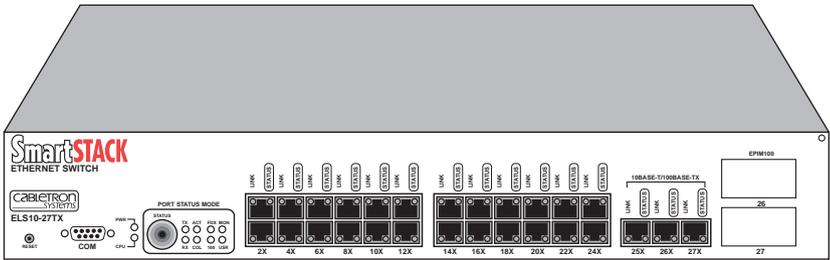


SmartSTACK ETHERNET ELS10-27 USER GUIDE



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73/23/EEC

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Manufacturer's Address: **35 Industrial Way**
PO Box 5005
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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**
Commercial or Light Industrial
Environment.

We the undersigned, hereby declare, under our sole responsibility, that the equipment packaged with this notice conforms to the above directives.

Manufacturer

Mr. Ronald Fotino

Full Name

Compliance Engineering Manager

Title

Rochester, NH, USA

Location

Legal Representative in Europe

Mr. J. Solari

Full Name

Managing Director - E.M.E.A.

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CHAPTER 1

INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual is for system administrators responsible for configuring, monitoring, and maintaining the SmartSTACK Ethernet ELS10-27TX (also referred to as ELS10-27). You should have a familiarity with networking concepts and principles. In addition, a basic understanding of SNMP is helpful.

Some SmartSTACK Ethernet ELS10-27 configurations can only be done using an SNMP-based Network Management System (NMS). Where applicable, this manual provides instructions for using the Local Console Manager (LCM) to perform basic configuration. Where it is not possible to use LCM, general instructions and guidelines applicable to most NMSs are provided.

The contents of each chapter are described below.

- Chapter 1, **Introduction**, outlines the contents of this manual and provides an overview of the SmartSTACK Ethernet ELS10-27's switching functions, applications, and the Local Console Manager (LCM).
- Chapter 2, **Unpacking and Installing Your SmartSTACK Ethernet ELS10-27**, describes the SmartSTACK Ethernet ELS10-27 front and rear panels, how to install the SmartSTACK Ethernet ELS10-27, how to connect the Local Console Manager (LCM), and how to connect the ELS10-27 to the network.
- Chapter 3, **Configuring Your SmartSTACK Ethernet ELS10-27**, provides instructions for configuring the SmartSTACK Ethernet ELS10-27 using the Local Console Manager (LCM). It also provides some common Management Information Base (MIB) variables you may want to change.
- Chapter 4, **Monitoring and Managing Your SmartSTACK Ethernet ELS10-27**, describes how to monitor SmartSTACK Ethernet ELS10-27 status and statistics. It also describes how to manage the SmartSTACK Ethernet ELS10-27 Ethernet ports using the Local Console Manager (LCM).

- Chapter 5, **SmartSTACK Ethernet ELS10-27 Diagnostics and Troubleshooting**, describes the SmartSTACK Ethernet ELS10-27 diagnostics and provides information on troubleshooting common problems.
- Appendix A, **Technical Specifications**, provides the SmartSTACK Ethernet ELS10-27 specifications and basic cabling pin assignments.
- **Index** provides a glossary of terms specific to the SmartSTACK Ethernet ELS10-27 and the page(s) on which they are explained within this manual.

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- The serial and revision numbers of all involved Cabletron Systems products in the network
- A description of your network environment (layout, cable type, etc.)

- Network load and frame size at the time of trouble (if known)
- The device history (i.e., have you returned the device before, is this a recurring problem, etc.)
- Any previous Return Material Authorization (RMA) numbers

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The following conventions are used throughout this document:

LCM commands, prompts, and information displayed by the computer appear in Courier typeface, for example:

```
Current Number of Learned Addresses: 133
```

Information that you enter appears in Courier bold typeface, for example:

```
ELS10-27 >status
```

Information that you need to enter with a command is enclosed in angle brackets < >. For example, you must enter an IP address to execute the `ipaddr <IP address>` command:

```
ELS10-27 >ipaddr 192.138.217.40
```

Field value options appear in bold typeface.

The following conventions are also used in this document:

Note: *Calls the reader's attention to any item of information that may be of special importance.*

Tip: *Conveys helpful hints concerning procedures or actions.*

Caution: *Contains information essential to avoid damage to the equipment.*

Warning: *Warns against an action that could result in equipment damage, personal injury or death.*

1.4 RELATED DOCUMENTATION

The following documentation may assist the user in using this product:

- *Interconnections, Bridges and Routers*, Radia Perlman, Addison Wesley © 1992.
- *Internetworking with TCP/IP: Principles, Protocols, and Architecture* (2nd edition), Volumes I and II, Douglas Comer, Prentice Hall © 1991.
- *The Simple Book, An Introduction to Management of TCP/IP-based internets*, Marshall T. Rose, Prentice Hall © Second Edition, 1994.

