree Port Configuration Menu displays. Change the parameters that display in this menu as required.

## Configuring VLANs

A virtual LAN (VLAN) is a group of network devices on one or more network segments configured such that they can communicate as if they are on the same LAN. VLANs are based on logical instead of physical connections and so enable greater flexibility in network design.

The most fundamental benefit of VLANs is the ability to create workgroups of users based on function rather than on physical location or media. For further information, see Appendix D, “Virtual LANs (VLANs).”

To configure VLANs, do the following:

1. Select Switch Configuration Menu from the Main Menu.
2. Select VLAN Configuration Menu.
3. Turn the global switch VLAN operation on or off by toggling the VLAN Enable option by pressing **a**.
4. Select VLAN Menu.  
The VLAN Menu displays. This menu displays the current configuration of VLANs in the system.
5. To delete a current VLAN, select Delete, then enter the number of the VLAN.
6. To configure a VLAN, select Configure and enter a VLAN number. A new VLAN can be created this way.  
The VLAN #n Configuration Menu displays. From this menu, you can configure VLAN names, add/delete ports in a VLAN, and add/delete egress ports for a VLAN.
7. From the main VLAN Configuration Menu, select VLAN Port Menu to configure the VLAN port mode (hybrid or access) for individual ports.

---

## Configuring Class of Service

You can configure Class of Service parameters using the Class of Service Configuration Menu. This menu permits you to configure priority levels to traffic being forwarded through the switch. During periods of congestion, Class of Service settings ensure that traffic which has been assigned high priority is forwarded through the switch ahead of normal priority traffic. For further information, see Appendix E, "Class of Service."

To configure Class of Service, do the following:

1. Select Class of Service Configuration Menu from the Switch Configuration Menu.
2. Turn the global switch Class of Service operation on or off by toggling the Class of Service Enable option by pressing **a**.
3. Select Priority Threshold and enter a number between 0 and 7. This number represents the threshold between high and low priority traffic passing through the switch.
4. Select Configure Port Priority.

The Port Priority Menu displays. From this menu, individual port priority levels can be configured.

## Configuring Port Operation

You can configure 10/100 ports for operational parameters such as auto-negotiation, duplex mode, port speed and flow control. On the Gigabit Ethernet ports, flow control and auto-negotiation can be configured, but duplex mode and port speed cannot. The Gigabit Ethernet ports always operate in full duplex mode and at a 1000Mbps speed.

To configure port operation, do the following:

1. Select Port Menu from the Main Menu.
2. Select Configure and enter an individual port number or multiple port numbers. Press [Enter].



**Examples: You can configure an individual port or multiple ports, separated by commas or hyphens, in either:**

**a list: ports 1, 3, 5, 7**

**a range: ports 6-9**

**or a combination of both: 1, 3, 5, 7, 10-15, 21, 23**

The port number(s) entered displays on the top of the Port Configuration screen.

- 
3. Select Port Name and enter a Port Name. Press [Enter].
  4. Select Port Enable to toggle between enabling (Yes) and disabling (No) the port(s).
  5. Select Flow Control Enable to toggle between enabling (Yes) or disabling (No) flow control on the port(s).
  6. Select Auto-negotiation Enable to toggle between enabling (Yes) or disabling (No) auto-negotiation on the port.



**For 10/100 ports, if Auto-negotiation Enable is set to "No", the Full Duplex and Port Speed parameters can be configured. For Gigabit Ethernet ports, if Auto-negotiation Enable is set to "No", the Flow Control Enable parameter can be configured.**

**For 10/100 ports, if Auto-negotiation Enable is set to "Yes", the Full Duplex and Port Speed fields disappear and the system automatically configures these functions. For Gigabit Ethernet ports, if Auto-negotiation Enable is set to "Yes", the Flow Control Enable field disappears and the system automatically configures this function.**

7. Select Full Duplex to toggle between Yes (Full Duplex) and No (Half Duplex) mode on the port(s).
8. Select Port Speed to toggle between 10Mbps and 100Mbps speeds on the port(s).

## Configuring the Forwarding Table

The Forwarding Table allows you to designate forwarding treatment through the switch for specific MAC addresses, allowing you to maintain the efficiency and security of your network. You can search for specific MAC addresses by the address itself or by port number. The switch learns addresses dynamically from incoming packets and builds a table of these addresses along with their associated ports. There are three types of MAC addresses in the forwarding table:

- Dynamic MAC addresses, which are dynamically learned by the switch and removed automatically from the forwarding table. These addresses are removed due to non-use based on the time period defined by the Forwarding Table Aging Time parameter in the Switch Configuration Menu.
- Static MAC addresses, which are entered manually, stored in nonvolatile memory and automatically placed in the forwarding table.
- System MAC addresses, which are set by the system software and cannot be modified. Each switch port has a permanent system MAC address assigned to it.

---

There are three types of dispositions associated with each address in the forwarding table:

- Forward, which directs packets destined for a specific MAC address to a specific port.
- Discard, which drops packets destined for a specific MAC address (and thus provides a security function by blocking certain packets).
- Local, which is for packets destined for the switch itself (such as a “local” SNMP management packet).

To configure the forwarding table, do the following:

1. Select Switch Configuration Menu from the Main Menu.
2. Select Forwarding Table Configuration Menu.

To either make an existing dynamic entry static (Make Entry Static) or delete a static entry (Delete Static Entry), do the following:

1. Select the letter associated with the option.

The following message prompt displays:

```
Enter MAC Address:
```

2. Enter the MAC address. Press [Enter].

To either add a static entry (Add Static Entry) or modify a static entry (Modify Static Entry), do the following:

1. Select the letter associated with the option.

The following message prompt displays:

```
Enter MAC Address:
```

2. Enter the MAC address. Press [Enter].

The following message prompt displays:

```
Forward to Port (Y/N):
```

3. Do one of the following:

If you select “Y” and Press [Enter], the system displays:

```
Enter Port Number (1-26):
```

Enter the port number. Press [Enter].

If you select “N” and press [Enter], the system displays “discard” in the Disposition field.

---

## Configuring Broadcast Cutoff Rate

This setting affects the throttling of excessive broadcast or unicast packets with unknown MAC addresses being handled by the switch. Normally, when these types of packets are received by the switch, they are forwarded (flooded) to every port on the switch or on a VLAN. However, if the receiving rate of these packets exceeds the broadcast cutoff rate, the switch will throttle back or limit the forwarding of these packets based on the configured Broadcast Cutoff Rate. This mechanism helps to prevent broadcast storms, a problem often encountered in Ethernet networks.

To configure the broadcast cutoff rate, do the following:

1. Select Switch Configuration Menu from the Main Menu.
2. Select Broadcast Cutoff Rate, enter the rate value, and press [Enter].

Valid values are in the range from 100 to 500,000 per second. This rate value is applied to each grouping of 8 10/100 ports and each Gigabit Ethernet port on the switch. A setting of 500,000 essentially disables this feature.

## Setting a Default Gateway

The Default Gateway parameter defines the IP address of a router or other network device to which IP packets are to be sent if destined for a subnet outside of that which the switch is operating.

To set a default gateway, do the following:

1. Select System Configuration Menu from the Main Menu.
2. Select Default Gateway.
3. Enter the gateway IP address. Press [Enter].

## Configuring BootP/DHCP

The DHCP and BootP protocols allow you to automatically configure the switch's IP address information. Enabling this feature greatly speeds up device configuration, especially when a large number of devices are installed.

A DHCP and/or BootP server must be operating on the network and be properly configured for this option to work. When this option is enabled, the switch first tries to obtain an IP address from a DHCP server. If this fails, the switch tries to obtain an IP address from a BootP server. If this fails, the switch uses a previously configured IP address, if one exists.

To configure BootP/DHCP, do the following:

1. Select System Configuration Menu from the Main Menu.
2. Select BootP/DHCP Enable.

This selection toggles between Enable and Disable.