1.5 OVERVIEW

The SmartSTACK Ethernet ELS10-27 provides a low cost, high performance solution for 10/100 Mbps switched networks. The SmartSTACK Ethernet ELS10-27TX is configured with twenty-seven RJ45 ports supporting twenty-four autonegotiating 10 Mbps ports and three autonegotiating 10/100 Mbps ports. The device also features two EPIM-100 slots that allow the user to install up to two EPIM-100s to provide multimode fiber uplinks (with potential for single mode fiber). It also includes an RS232C port for out-of-band management.

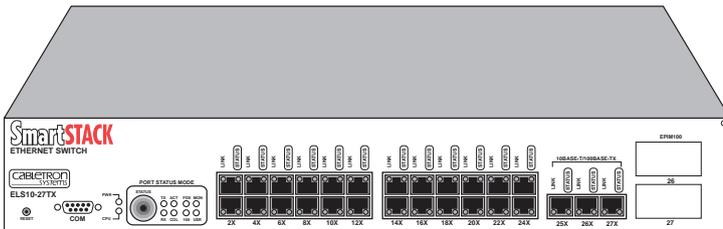


Figure 1-1. SmartSTACK Ethernet ELS10-27 Front Panel

The SmartSTACK Ethernet ELS10-27:

- Provides dedicated bandwidth for each network connected to its ports.
- Provides full store and forward bridging functionality.
- Provides complete error checking functionality.

- Provides port trunking to increase bandwidth.
- Provides a user selectable monitor port for enhanced troubleshooting.
- Supports Auto-negotiation.
- Operates in either Half Duplex or Full Duplex modes on all ports.
- Implements the Spanning Tree protocol (802.1D).
- Configured with factory-set defaults for immediate plug-and-play capability (IP address is not configured at factory).

In addition, the SmartSTACK Ethernet ELS10-27 offers the following features that can help you manage and maintain your network:

- RMON support
- Configuration and management using the Simple Network Management Protocol (SNMP) with either an in-band or out-of-band connection.
- Protection against broadcast/multicast storms.
- Ability to define virtual workgroups for more efficient bandwidth usage. The SmartSTACK Ethernet ELS10-27 ports can be segmented into 8 separate domains.
- Compilation of statistics, including Broadcast and Unicast (by port) for traffic generated to a SmartSTACK Ethernet ELS10-27 segment.

1.5.1 SmartSTACK Ethernet ELS10-27 Architecture

The SmartSTACK Ethernet ELS10-27 supports all standard Ethernet-to-Ethernet bridging functions, has (24) 10 Mbps IEEE 802.3/Ethernet full duplex 10Base-T ports, (3) standard 10/100 Mbps TX full duplex Fast Ethernet ports, and (2) optional 100BaseFX full or half duplex fiber EPIM ports.

1.5.2 SmartSTACK Ethernet ELS10-27 Functionality

- Support IEEE 802.1D Spanning Tree Protocol for MAC Bridges.

A 2K entry Filtering Database with learning and aging of entries.

- Per Ethernet and Fast Ethernet port packet buffer supporting (1,061) 128-byte packets or (88) 1518-byte packets per port.
- Per switch packet buffering is (28,672) 128-byte packets and (2,389) 1518-byte packets.

Two modes of operation are supported, 802.1D and 802.1Q. These are mutually exclusive.

Provide store and forward capability with the ability to switch to fragment free cut-through (starts forwarding after first 128 bytes received) on a per system basis. Autonegotiation on all ports for full or half duplex mode. Autonegotiation of 10/100 Mbps for Fast Ethernet ports.

Two forms of flow control are supported.

- In full duplex mode, 802.3x pause frames are supported.
- In half duplex mode, back pressure is supported.

Broadcast storm control on a per port basis will limit transmissions.

Local port mirroring of all ports for valid frames on both Rx and Tx using a user selectable mirror port or MAC address based mirroring.

SmartSTACK Ethernet ELS10-27 offers two basic methods to configure the IP address for the device. These two methods are BOOTP and LCM.

- The SmartSTACK Ethernet ELS10-27 utilizes the BOOTP protocol to obtain an IP Address that may be used by this unit.
- Configuration via LCM of the device IP address and Default Gateway

The Operational Image is maintained by use of TFTP in conjunction with BOOTP.

The SmartSTACK Ethernet ELS10-27 acts as an IP Multicast filter by snooping IGMP messages, IP Multicast UDP messages and other IPM routing messages.

Two forms of VLANs will be supported.

- Virtual Workgroup support. Up to 8 workgroups may be configured, with up to 27 ports in a workgroup. These configurable broadcast/multicast/unicast filtering parameters for the Virtual Workgroup feature are only supported in 802.1D mode.

- IEEE 802.1Q is a standard for virtual bridged local area networks (VLANs). Thirty-two simultaneous VLANs are supported.

Support RMON Ethernet Statistics, Alarms, Events, and History group.

Network interfaces supported.

- All twisted pair copper ports are RJ-45 with internal crossover.
 - The device has two uplink slots which support a single interface module each. Each interface supports one EPIM-100FX. The interface module is user installable and is hot-swappable. Use of an EPIM in the uplink slot disables one of the fixed 10/100 Mbps ports.

Several forms of user interface are available for configuration and/or statistics monitoring.

- Local Console Management (LCM)
- Up to 4 simultaneous Telnet sessions are supported.

Telnet, and SNMP can be accessed by either the out-of-band COM port via PPP (Point-to-Point Protocol) or any in-band Ethernet port.

Non-volatile memory is provided to store all user modifiable configuration parameters.

Upload and download of configuration parameters:

A system reset button is provided on the front panel. The SmartSTACK Ethernet ELS10-27 will supply port level and system level information via front panel LEDs. Each port has a Link LED and a function LED. The EPIM-100FX has a single green LED which indicates link. When an EPIM is in use the function indicator for one of the fixed ports is used to indicate the status of the corresponding EPIM.

Serial Number/Revision Identification is displayed within the user interfaces.

Watchdog timer feature.

The SmartSTACK Ethernet ELS10-27 enables you to link two or more Local Area Networks (LANs) together. To accomplish this, the SmartSTACK Ethernet ELS10-27 regulates network traffic on the basis of the source and destination addresses that are in each data packet it receives.

The SmartSTACK Ethernet ELS10-27 is protocol-transparent, meaning it can handle different types of network traffic regardless of the network protocol, such as IP and IPX. As the SmartSTACK Ethernet ELS10-27 reads addresses from the packets it processes, it builds a dynamic database of addresses called the *Bridge Address Table*. In this way, the SmartSTACK Ethernet ELS10-27 continuously learns the addresses of all connected devices. Consequently, you can add new devices to the network, change device addresses, and remove devices from the network without having to reconfigure the SmartSTACK Ethernet ELS10-27.

The Open System Interconnection (OSI) Reference Model, developed by the International Standards Organization (ISO), identifies the levels of functionality inherent in each of its seven layers. The SmartSTACK Ethernet ELS10-27 operates at the Media Access Control (MAC) sub-layer of the Data Link layer.

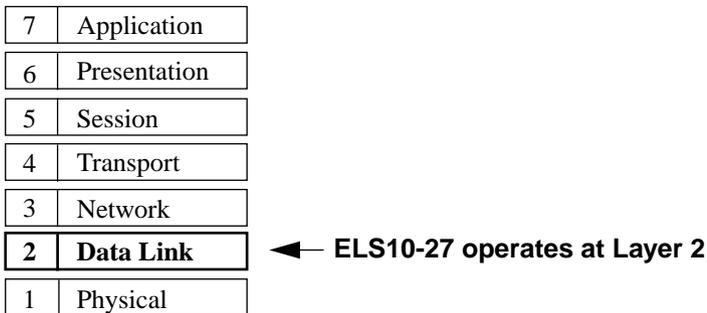


Figure 1-2. OSI Reference Model

Because the SmartSTACK Ethernet ELS10-27 does not process any Network Layer information, it provides a high level of performance in terms of packet throughput. In addition, the SmartSTACK Ethernet ELS10-27 does not need to learn network topology, requiring less programming and configuration time.

Store and Forward Switching

As an intelligent Ethernet switch, the SmartSTACK Ethernet ELS10-27 uses store and forward switching. Store and forward switching allows the SmartSTACK Ethernet ELS10-27 to temporarily store packets until network resources, typically an unused link, are available for forwarding.

This allows for complete error checking, and limits the amount of time between a device request access to the network, and permission to transmit. In addition, full store and forward switching ensures data integrity; preventing network error conditions from being generated throughout the network.

Discarding Local Traffic

The SmartSTACK Ethernet ELS10-27 checks all incoming packets for the destination address against the Bridge Address Table. If a packet's destination address is not on the same network segment as the originating packet, the SmartSTACK Ethernet ELS10-27 forwards the packet to the network segment associated with that destination address, if known. However, if the packet's source and destination addresses are on the same network segment, known as *local traffic*, the packet is automatically discarded (i.e., ignored by the SmartSTACK Ethernet ELS10-27).

For example, a file transmitted from Workstation A, to Workstation C, in Figure 1-3, does not need to leave LAN 1. The SmartSTACK Ethernet ELS10-27 connected to LANs 1 and 2 sees all traffic from LAN 1, including LAN 1 local traffic.

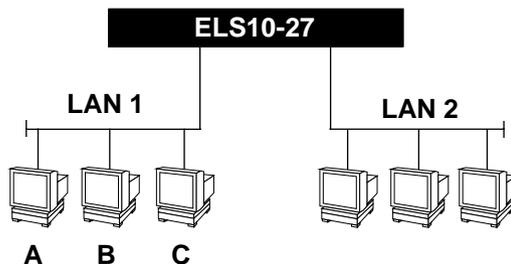


Figure 1-3. Typical Switching Application

By forwarding only packets addressed to devices on other network segments, the SmartSTACK Ethernet ELS10-27 reduces unnecessary traffic and thereby enhances the overall performance of the network.