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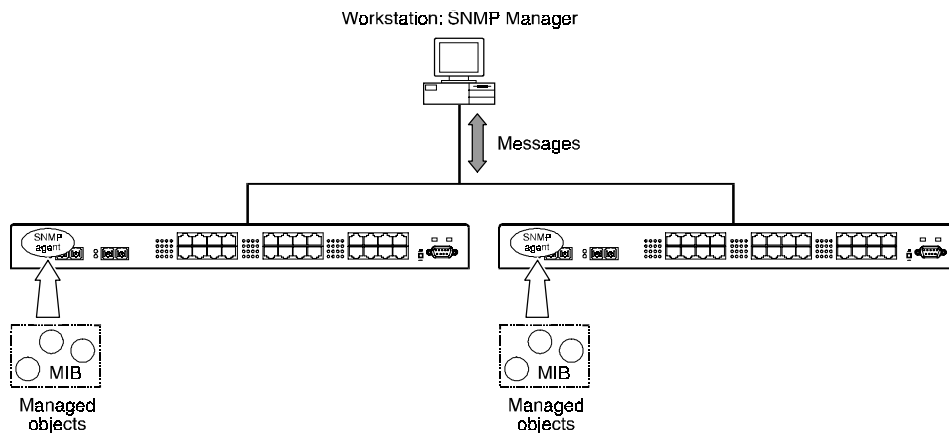
## 5. SNMP MANAGEMENT

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### The SNMP Protocol

SNMP (Simple Network Management Protocol) is a communication protocol designed specifically for the purpose of managing devices or other elements on a network. Network equipment commonly managed with SNMP includes hubs, switches, routers, and host computers. SNMP is typically used to configure these types of devices for proper operation in their network environment, as well as to monitor them to evaluate their performance and detect potential problems.

Managed entities supporting SNMP typically contain software, which runs locally on the device and is referred to as an agent. In Figure 5-1, software in an ELS100-24TXG switch functions as an agent, monitoring and controlling the functionality of the switch.



**Figure 5-1. ELS100-24TXG Switches Managed by an SNMP Management Workstation**

A defined set of variables, referred to as managed objects, is maintained by the agent and used to manage the device. These objects are defined in a Management Information Base (MIB) which allows for a standard presentation of the information controlled by the agent over the network.

The software used to access the information maintained by the SNMP agents across a network is referred to as the SNMP Manager, and typically runs on a workstation.

The SNMP manager software uses a MIB specification, equivalent to that which the agent maintains, to read and write objects controlled by the agent for purposes of configuring and monitoring the device. SNMP defines the format of the MIB specifications and the protocol used to access this information.

---

There are three main operations defined in SNMP:

- Operations that read information from the managed device, such as those used to obtain status or statistical data, are called GET operations.
- Operations that change a functional parameter on the device, such as those used to configure Spanning Tree or to initiate a software download, are referred to as SET operations. GET and SET operations are initiated only by the manager software, and result in a response by the agent.
- The third operation type, the TRAP, allows the agent to send an unsolicited message to the manager. This operation is typically used as an alert of a potential problem or a change of status with the device. The Trap Destination parameter in the SNMP Configuration Menu is used to configure the IP addresses of the SNMP Manager to which ELS100-24TXG trap messages are sent.

## MIB Objects

A number of standard MIB specifications have been defined for managing network equipment. SNMP compliant devices typically support one or more standard MIBs defined by the Internet Engineering Task Force (IETF), in the form of Request for Comments (RFC) documents.

These MIBs provide a common method of managing devices, such as switches and hubs, and network interfaces, such as Ethernet and token ring. The primary standard MIB, referred to as MIB-II, provides an overall view of the managed agent and must be supported, at least in part, by all SNMP agents. In addition, proprietary MIB extensions are defined by commercial vendors for managing device-specific functions of their products.

The ELS100-24TXG switch supports four standard MIBs:

- RFC 1213 - Management Information Base for Network Management of TCP/IP based Internets (MIB-II)
- RFC 1398 - Definitions of Managed Objects for the Ethernet-like Interface Types (Ethernet MIB)
- RFC 1493 - Definitions of Managed Objects for Bridges
- RFC 1757 - Remote Network Monitoring Management Information Base

The ELS100-24TXG switch also supports Cabletron proprietary MIB extensions.

### RFC 1213 (MIB-II)

RFC 1213 provides management of switch system-level parameters, including TCP/IP protocol-related statistics, IP addressing, routing table information, and interface statistics for each switch port. MIB-II is the standard MIB defined by RFC 1213. All agent devices operating SNMP are required to support at least part of MIB-II.



---

This MIB reports information about the protocols and network interfaces supported on the agent itself, as well as other general information. The MIB is divided into a number of groups, each of which corresponds to a specific protocol or set of information. Some groups are defined in other RFC documents.

The groups specifically defined in RFC 1213 and supported by the ELS100-24TXG switch system software are as follows:

- System – General information about the agent system
- Interfaces – Information about the network interfaces of the system
- Address Translation – Interface address information, both MAC level and network (IP) level
- IP – Statistics and information related to the IP protocol
- ICMP – Statistics and information related to the ICMP protocol
- TCP – Statistics and information related to the TCP protocol
- UDP – Statistics and information related to the UDP protocol
- Transmission – Statistics and information related to the physical network medium to which the system interfaces (e.g. Ethernet, token ring, etc.).
- SNMP – Statistics and information related to the SNMP protocol

### **RFC 1398 (Ethernet MIB)**

RFC 1398 provides management and monitoring for the Ethernet-specific aspects of each port on the switch. This is the Ethernet-specific statistics subgroup of the MIB-II Transmission group. This group provides a set of statistics related to Ethernet's physical level operation. Specifically, error and collision-related statistics are presented.

### **RFC 1493 (Bridge MIB)**

RFC 1493 is a group defined under MIB-II. This MIB deals with the operation of the system as an 802.1D-compliant bridge. Areas of functionality supported by this group include Spanning Tree and forwarding table information and configuration.

### **RFC 1757 (RMON MIB)**

RFC 1757 is a group defined under MIB-II. This MIB provides management for the RMON aspects of the switch. The ELS100-24TXG switch supports four of the nine groups of RMON defined for Ethernet networks on a per port basis. For further information, see the subsection "RMON" in Chapter 1.

### **Cabletron Proprietary MIB Extensions**

Areas of ELS100-24TXG switch functionality not covered by the standard RFC MIBs are specified in the Cabletron private MIB. This MIB definition is specified separately from MIB-II. Areas covered in this MIB include

various system, switch, and port level information. System information MIB variables are shown in Table 5-1, switch information variables in Table 5-2, and port variables in Table 5-3.

**Table 5-1. System Information Variables**

| Variable            | Description                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SerialNo            | Serial number of the unit.                                                                                                                                                |
| TftpIpAddress       | TFTP server IP address for TFTP downloads.                                                                                                                                |
| TftpFilename        | Filename of the download upgrade file on the TFTP server.                                                                                                                 |
| PowerUpCount        | Cumulative number of times switch has powered up or been reset.                                                                                                           |
| BroadcastCutoffRate | Per second rate past which broadcast and destination unknown unicast frames are not flooded on each group of 8 10/100 ports and each Gigabit Ethernet port on the switch. |
| GatewayIPAddress    | IP address of the default gateway (router) to which packets destined for another subnet are sent.                                                                         |
| TftpStartDownload   | Start TFTP downloads via SNMP, using TftpIpAddress and TftpFilename.                                                                                                      |
| BootpDhcpEnable     | Enable/disable BootP/DHCP for IP address configuration.                                                                                                                   |
| Reset               | Remotely execute a software reset of the switch.                                                                                                                          |