Note: *If the packet address is not found in the Bridge Address Table, it will be forwarded (flooded) to all network segments.*

Spanning Tree Algorithm

The SmartSTACK Ethernet ELS10-27 supports the IEEE 802.1D Spanning Tree algorithm. The Spanning Tree algorithm converts multiple LANs into a “spanning tree” of networks. It is used to prevent bridging loops. This standard defines a logical (not physical) network configuration consisting of one extended LAN without active duplicate paths between spanning tree bridges.

The SmartSTACK Ethernet ELS10-27, along with other IEEE 802.1D Spanning Tree compliant bridges in the network, dynamically configure the network topology into a single Spanning Tree by exchanging Bridge Protocol Data Units (BPDUs). Typically, each LAN segment is sent one BPDU every two seconds (this is the default setting).

When there are multiple SmartSTACK Ethernet ELS10-27s connecting LANs in a loop, the Spanning Tree algorithm determines which SmartSTACK Ethernet ELS10-27 should forward packets to the LAN. If there is a cable break or a port failure, the network topology is automatically reconfigured by the Spanning Tree protocol to create an alternate path to the LAN.

1.5.3 SmartSTACK Ethernet ELS10-27 Bridge Address Table

In 802.1D mode, the SmartSTACK Ethernet ELS10-27 creates and maintains a dynamic database of addresses called the Bridge Address Table. The SmartSTACK Ethernet ELS10-27 examines every packet to determine its source address and LAN segment origin. It then compares the source address and segment information it finds to the entries in the Bridge Address Table.

In 802.1Q mode, if a packet’s address is not already stored in the Bridge Address Table, the SmartSTACK Ethernet ELS10-27 adds the learned address, associated segment number, and a timer value indicating the age of the observation. Consequently, the SmartSTACK Ethernet ELS10-27 knows the address and associated segment number the next time it sees that address. By using the information stored in the Bridge Address Table, the SmartSTACK Ethernet ELS10-27 is able to quickly forward each packet to the correct LAN segment.

The SmartSTACK Ethernet ELS10-27 learns addresses from all packets, including data transmissions and “keep alive” packets (packets sent by

an idle station to let other stations know it is present and functional). When devices are added to the network, removed from it, or relocated, you do not have to reconfigure the SmartSTACK Ethernet ELS10-27. The unit automatically learns new device addresses, recognizes when a previously used address is missing, or when a device has been moved to a new LAN segment.

An address stored in the Bridge Address Table is discarded if there is no subsequent activity from that address after a configured length of time (five minutes by default). This aging process ensures that the Bridge Address Table is continually updated.

Addresses are continually added to and deleted from the Bridge Address Table, reflecting the dynamic nature of internetwork traffic.

Each dynamic entry includes:

- An Ethernet MAC address
- A single port number of the LAN on which the address resides
- The age of the entry

The SmartSTACK Ethernet ELS10-27 database allows for 2048 entries. Some of these entries will be used for permanent entries needed by the switch, and temporary entries dependent on the feature set selected. The remainder will be available for user addresses.

1.5.4 SmartSTACK Ethernet ELS10-27 Port Mirroring

Port Mirroring allows the user to configure a port to be used as an “analyzer” or “monitor” port. Any port can be selected as the “monitor” port. The user can copy data from one user selectable port on the device to the designated “monitor” port. Packets copied to the monitor port will not include erred packets.

Mirroring will be supported regardless of the port speed and duplex operation. There, in fact, are two forms of mirroring: port mirroring and MAC address mirroring.

With port mirroring, a port is selected as the source port and a port is selected as the destination port. Any packet received on or sent to the source port will be monitored to the destination port.

With address mirroring, a unicast MAC address and a destination port are specified. Any time a valid packet is received on any port with that destination MAC address within the switch, that packet will be monitored to the destination port. If the address form of the mirror command is issued multiple times, all unicast MAC addresses selected will be mirrored. Up to 4 MAC addresses may be mirrored at any one time.

When mirroring is turned off, the previous parameters are still maintained in non-volatile memory and available if mirroring is re-enabled. The setting of port mirroring clears any address mirroring parameters or vice-versa.

Note: Address entries will be flagged so that they do not get aged out of the database. We will however allow the port on which they are learned to change.

1.5.5 SmartSTACK Ethernet ELS10-27 Sample Applications

Just as a six lane highway allows you to travel much faster than a single lane highway, a network backbone creates high-speed connections for your network. In general, a network backbone allows you to distribute access to important network resources such as file or print servers. Additional SmartSTACK Ethernet ELS10-27 features, such as trunking, Fast Ethernet, and virtual workgroups allow you to optimize bandwidth and design a more efficient flow for your network traffic.

SmartSTACK Ethernet ELS10-27 Trunking

SmartSTACK Ethernet ELS10-27 supports one form of port trunking, StackTRUNK Trunking.