**Table 5-2. Switch Information Variables**

| Variable                   | Description                                                                           |
|----------------------------|---------------------------------------------------------------------------------------|
| SwitchIpAddress            | IP address of the switch, used for management.                                        |
| SwitchSubnetMask           | Subnet mask corresponding to the SwitchIpAddress.                                     |
| ActiveAgingTime            | Aging tick period in seconds by which addresses in the forwarding table are aged out. |
| SwitchStpStatus            | Enable/disable operation of Spanning Tree on the switch.                              |
| SwitchManager              | List of SNMP trap manager IP addresses.                                               |
| SwitchTrapRcvr1            | SNMP trap manager IP address #1.                                                      |
| SwitchTrapCommunity1       | SNMP community associated with trap manager IP address #1.                            |
| SwitchTrapRcvr2            | SNMP trap manager IP address #2.                                                      |
| SwitchTrapCommunity2       | SNMP community associated with trap manager IP address #2.                            |
| SwitchTrapRcvr3            | SNMP trap manager IP address #3.                                                      |
| SwitchTrapCommunity3       | SNMP community associated with trap manager IP address #3.                            |
| SwitchTrapRcvr4            | SNMP trap manager IP address #4.                                                      |
| SwitchTrapCommunity4       | SNMP community associated with trap manager IP address #4.                            |
| SwitchPortMirroring Status | Enable/disable port mirroring operation of the switch.                                |

*continued on next page*

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**Table 5-2 Switch Information Variables (continued)**

| Variable                | Description                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| SwitchMirroredPort      | Port to be mirrored from.                                                                             |
| SwitchMirroringPort     | Port to be mirroring to.                                                                              |
| SwitchXmitMirrorEnable  | Enable/disable mirroring of transmitted traffic out of the mirrored port to the mirroring port.       |
| SwitchRcvMirrorEnable   | Enable/disable mirroring of received traffic into the mirrored port to the mirroring port.            |
| SwitchVlanEnable        | Enable/disable global VLAN operation of switch.                                                       |
| SwitchVlanConfigTable   | Table indexed by SwitchVlanId                                                                         |
| SwitchVlanId            | VLAN number or ID.                                                                                    |
| SwitchVlanName          | Text string for VLAN name.                                                                            |
| SwitchVlanPorts         | Ports in the VLAN.                                                                                    |
| SwitchVlanStatus        | Variable used to add or delete entries from the VlanConfigTable.                                      |
| SwitchVlanEgressPorts   | Ports to which traffic destined for this VLAN may be transmitted.                                     |
| SwitchVlanStatus        | Variable used to add or delete entries from the VlanConfigTable.                                      |
| SwitchVlanPortTable     | Table indexed by SwitchVlanPortId.                                                                    |
| SwitchVlanPortId        | Port number or ID.                                                                                    |
| SwitchVlanPvid          | Port VLAN ID (PVID) for this port.                                                                    |
| SwitchVlanPortType      | The type of VLAN this port is operating as, either hybrid or access.                                  |
| SwitchPriorityEnable    | Enable/disable global traffic priority in the switch.                                                 |
| SwitchPriorityThreshold | Priority threshold level (0-7) in the switch which defines switch traffic to be high or low priority. |
| SwitchPriorityPortTable | Priority table indexed by SwitchPriorityPortId.                                                       |
| SwitchPriorityPortId    | Port number or ID.                                                                                    |
| SwitchPriorityDefault   | Priority level (0-7) assigned to untagged traffic entering the associated port.                       |

---

---

**Table 5-3. Port Variables**

| Variable              | Description                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------|
| PortId                | Port number or ID.                                                                        |
| PortStatus            | Link status of the port.                                                                  |
| PortDuplexStatus      | Full/half duplex setting of the port. Not configurable if auto-negotiation is enabled.    |
| PortName              | Text name assigned to the port.                                                           |
| PortEnable            | Enable/disable status of the port.                                                        |
| PortSpeed             | Speed the port is operating at. Not configurable if auto-negotiation is enabled.          |
| PortAutonegEnable     | Enable/disable auto-negotiation on the port.                                              |
| PortFlowControlEnable | Enable/disable flow control on the port.                                                  |
| PortType              | The type of port, either: 10Base-T, 100Base-TX, 1000Base-SX, 1000Base-LX, or 1000Base-CX. |

## Compiling MIB Extensions: Cabletron Website

The MIBs supported by the ELS100-24TXG switch must be compiled into the SNMP network management platform before the switch can be managed. The supported MIBs are available using Cabletron's website at:

*<http://www.cabletron.com>*

The four standard MIB specifications listed above with which the ELS100-24TXG switch is compliant are generally available with the SNMP management platform.

Application modules specific to managing the ELS100-24TXG switch under different network management platforms are available. Contact Cabletron Systems for information regarding supported platforms.

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## APPENDIX A. TECHNICAL SPECIFICATIONS

---

### General

#### Standards Compliance

IEEE 802.1D Transparent Bridging Specifications (ISO/IEC 10038)  
IEEE 802.1p Traffic Class Expediting and Dynamic Multicast Filtering  
IEEE 802.1Q Virtual Bridged Local Area Networks  
IEEE 802.2 Local Area Networks, Logical Link Control (LLC)  
IEEE 802.3 CSMA/CD 9 (ISO/IEC 8802-3)  
IEEE 802.3i 10Base-T (ISO/IEC 8802-3, clause 14)  
IEEE 802.3u 100Base-TX (ISO/IEC 8802-3, clause 25)  
IEEE 802.3x Flow Control  
IEEE 802.3z Gigabit Ethernet  
EIA RS-232C (DTE-to-DCE)  
EIA RS-310C (19" rackmount)

#### Certification

Emissions: FCC Part 15, Subpart B, Class A; EN55022 (CISPR 22), Class A; VCCI  
Safety: UL 1950; cUL 1950 (CSA); IEC 950 (TUV)  
CE Directives: 89/336/EEC; 93/68/EEC; 73/23/EEC

#### Data Rate

10 Mbps Manchester encoded, 100 Mbps 4B/5B encoded, or 1 Gbps 8B/10B encoded.

#### Environmental Specifications

|                        |                                   |
|------------------------|-----------------------------------|
| Operating temperature: | 32° to 113° F ( 0° C to 45° C)    |
| Operating humidity:    | 5 to 95% relative, non-condensing |
| Storage temperature:   | -22° to 158°F (-30° C to 70° C)   |
| Storage humidity:      | 5 to 95% relative, non-condensing |

---

## Electrical Specifications

|                            |             |
|----------------------------|-------------|
| Input voltage:             | 100-240 VAC |
| Input frequency:           | 50-60 Hz    |
| Maximum power consumption: | 75 VA       |

## Physical

|                                 |                                  |
|---------------------------------|----------------------------------|
| Height:                         | 1.75 in. (4.4 cm)                |
| Length:                         | 16.0 in. (40.6 cm)               |
| Width:<br>standard 19 in. rack) | 17.1 in. (43.4 cm mountable in a |
| Weight:                         | 10.5 lb. (4.8 kg)                |

## Microprocessor

|        |                            |
|--------|----------------------------|
| Type:  | Intel i960J series, 32 bit |
| Speed: | 33 MHz                     |

## Memory

|                       |                                                             |
|-----------------------|-------------------------------------------------------------|
| Processor DRAM:       | 4 MB                                                        |
| Packet Buffer Memory: | 4 MB per 8 10/100 ports<br>8 MB per 1 Gigabit Ethernet port |
| Flash Memory:         | 2 MB                                                        |

---

## Port Specifications

### Console Port

Table A-1 shows the console port pin assignments.

**Table A-1. RS-232 Console Port Pin Assignments**

| Pin | Signal Name |
|-----|-------------|
| 1   | RTS/CTS     |
| 2   | TXD         |
| 3   | RXD         |
| 4   | DSR         |
| 5   | Ground      |
| 6   | DTR         |
| 7   | DCD         |
| 8   | DCD         |
| 9   | Not used    |

### 10Base-T and 100Base-TX Ports

Table A-2 shows the 10Base-T/100Base-TX pinouts. These ports are wired MDI-X. All undefined pins are not used.

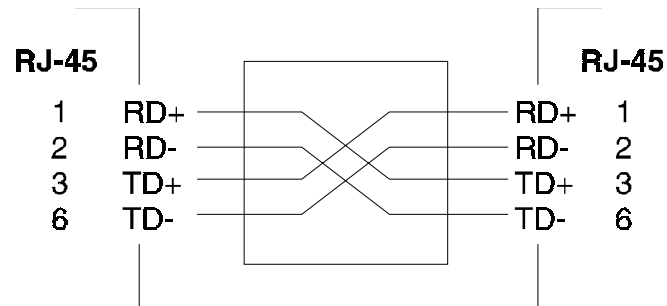
**Table A-2. 10Base-T/100Base-TX Pinouts**

| Pin | MDI-X Signal Name |
|-----|-------------------|
| 1   | RD+               |
| 2   | RD-               |
| 3   | TD+               |
| 6   | TD-               |

---

## MDI/MDI-X Crossover Cable Wiring

Figure A-1 shows the wiring scheme for implementing a crossover cable if needed for connection to the switch's 10Base-T or 100Base-TX ports. Such a cable may be required when connecting the switch to another switch or a hub device.



**Figure A-1. External Crossover Cable Wiring**

## Power Cord Set Requirements

The wide-range input feature of the ELS100-24TXG Ethernet switch permits it to operate from any line voltage between 100 and 240 VAC.

The power cord set (appliance coupler, flexible cord, and wall plug) you received with the switch meets the requirements for use in the country where you purchased the switch.

Power cord sets for use in other countries must meet the requirements of the country where you use the switch. For more information on power cord set requirements, contact your Cabletron System Support Representative.

### General Requirements

The requirements listed below are applicable to all countries:

- The length of the power cord set must be at least 5.00 feet (1.5 m) and a maximum of 6.56 feet (2.0 m).
- All power cord sets must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be used.
- The power cord set must have a minimum current capacity of 10A and a nominal voltage rating of 125 or 250 VAC, as required by each country's power system.
- The appliance coupler must meet the mechanical configuration of an EN 60 320/IEC 320 Standard Sheet C13 connector for mating with appliance inlet on the switch.



---

## Country-Specific Requirements

Table A-3 lists the power cord set requirements by country and identifies the accredited agency within that country.

**Table A-3. Power Cord Set Requirements by Country**

| Country        | Accredited Agency | See Notes * |
|----------------|-------------------|-------------|
| Australia      | EANSW             | 1           |
| Austria        | OVE               | 1           |
| Belgium        | CEBC              | 1           |
| Canada         | CSA               | 2           |
| Denmark        | DEMKO             | 1           |
| Finland        | FIMKO             | 1           |
| France         | UTE               | 1           |
| Germany        | VDE               | 1           |
| Italy          | IMQ               | 1           |
| Japan          | JIS               | 3           |
| Netherlands    | KEMA              | 1           |
| Norway         | NEMKO             | 1           |
| Sweden         | SEMKO             | 1           |
| Switzerland    | SEV               | 1           |
| United Kingdom | BSI               | 1           |
| United States  | UL                | 2           |

**\* The note column includes a number. Associate this number with the corresponding notes listed after the table to obtain specific power standards and requirements.**

### Note 1

Flexible cord must be <HAR> Type HO5VV-F or HO3VV-F, 3-conductor, 1.0 mm<sup>2</sup>, or 0.75 mm<sup>2</sup> conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country where it will be used.

---

### Note 2

Flexible cord must be Type SV, SJ, SPT or equivalent, No. 18 AWG, 3-conductor. Wall plug must be a two-pole grounding type with a NEMA 5-15P (15A, 125V) or NEMA 6-15P (15A 250V) configuration.

### Note 3

Appliance coupler, flexible cord, and wall plug must bear a "T" mark and registration number in accordance with the Japanese Dentori Law. Flexible cord must be Type VCT or VCTF, 3-conductor, 0.75mm<sup>2</sup> conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (15A, 125V) configuration.

---

## APPENDIX B. SPANNING TREE CONCEPTS

---

### General

The IEEE 802.1D Spanning Tree Protocol resolves the problems of physical loops in a network by establishing one primary path between any two switches in a network. Any duplicate paths are barred from use and become standby or blocked paths until the original path fails, at which point they can be brought into service.

### Spanning Tree Features

The ELS100-24TXG switch meets the requirements of the Spanning Tree Protocol (STP) by performing the following functions:

- Creates a single spanning tree from any arrangement of switching or bridging elements.



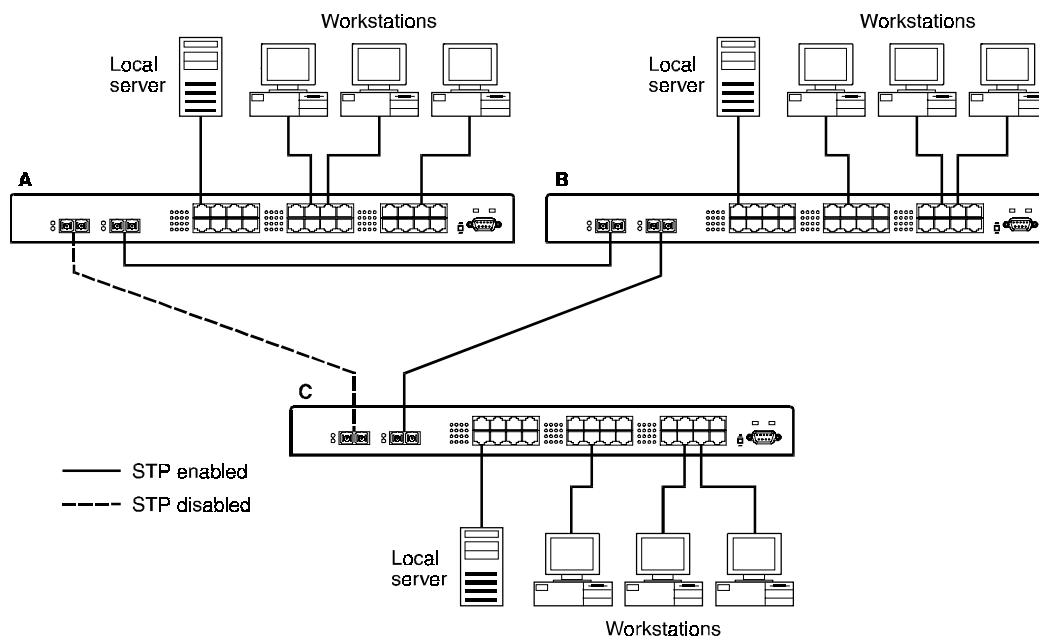
**The term “switch” is used as an equivalent to “bridge” in this document.**

- Compensates automatically for the failure, removal, or addition of any device in an active data path.
- Achieves port changes in short time intervals, which establishes a stable active topology quickly with a minimum of network disturbance.
- Uses a minimum amount of communications bandwidth to accomplish the operation of the Spanning Tree Protocol.
- Reconfigures the active topology in a manner that is transparent to stations transmitting and receiving data packets.
- Manages the topology in a consistent and reproducible manner through the use of Spanning Tree Protocol parameters.

---

## Spanning Tree Protocol in a Network

Figure B-1 illustrates the use of three ELS100-24TXG switches to establish an effective Spanning Tree configuration. Switches A, B and C are connected together in a redundant topology (more than one path between two points). If the connection between A and B goes down, the link between A and C becomes active, thereby establishing a path between A and B through switch C. Additionally, if the connection between B and C goes down, the link between A and C becomes active, establishing a path between B and C through switch A.



**Figure B-1. Spanning Tree Using ELS100-24TXG Switches**

## Spanning Tree Protocol Parameters

Several configuration parameters control the operation of the Spanning Tree Protocol. Table B-1 describes the parameters and lists the ELS100-24TXG switch default settings for each parameter.