SmartSTACK Ethernet ELS10-27 supports a single trunk group of up to 3 trunked ports. The group can be composed of only the 10/100 Mbps ports. Trunked ports have the following characteristics:

- Learned unicast traffic destined to one of the trunked ports shall be distributed evenly between all ports in the trunk group using the same algorithm as the LynxSwitch product.
- Unknown addresses and broadcast/multicast traffic shall be forwarded only to a single port within the trunk group according to the trunking algorithm.

- Traffic received on a trunk port shall not be forwarded to any other port in the trunk group.

The operator is able to display the trunking state on each port or enable/disable trunking functionality on a port or a range of ports.

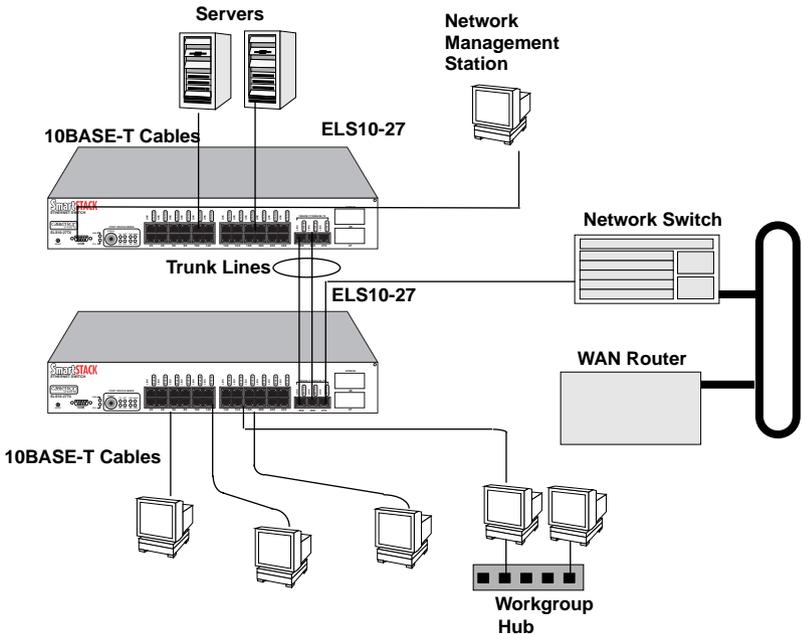


Figure 1-4. SmartSTACK Ethernet ELS10-27 Backbone Configuration

1.5.6 VLANs

There are two types of VLANs that are supported by the SmartSTACK Ethernet ELS10-27 architecture, Virtual Workgroups and 802.1Q VLANs. Virtual Workgroups are only supported in the 802.1D mode.

Virtual Workgroups

The SmartSTACK Ethernet ELS10-27 allows you to define ports for logical groups of associated devices (virtual workgroups) to provide a more efficient flow of traffic across your Ethernet network. You can define a maximum of eight virtual workgroups the number of ports within that

VLAN is not restricted and an individual port can be a member of multiple Virtual Workgroups.

Note: Virtual Workgroups will only operate in 802.1D mode.

Virtual workgroups offer the ability to limit broadcasts to logical domains within the network. Workgroup destinations are recognized by the SmartSTACK Ethernet ELS10-27 and broadcast and unicast packets are routed directly to hosts within the workgroup, eliminating the need to perform a general broadcast across each segment of the network to find specific host addresses.

IEEE 802.1Q VLANs

IEEE 802.1Q is a standard for virtual bridged local area networks (VLANs). It provides an alternate method for forwarding packets through a switch. In an 802.1D (Spanning Tree) bridge, packets are forwarded in accordance with the spanning tree as dynamically created by the 802.1D protocol (Bridge Protocol Data Units (BPDUs), and the spanning tree state of each port. In 802.1Q, in addition to spanning tree, packets are forwarded in accordance with a VLAN tag that is embedded in the packet, and the set of ports registered for that VLAN. A set of rules are used for ingress (receipt), forwarding, and egress (transmit).

The SmartSTACK Ethernet ELS10-27 provides support for port based VLANs.

The ingress rules deal with the reception of tagged and untagged packets and the decision to either drop them, or forward them to the forwarding process.

The forwarding rules deal with forwarding packets utilizing topology restrictions, the filtering database, queue frames (not supported), map priorities (not supported), and recalculation of the FCS. The forward/filtering database can contain three types of entries.

- Permanent entries
- Static entries
- Dynamic entries

Dynamic entries are created by the protocols supported by the switch (GVRP). There will be no learning of VLANs outside of this protocol.

The egress rules deal with whether the destination port(s) are members of the VLAN, and whether the VLAN tag is to be stripped. There is also an

issue of address translation on a packet that is having the VLAN tag stripped. This only applies to multi-protocol environments, such as a combination of Ethernet, FDDI, and Token Ring protocols and does not apply to the SmartSTACK Ethernet ELS10-27.

802.1Q does NOT replace 802.1D but limits the relaying of packets on the spanning tree to a subset. The subset being the members of a particular VLAN. This is determined by comparing the VLAN ID, which is a field within the tag, to the ports which are members of that VLAN. 802.1Q VLANs will span multiple systems and could span the entire network. Unlike the Cabletron FN series of products where the VLAN (or Virtual Workgroup) is limited to within a particular unit. The maximum number of VLANs supported in 802.1Q is 32.