**You can cause serious network performance degradation if you do not fully understand Spanning Tree concepts. Be sure to consult personnel experienced with this process prior to configuring Spanning Tree parameters.**

---

**Table B-1. Spanning Tree Protocol Defaults**

| Parameter                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Default Value           |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Bridge Group Address        | Unique MAC group address, recognized by all bridges in the network.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |
| Bridge Identifier           | Identifier for each bridge. This parameter consists of two parts: a 16-bit bridge priority and a 48-bit network adapter address. Ports are numbered in absolute numbers starting from 1 regardless of their bridge attachment. The network adapter address is the same address as the first port of the bridge.                                                                                                                                                                                                                                                                                                                              | 32768 (bridge priority) |
| Port Identifier             | Identifies each port of each bridge, with an incremental default value given for each port.<br><br>Port 1 -32768      Port 10 -32777      Port 19 -32786<br><br>Port 2 -32769      Port 11 -32778      Port 20 -32787<br><br>Port 3 -32770      Port 12 -32779      Port 21 -32788<br><br>Port 4 -32771      Port 13 -32780      Port 22 -32789<br><br>Port 5 -32772      Port 14 -32781      Port 23 -32790<br><br>Port 6 -32773      Port 15 -32782      Port 24 -32791<br><br>Port 7 -32774      Port 16 -32783      Port 25 -32792<br><br>Port 8 -32775      Port 17 -32784      Port 26 -32793<br><br>Port 9 -32776      Port 18 -32785 |                         |
| Port Priority               | Indicates the priority of a specific port in relation to other ports.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 128                     |
| Cost Component of Each Port | The Spanning Tree Protocol calculates and ensures that an active topology generates minimal cost paths. A value of 100 is generally used for 10Mbps Ethernet networks, a value of 10 is for 100Mbps Ethernet networks, and a value of 1 is for 1Gbps Ethernet networks.                                                                                                                                                                                                                                                                                                                                                                      | 10                      |

For detailed information on the operation of the Spanning Tree Protocol, consult Section 4 of IEEE Standard 802.1D, ISO/IEC 10038:1993.

## Spanning Tree Protocol Operation

When the Spanning Tree Protocol is enabled for the first time or when there is a change in the network topology, such as a failure or the addition or removal of a component, the Spanning Tree Protocol automatically sets up the active topology of the current network.

---

## Communicating Between Bridges

Periodically, all devices running the Spanning Tree Protocol on a network transmit packets to each other “in care of” the Bridge Group Address which all bridges share. When a bridge receives a frame sent to the Bridge Group Address, the bridge’s Spanning Tree Protocol processes the packet. Application software and other LAN segments ignore the packet. Bridges communicate between each other in order to determine the Root Bridge.

## Selecting a Root Bridge and Designated Bridges

During communication between bridges, one bridge is determined to have the lowest bridge identifier. This bridge becomes the Root Bridge.

After the Root Bridge has been selected, each LAN segment looks for the bridge that has the lowest cost relative to the Root Bridge. These bridges become Designated Bridges.

## Selecting Designated Ports

Each Designated Bridge selects a Designated Port. This port is responsible for forwarding packets to the Root Bridge.

## Handling Duplicate Paths

When the active topology of the network is determined, all packets between any two nodes in the network use only one path. Where a duplicate path exists, the non-designated port is put into a blocking state.

## Remapping Network Topology

If there is a change in the network topology due to a failure or the removal or addition of any active components, the active topology also changes. This may trigger a change in the state of some blocked ports.

There are five (5) states that the ports can be in for spanning tree:

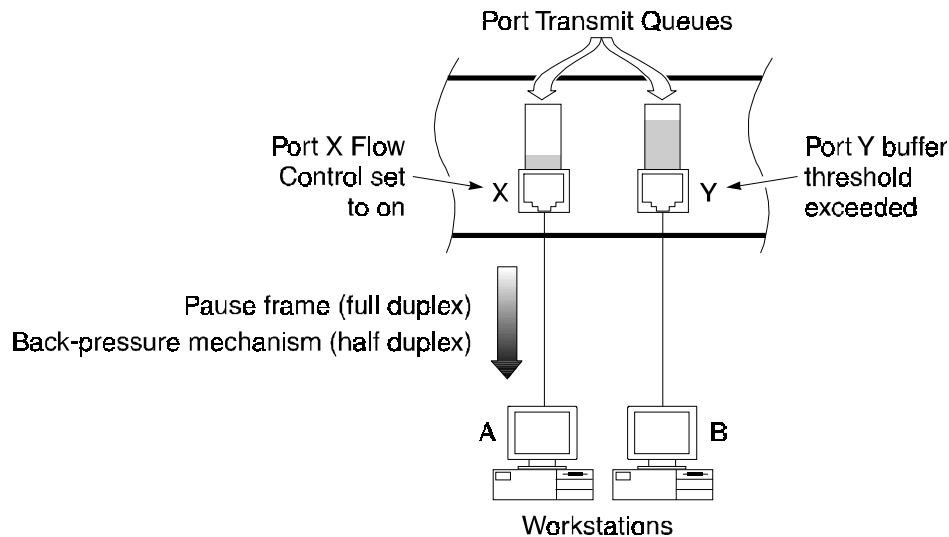
- **Blocking:** A port in this state does not participate in the transmission of frames, thus preventing duplication arising through multiple paths existing in the active topology of the bridged LAN.
- **Listening:** A port in this state is preparing to participate in the transmission of frames. The transmission of frames is temporarily disabled in order to prevent temporary loops, which may occur in a bridged LAN during the lifetime of this state as the active topology of the bridged LAN changes.
- **Learning:** A port in this state is preparing to participate in the transmission of frames.
- **Forwarding:** A port in this state is participating in the transmission of frames.
- **Disabled:** A port in this state does not participate in the transmission of frames or the operation of the spanning tree process.

---

## APPENDIX C. FLOW CONTROL

---

Flow control is a mechanism which allows you to protect the switch from overload conditions and to keep additional traffic off the network when excessive congestion will result. Figure C-1 illustrates flow control for both half and full duplex applications.



**Figure C-1. Flow Control for Full and Half Duplex Applications**

Each port of the switch has a transmit queue which buffers frames to be sent out on that port. In this example, large amounts of data are being sent from Workstation A (connected to port X) and other ports on the switch to Workstation B (connected to port Y). The queue on port Y starts filling up with data until it reaches a determined threshold. The packet which causes the threshold to be exceeded triggers the Flow Control function on the port from which the packet entered the switch, in this case port X.

Since port X is configured with Flow Control set to Enabled, the switch responds by initiating a pause frame (full duplex applications) or back-pressure mechanism (half duplex applications). The pause frame causes Workstation A to stop sending packets. After a certain amount of time has elapsed, determined by a value in the pause frame, Workstation A will resume sending data. Similarly, the back-pressure mechanism forces Workstation A to stop sending packets by inducing collisions on port X.

The pause frame flow control mechanism supported by the ELS100-24TXG switch conforms with the IEEE 802.3x specification for full duplex flow control.

---

The ELS100-24TXG Port Statistics Screen indicates the number of pause frames that have been sent, indicating the number of times full duplex flow control has occurred. For the full duplex pause frame mechanism to work, the device connected to the switch port must also support IEEE 802.3x flow control. Flow Control is configurable per port in the Port Configuration Menu of the console menu or via SNMP.