1.5.7 Configuration Commands

Several configuration parameters must be specified by the user. Manufacturing default values are supplied to allow the unit to operate in a default (Plug and Play) configuration.

802.1Q Enable

The unit operates in either an 802.1D or 802.1Q mode. The mode must be selected by the user and applies to all ports. The unit **WILL NOT** operate in a mixed mode. The default is to operate in 802.1D mode.

Port Default VLAN ID

If the unit is operating in 802.1Q mode, then each port must be configured with a default port VLAN ID. The default value for each port will be the default VLAN ID of 0x001. You are allowed to modify this on a per port basis.

Network Management VLAN ID

If the unit is operating in 802.1Q mode a VLAN ID must be specified for each IP address configured on the unit. When the network management processor issues a response to a network management packet, it selects the correct VLAN ID to use based on the IP subnet.

GVRP Enable

This indicates if the GVRP protocol is selected. If selected, the GVRP application propagates that information to other GVRP applications. GVRP is enabled on a per port basis.

GVRP Filter

You are able to specify a list of VLAN ID's that should not be dynamically learned by GVRP. When the management processor receives a GVRP packet, it checks this database to determine if the learning of this ID should be restricted.

VLAN Group

You are given the ability to specify the group of ports associated with a particular VLAN ID.

Aging Time

The aging time for 802.1D and 802.1Q mode will be the same.

Access Ports

You are able to specify which ports on the system are access ports and always have the tags stripped.

1.6 LOCAL CONSOLE MANAGER

The Local Console Manager (LCM) is a command-line interface built into the SmartSTACK Ethernet ELS10-27. The LCM enables you to monitor, manage, and configure the SmartSTACK Ethernet ELS10-27 through the out-of-band RS232C connection attached to any non-intelligent terminal or workstation running terminal emulation.

You can also use a Cabletron Systems Network Management System, or a standard SNMP-based Network Management System, to manage the SmartSTACK Ethernet ELS10-27. For a list of available SmartSTACK Ethernet ELS10-27 network management tools, see Section 4.1, SmartSTACK Ethernet ELS10-27 Management Tools.

The following sections describe LCM command syntax and the basic LCM commands for logging in, logging out, and getting help.

- LCM commands used for configuring the SmartSTACK Ethernet ELS10-27 are described in Chapter 3, **Configuring Your SmartSTACK Ethernet ELS10-27**.
- LCM commands used for monitoring and managing the SmartSTACK Ethernet ELS10-27 are described in Chapter 4, **Monitoring and Managing Your SmartSTACK Ethernet ELS10-27**.

Note: The **Getting Started with the SmartSTACK Ethernet ELS10-27** guide lists the available LCM commands, including each command's options.

1.6.1 Command Syntax Conventions

Basic LCM Commands

If you are going to manage the SmartSTACK Ethernet ELS10-27 using LCM, you first must connect the SmartSTACK Ethernet ELS10-27 to an ASCII terminal or terminal emulator.

When you want to use LCM, begin by pressing the **Enter** key several times to get the LCM prompt (ELS10-27 >).

Help

Displays the menu of available commands. Help can also be displayed by typing a question mark (?).

Telnet support allows you to telnet to the device and gain access to LCM. The device allows 4 sessions. Passwords for telnet are the RO and RW community names for the device and allow the corresponding level of access. You are not allowed to modify passwords via a Telnet session. If an IP address is added or modified using Telnet, the new address will not take affect until the next reboot.

Erase

Entering **erase** to erase the current SmartSTACK Ethernet ELS10-27 configuration returns all parameters to the default values.

Exit or Logout

This command logs you out of LCM. (The **exit** command is functionally equivalent to the **logout** command.)

Traplog

Traplog displays the traps messages captured by the SmartSTACK Ethernet ELS10-27. The following is an example of a traplog display:

```
ELS10-27TX> traplog
Trap 16 0:00:00
    The unit has booted.
Trap 25 0:00:00
    The unit's spanning tree maximum age has changed.
Trap 26 0:00:00
    The unit's spanning tree hello time has changed.
Trap 27 0:00:00
    The unit's spanning tree forward delay times has changed.
Trap 3 0:00:02 port 1
    The current functional state of the port has changed.
.
.
.
ELS10-27TX>
```

Figure 1-5. Traplog display

The following conventions apply as you use LCM commands:

- Press the **Enter** key to execute a command after you type it in.
- A **port range** is either a single port number, or a list of port numbers separated by commas or hyphens. For example, 3 is port 3; 3,7 are ports 3 and 7; 3-5 are ports 3,4, and 5; and 3-5,7 are ports 3,4,5, and 7.
- To quit any command, press the Control-C keys (^C or Ctrl-C).
- You can abbreviate any command where there is no ambiguity; if there is ambiguity, LCM responds with an error message.
- Commands are not case sensitive.
- Any invalid commands or misspellings will receive an error message.
- A previous command can be repeated by typing **!!**
- MAC addresses are displayed in little-endian Ethernet (least significant bit) bit order, with each octet separated by a colon. For example:

```
ELS10-27 >address 00:40:27:04:1a:0f
```