---

## APPENDIX D. VIRTUAL LANS (VLANs)

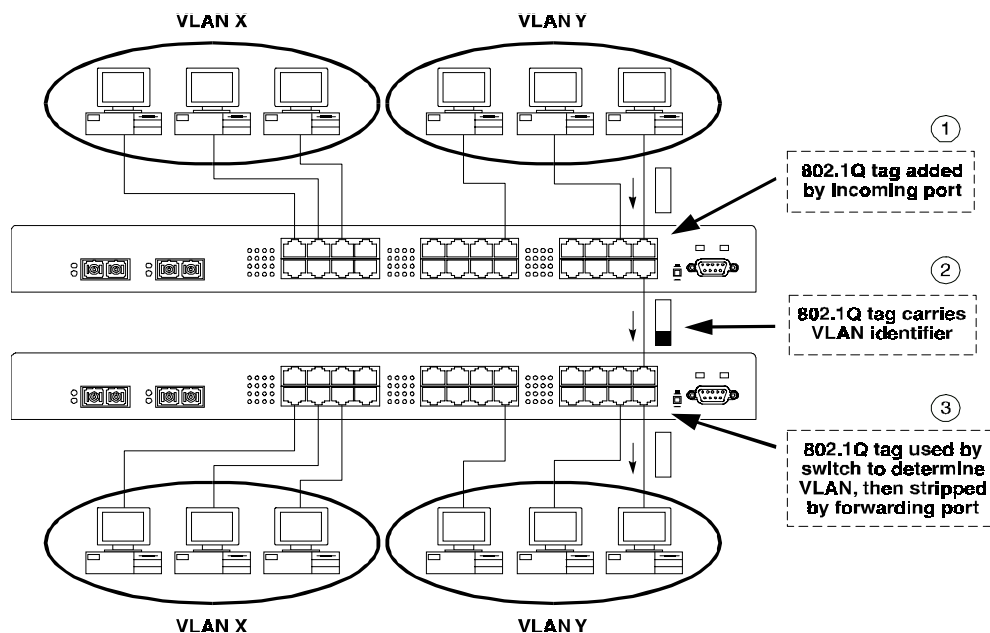
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### VLANs and Frame Tagging

The ELS100-24TXG supports IEEE 802.1Q-compliant virtual LANs (VLANs). This capability provides a highly efficient architecture for establishing VLANs within a network and for controlling broadcast/multicast traffic between workgroups. Central to this capability is an explicit frame tagging approach for carrying VLAN information between interconnected network devices.

With frame tagging, a four byte data tag field is appended to frames that cross the network. The tag identifies which VLAN the frame belongs to. The tag may be added to the frame by the end station itself or by a network device, such as a switch. In addition to VLAN information, the relative priority of the frame in the network can be specified by the tag (see Appendix E, “Class of Service”).

In the example in Figure D-1 below, the workstations attached to the top switch are members of the same two VLANs as the workstations attached to the bottom switch. The 802.1Q tags are used to carry VLAN information in the frames traveling between the two switches.



**Figure D-1. Two Switch VLAN Configuration**

If the ELS100-24TXG is so configured, and, if the frame does not already contain a tag, a VLAN identifier is placed in a tag which is appended to frames as they are received by the switch. Within the switch and between switches compliant with IEEE 802.1Q, these identifiers are used to control the destination of broadcast frames, preventing them from being flooded

---

to all connected stations and interfaces. When frames are forwarded back to destination end stations, the tag may or may not be stripped off, depending on the configuration of the end station and the switch port.

By using 802.1Q tagged VLANs, users from physically dispersed locations can be formed into groups by assigning them to specific VLANs. Broadcast and multicast traffic for these specific VLANs can be directed across the network without being radiated out to stations that are not members of the same VLANs. Up to 4094 different VLANs can be specified by the 802.1Q tag, thus permitting the configuration of up to 4094 virtual workgroups. This implementation is nonintrusive to end-station applications and the associated clients.

## **ELS100-24TXG VLAN Configuration**

VLAN operation on the ELS100-24TXG is disabled by default. When VLANs are enabled, all frames are transferred internally through the switch with a VLAN tag. This tag may already be on the frame entering the switch, or added to the frame by the switch. VLAN information already existing on frames entering the switch is automatically handled by the switch. The ELS100-24TXG learns VLAN information from tagged frames and appropriately switches frames out the proper ports based on this information. The configuration of VLANs for frames entering the switch without tags must be made by the user of the switch. This configuration can be made either through the VLAN Menu in the console interface or via SNMP. The parameters used to configure VLANs on the ELS100-24TXG are explained below.

### **VLAN ID**

The VLAN ID is used to uniquely identify different VLANs on a network. The VLAN ID information is contained in the 802.1Q tag header on a frame, and so identifies the VLAN to which a frame belongs. The ELS100-24TXG recognizes VLAN IDs in the tags on frames entering the switch, and can also add tags with an appropriate VLAN ID to untagged frames.

### **Ports in VLAN**

When configuring VLANs on the ELS100-24TXG, individual ports are assigned to specific VLANs by setting the Port VLAN ID (PVID) for each port. Frames entering the switch which are untagged are automatically assigned a VLAN ID by the switch based on the PVID of the incoming port. The Ports in VLAN parameter makes the assignment of ports to PVIDs. An individual port can only be assigned to a single PVID with this parameter.

---

## VLAN Egress Ports

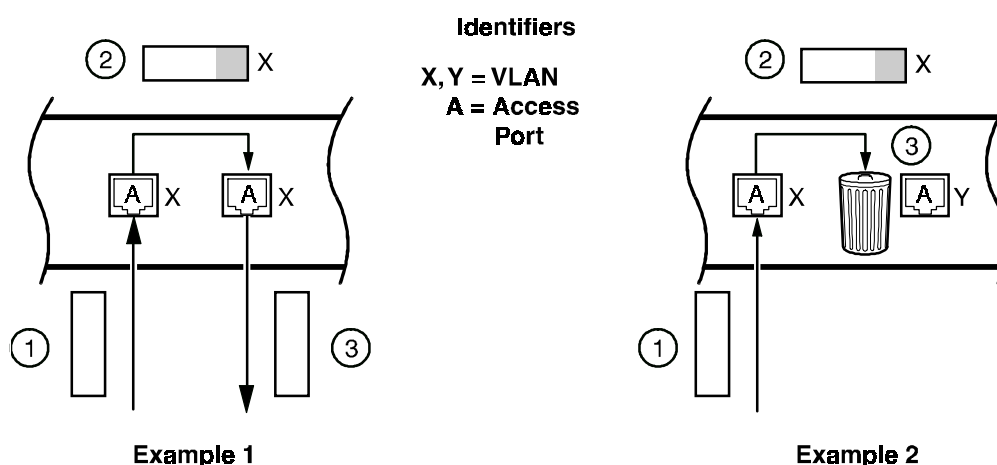
The VLAN Egress Ports parameter is used to assign ports to a VLAN for carrying VLAN tagged frames across a network. The assignment of egress ports does not affect the assignment of VLAN IDs to frames entering the switch. However, frames exiting the switch may be sent out the egress ports configured for a specific VLAN ID. Frames exiting the switch via egress ports for a given VLAN are normally tagged.

## VLAN Access Ports

Individual ELS100-24TXG ports can be configured as one of two types for the purpose of VLAN configuration: Access or Hybrid. A VLAN Access port is used to connect one or more VLAN-unaware devices to the switch. VLAN tagged frames are not allowed to enter or exit an Access port. If a tagged frame enters the switch on an Access port, the switch will drop the frame. End-user stations which do not support 802.1Q tags should be attached to ports on the switch configured as Access ports.

In Example 1 in Figure D-2, both ports are designated as Access ports. The ports are both configured to be on VLAN X. An untagged frame (1) comes in through the left port and gets tagged with a VLAN X tag (2), based on the incoming port PVID. As the frame exits through the right port, the tag is stripped (3) since the outgoing port is an Access port as well and can only transmit untagged frames. The frame can propagate through the switch in this example only because both ports are on the same VLAN.

In Example 2 in Figure D-2, both ports are also Access ports, however the port on the left is on VLAN X while the port on the right on VLAN Y. The untagged frame (1) comes in through the left port and again gets tagged with a VLAN X tag (2). However, because the outgoing port is on a different VLAN (VLAN Y), the frame is dropped. In general, frames cannot propagate between ports unless both ports belong to the same VLAN.



**Figure D-2. VLAN Access Ports**

## VLAN Hybrid Ports

A VLAN Hybrid port is used to connect one or more VLAN-aware or VLAN-unaware devices to the switch. Both tagged and untagged frames can be received and transmitted on Hybrid ports. Egress ports should typically be configured as Hybrid ports.

When a frame with an unlearned source MAC address enters a Hybrid port, the learning of that address and its associated VLAN is dependent on whether the frame is tagged or not. If the frame is untagged, its source MAC address is learned as a non-tagging station, with a VLAN ID equal to the input port PVID. All frames subsequently sent to that MAC address from this Hybrid port will be untagged. If the frame is tagged, its source MAC address is learned as a tagging station, with a VLAN ID equal to the value of the VLAN ID in the tag. All frames subsequently sent to that MAC address from this Hybrid port will be tagged with that same VLAN ID.

In Example 1 in Figure D-3A, two ports are configured with two different PVIDs, X and Y. A frame arrives (1) with a tag for VLAN Z. If the destination MAC address of that frame has already been learned on the destination port as a tagged station with the same VLAN ID of Z, the frame is sent out that port (3) with the VLAN Z tag still appended to it. If the address has not been learned with the VLAN ID of Z on the destination port, the frame is dropped.

In Example 2 in Figure D-3A, a similar scenario to Example 1 occurs, except that the incoming frame (1) is tagged with a VLAN Y tag. The frame is being sent (2) to a port that belongs to VLAN Y. In this case, the decision to append a VLAN Y tag or not to the outgoing frame depends on whether the destination MAC address has been learned as a tagged or as an untagged station. In this example, it was learned as an untagged station, so the frame is sent out without a tag (3).

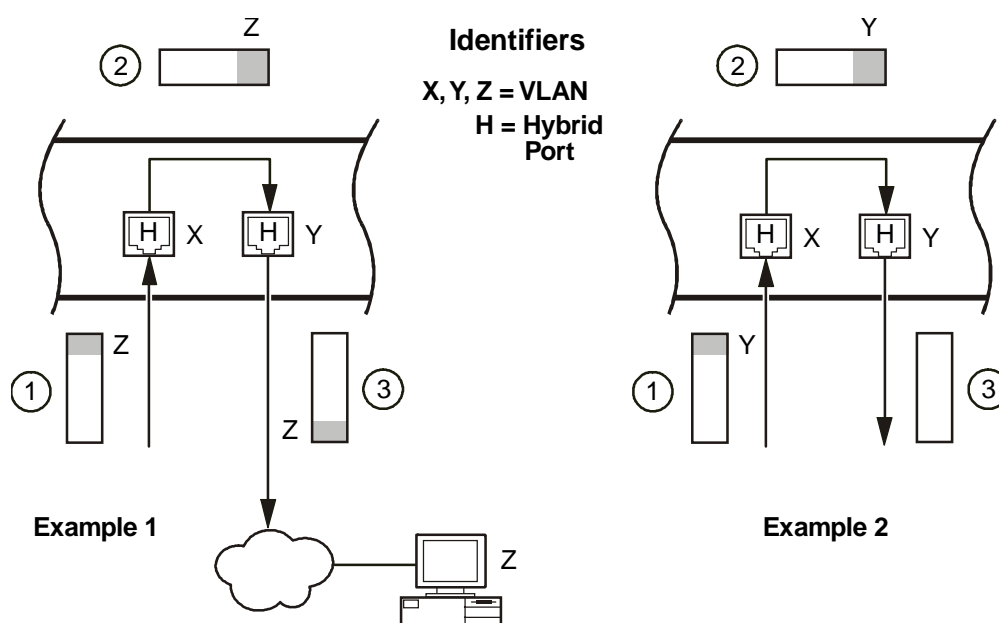


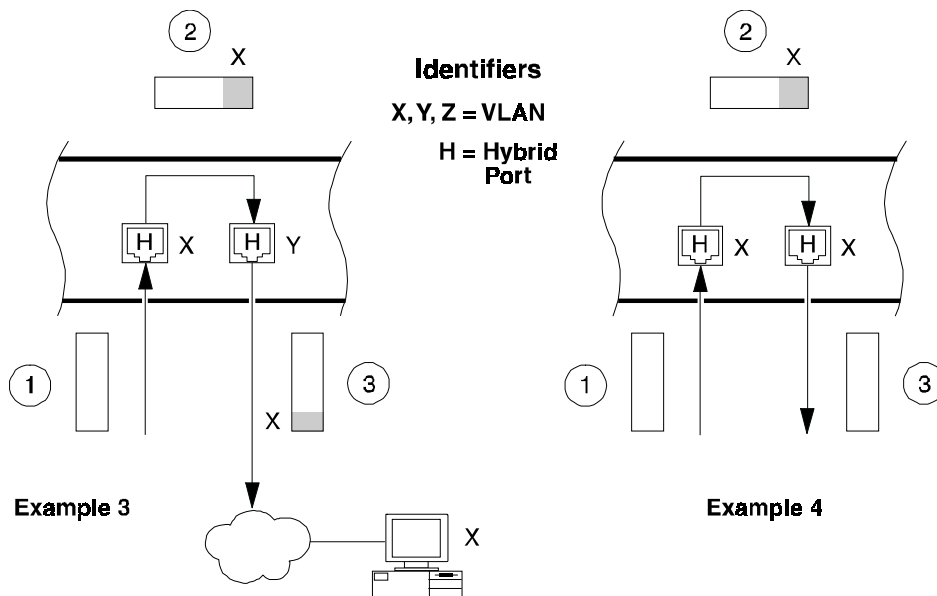
Figure D-3. VLAN Hybrid Ports (Examples 1 and 2)

In Example 3 in Figure D-3B, an untagged frame arrives at the left port (1). The switch tags the frame with the PVID for VLAN X (2). Since the destination MAC address has already been learned as a tagged station on VLAN X on the outgoing port, the frame is sent out with a VLAN X tag.

Example 4 in Figure D-3B is similar to Example 3 except that both ports (incoming and outgoing) have a VLAN X PVID. The untagged frame arrives at the incoming port (1) and gets tagged with a VLAN X tag (2). The tag may or may not be stripped off as the frame exits the switch, depending on how the MAC address of the destination device was learned (3). In this example, the destination was learned as an untagged station so the tag is stripped. This Hybrid port example is thus essentially the same as the Access port case in Figure D-2, Example 1.



**When sending broadcast or unknown DA unicast frames out a Hybrid port, the frames are always tagged. The VLAN ID of the tag is identical to the VLAN ID that was assigned to the frame when it entered the switch on the source port.**



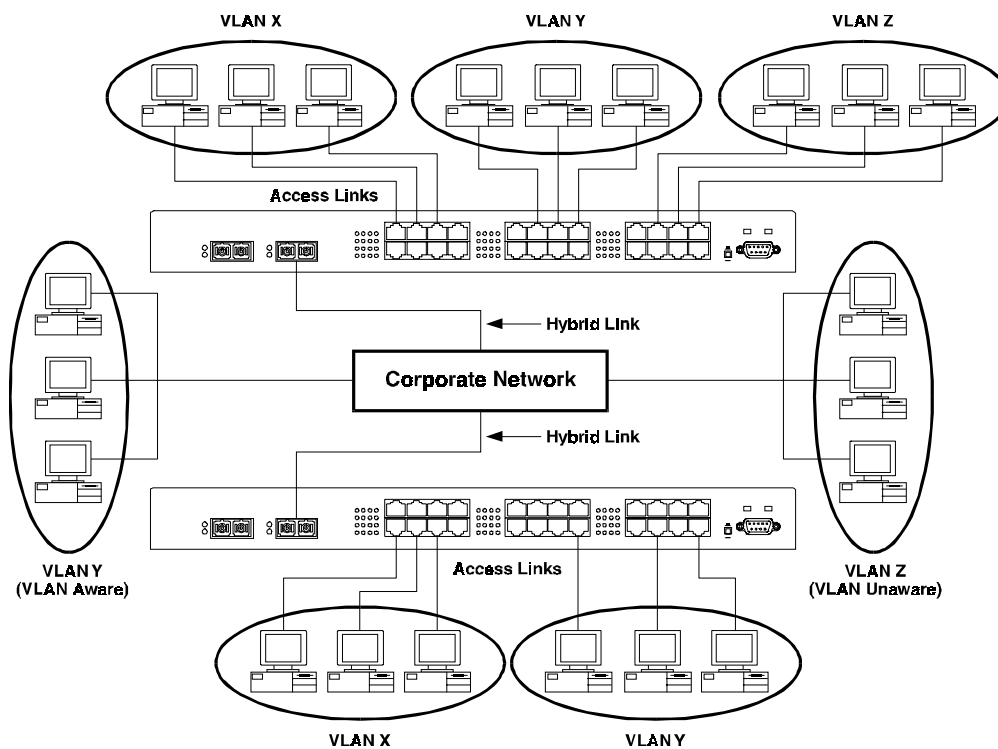
**Figure D-3B. VLAN Hybrid Ports (Examples 3 and 4)**