- Information that is optional with an LCM command is enclosed in square brackets [].

```
ELS10-27 >ipaddr 192.138.217.40
```

- Parameters that appear in all capital letters, for example `bridge [PORT-RANGE]`, indicate that you must enter a value for that parameter. If a string of parameters is displayed between braces, for example `[{off|on|noBPDU}]`, you must select one of the displayed options. For example, if you wanted to enable bridging on a port, or a range of ports, you would enter:

```
ELS10-27 >bridge 2-4 on
```

LCM Command Summary

help or ?	Display this menu
addresses display [any] [ADDR [MASK]]	to display learned addresses
arp display	to display the ARP table
baud [BAUD-RATE]	to change the console baud rate
bridge [PORT-RANGE [OPTIONS]]	to set bridging methods
community	to change the password/community
disable [? for syntax]	to disable a set of ports
enable [? for syntax]	to enable a set of ports
erase	to erase configuration
exit or logout	to logout
ident	to display unit identification
igmp [on off]	to enable IPM filtering by snooping IGMP
ipaddr [IPADDR [MASK]]	to set or display IP addresses
ipmfilter [? for syntax]	to statically filter out ports
ipmrouter {add delete} PORT-RANGE	to set or display IP Multicast Router ports
kill {session-number}	to kill a session (console use only)
mirror [? for syntax]	to set or display port mirroring
ping [-rvsx] HOST [DATASIZE [COUNT]]	send ICMP ECHO_REQUEST pkts
port [? for syntax]	to set or display port parameters
query [on off] [name]	to act as an IGMP Querier
reboot [? for syntax]	to reboot the unit after SECONDS
route [? for syntax]	to display routing table information
session	to display current LCM sessions
switch [? for syntax]	to set or display switch parameters
status[PORT-RANGE/clear PORT-RANGE]	to display unit or port status
sttimer [TIMER-VALUE]	to set or display st age time
traceroute [? for syntax]	to print the route taken to a host
trapcontrol [on off]	to set or display traps control value
traplog	to display the most recent SNMP traps
trunk [? for syntax]	to set display trunking status
vlan [? for syntax]	to configure IEEE Vlans
workgroup [? for syntax]	to set or display workgroups

If a line contains the text “[? for syntax]” one of the following displays will detail the syntax.

additional command syntax:

```

switch      [802.1d | 802.1Q]
            cut[-through] | store[-and-forward]
            [back[pressure] {on | off}]

enable      [PORT-RANGE [RIP]] [TransmitPacing]]]

port        [PORT-RANGE [speed {auto | 10[Mbps] | 100[Mbps]}]
            [duplex {auto | full[-duplex] | half[-duplex]}]
            [storm THRESHOLD TIME-INTERVAL]
            [vlan {name | VLAN-ID}]
            [802.3x [flow control] {on | off}]
            [GVRP {On | off}]
            [access {add | del[ete]}]]]

reboot      [SECONDS [down[load]] | off]
            [par[ameters] PATH [IP-ADDR [GATEWAY-ADDR]]]

route       [add | del GATEWAY-ADDR]
            [display [IPADDR]]

traceroute  [-m MAX_HOPS][[-q NQUERIES][[-w WAIT] HOST_IP [DATA_SIZE]

vlan        [add PORT-RANGE NAME VLAN-ID [IP-ADDR] [MASK]]
            [del[ete] PORT_RANGE NAME VLAN-ID]
            [res[trict] {add | de[lete]} PORT-RANGE VLAN-ID]

ipmulticast [add | del[ete] IPMADDR PORT-RANGE IPMADDR]

mirror      [port {add | del[ete]} SRC-PORT DEST-PORT]
            [address]{add | del[ete]} MAC-ADDRESS DEST-PORT]
            [on | off]

ipmfilter   [add IPMADDR PORT-RANGE]
            [del[ete] IPMADDR]]
            [on | off]

trunk       [add PORT-RANGE]
            [del[ete] PORT-RANGE]

workgroup   [NAME [{del[ete]} | PORT_RANGE [INFO]]]]

```

Status

When the status command alone is typed, the following is displayed:

```
ELS10-27> status
Software Currently Running: Version 1.00.00 Mon 1/15/99--14:49:29
Next Bootstrap: Version 1.00.00 Mon 1/15/99--14:49:29
Power-up test failures: none
System Up Time: 4 weeks 3 days, 16:49:20
Current Number of Learned Addresses: 76
CPU utilization is heavy
```

Port	RX Packets	TX Packets	Collisions	Erred Packets
1	0	0	0	0
2	200771	170540573	11057	18756
3	160310185	260185705	1550454	2597695
4	0	220670886	0	0
5	0	0	0	0
6	0	0	0	0
7	879974	226060879	29462	59569
8	6367594	225306752	59103	122763
9	0	0	0	0
10	0	220670886	0	0
11	75924	214287698	76	1059
12	1963079	228024703	147751	252280