## VLAN Application Example

A network administrator can use VLANs to define user groups regardless of the physical LAN segment to which they are connected. The use of Hybrid and Access links can further refine traffic flow in a multi-switch environment. Figure D-4 shows the combination of both Hybrid and Access links used in a network with three different VLANs. Workstations are typically connected to the ELS100-24TXG via Access links. On the internal corporate network (backbone), VLAN tags are used to identify the VLAN association of frames.



**It is possible to mix VLAN-aware and VLAN-unaware devices on the same Hybrid switch port. However, this is not recommended design practice.**



**Figure D-4. VLAN Application Example**

---

## APPENDIX E. CLASS OF SERVICE

---

Class of Service support on the ELS100-24TXG allows you to assign mission-critical data a higher priority through the switch by delaying less critical traffic during periods of congestion. Higher priority traffic through the switch is serviced first before lower priority traffic. The Class of Service capability of the ELS100-24TXG switch is implemented by a priority queuing mechanism. Class of Service is based on the IEEE 802.1p draft standard specification and allows you to define two priorities of traffic on each switch port:

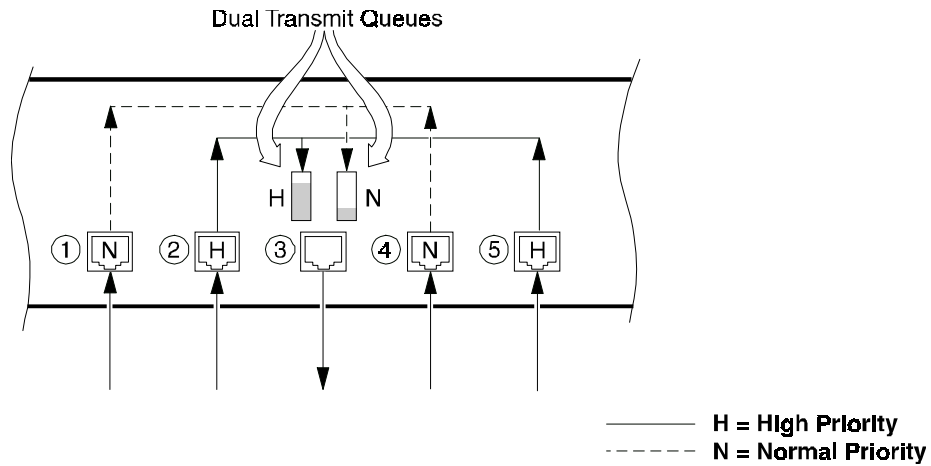
- high
- normal

As traffic enters the switch, it is assigned to one of the two priority levels according to information located in the 802.1Q header tag of the frame (see Appendix D, “Virtual LANs”) or according to the incoming port number. Frames are then placed into one of two transmit queues on the outbound switch port based on their priority level. Frames on the high priority queue are transmitted first; when that queue empties, traffic on the normal priority queue is transmitted. When priority queuing is being used, each frame that passes through the switch contains a priority level in its header tag. The priority information may already exist in incoming frames, or be assigned by the switch. The determination of individual frame priority is based on the following rules:

1. Incoming tagged frames contain a priority level (range: 0-7)
2. Incoming non-tagged frames are assigned a preconfigured default priority level based on their incoming port (range: 0-7). The assignment of priority per port is done via management using the Port Priority Default parameter.
3. Priority levels of frames are compared against a reconfigured global priority threshold setting, configured via management using the Priority Threshold parameter. Those frames with levels equal to or above the threshold are designated high priority traffic; those frames with levels below the threshold are designated normal priority traffic. The default setting for the threshold parameter is: 4 and above = High Priority, 3 and below = Normal Priority.

Properly configured, the Class of Service mechanism assures that during congestion, the highest priority data does not get delayed by normal priority traffic. The tagged header in the frame governs individual frame priority.

Figure E-1 shows priority queuing operating within a switch. Frames entering the switch through ports 1 and 4 are tagged as normal traffic and placed in a normal priority queue on the outbound port. Frames entering through ports 2 and 5 are tagged as high priority traffic and placed in a high priority queue on the outbound port. Priority queuing can be configured using the Class of Service Configuration Menu in the console interface or via SNMP.



**Figure E-1. Class of Service Example**



---

## APPENDIX F. ACRONYMS & ABBREVIATIONS

---

| Term        | Definition                                                                  |
|-------------|-----------------------------------------------------------------------------|
| 10Base-T    | 10 Mbps twisted-pair Ethernet                                               |
| 100Base-TX  | 100Mbps twisted-pair Fast Ethernet                                          |
| 1000Base-X  | 1000Mbps Gigabit Ethernet                                                   |
| 1000Base-SX | 1000Mbps Gigabit Ethernet, short-wave laser over multi-mode fiber           |
| 1000Base-LX | 1000Mbps Gigabit Ethernet, long-wave laser over single- or multi-mode fiber |
| 1000Base-CX | 1000Mbps Gigabit Ethernet, over shielded, balanced copper                   |
| ANSI        | American National Standards Institute                                       |
| ASIC        | Application Specific Integrated Circuit                                     |
| BootP       | Bootstrap Protocol                                                          |
| BPDU        | Bridge Protocol Data Unit                                                   |
| CAT5        | Category 5                                                                  |
| CoS         | Class of Service                                                            |
| CRC         | Cyclic Redundancy Check                                                     |
| CSMA/CD     | Carrier Sense Multiple Access/Collision Detection                           |
| DCE         | Data Communications Equipment (modem)                                       |
| DHCP        | Dynamic Host Configuration Protocol                                         |
| DSR         | Data Send Ready                                                             |
| DTE         | Data Terminal Equipment                                                     |
| DTR         | Data Terminal Ready                                                         |
| GBIC        | Gigabit Interface Converter                                                 |
| ICMP        | Internet Control Message Protocol                                           |
| IEEE        | Institute of Electrical and Electronics Engineers                           |
| IP          | Internet Protocol                                                           |
| LAN         | Local Area Network                                                          |
| MAC         | Media Access Control                                                        |
| LED         | Light Emitting Diode                                                        |
| MDI         | Media Device Interface                                                      |

---

| Term   | Definition                                      |
|--------|-------------------------------------------------|
| MIB    | Management Information Base                     |
| PVID   | Port VLAN ID                                    |
| RFC    | Request for Comment                             |
| RMON   | Remote Monitoring                               |
| RXD    | Receive Data                                    |
| SNMP   | Simple Network Management Protocol              |
| STP    | Spanning Tree Protocol                          |
| TCP/IP | Transmission Control Protocol/Internet Protocol |
| TFTP   | Trivial File Transfer Protocol                  |
| TXD    | Transmit Data                                   |
| UTP    | Unshielded Twisted Pair                         |
| VLAN   | Virtual Local Area Network                      |
| WAN    | Wide Area Network                               |

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