Type <CR> to continue the display... >

This is repeated by the remainder of the ports on the system, followed by a display for each individual port as follows.

```
Port 1                Status
Type/Speed:          10B-TPX/10 Mbps
VLAN ID              Blue 0x001
```

GVRP	Enabled
Port Mirroring:	No
Duplex Mode:	Half Duplex
Bridging:	Transparent Bridging
Enabled/Disabled:	Enabled, Rip listening, port w/o link
Spanning Tree:	Without link
Trunking State:	Off
Pkts Transmitted:	0
Pkts Received:	0
Carrier Losses:	0
Total Collisions:	0
Excess Collisions:	0
RX Filtered Pkts:	0
RX Runt Pkts:	0
RX FCS/Align Errs:	0
Internal TX Errs:	0

Type <CR> to display port 2 status ... >

If the status command is issued followed by a port number the following is displayed. If a port range is specified, all ports in the range are displayed.

```
ELS10-27> status 2
Port 2          Status

Type/Speed:    10B-TPX/10 Mbps
VLAN ID        Account 0x001
GVRP           Disabled
Port Mirroring: No
Duplex Mode:   Half Duplex
Bridging:      Transparent Bridging
Enabled/Disabled: Enabled, Rip listening
Spanning Tree: Forwarding
Trunking State: Off
Pkts Transmitted: 170646338
Pkts Received: 200806
```

Carrier Losses:	0
Total Collisions:	11057
Excess Collisions:	0
RX Filtered Pkts:	523
RX Runt Pkts:	0
RX FCS/Align Errs:	0
Internal TX Errs:	11057

Enable

If the enable command is typed without any parameters, the following is displayed. It does not enable any of the ports.

```
ELS10-27> enable
Usage:  enable [PORT-RANGE [RIP] [TransmitPacing]]
Port 1:  Enabled, port w/o link
Port 2:  Enabled, port w/o link
Port 3:  Enabled
Port 4:  Enabled, port w/o link
Port 5:  Enabled, port w/o link
Port 6:  Enabled, port w/o link
Port 7:  Enabled
Port 8:  Enabled
Port 9:  Enabled, port w/o link
Port 10: Enabled
Port 11: Enabled
Port 12: Enabled
```

Type <CR> to continue the display... >

To enable a port or group of ports, the command is followed by the port(s) and any options desired. The following is displayed:

```
ELS10-27> enable 2-4
Enabling port 2
Enabling port 3
Enabling port 4
```

By default all ports are enabled.

Disable

If the disable command is entered without any port(s) specified, the display reports the state of all of the ports. It does not disable any of the ports.

```
ELS10-27> disable
```

```
Usage: disable [PORT-RANGE]
```

```
Port 1:          Enabled, Rip listening, port w/o link
```

```
Port 2:          Enabled, Rip listening
```

```
Port 3:          Enabled
```

```
Port 4:          Enabled
```

```
Port 5:          Enabled, port w/o link
```

```
Port 6:          Enabled, port w/o link
```

```
Port 7:          Enabled
```

```
Port 8:          Enabled
```

```
Port 9:          Enabled, port w/o link
```

```
Port 10:         Enabled
```

```
Port 11:         Enabled
```

```
Port 12:         Enabled
```

Type <CR> to continue the display... >

If a port range is included, the following is displayed and the ports are disabled.

```
ELS10-27> disable 5-6
```

```
Port 5: Disabled
```

```
Port 6: Disabled
```

Switch

The switch command,

```
switch          [802.1d | 802.1Q]
                [cut[-through] | store[-and-forward]]
                [back[pressure] {on | off}]
```

allows you to select the mode in which the ELS10-27 operates. The two modes are 802.1D (spanning tree) or 802.1Q (spanning tree with IEEE VLANs). In addition, you can select cut through or store and forward,

and select to use back pressure as a means of flow control. The default settings are:

```
802.1d mode
store-and-forward
Backpressure off
```

The command by itself displays the following:

```
ELS10-27>switch
The present switch mode is: 802.1d
The switch mode upon the next reboot will be: 802.1d
The forwarding mode in use is: Store and Forward
Backpressure is off
```

Port

The Port command,

```
port [PORT-RANGE [speed {auto | 10[Mbps] | 100[Mbps]}]
      [duplex [{auto | full[-duplex] | half[-duplex]}]]
      [storm THRESHOLD TIME-INTERVAL]
      [vlan {name | VLAN-ID}]
      [802.3x [flow control] {on | off}]
      [GVRP {On | off}]
      [access {add | del[ete]}]]
```

allows you to configure the port(s) on the unit in regards to speed, duplex mode, broadcast storm protection values and default VLAN ID used on each port. You are not allowed to name the VLAN here. Refer to the vlan command to name a vlan. By setting the default VLAN ID for a port, the port WILL NOT automatically become a member of that VLAN. The VLAN must be created first using the VLAN command and this port made a member. Likewise, if the default VLAN ID is changed, the port is not removed from the old VLAN, you must use the VLAN command and remove the port from the VLAN. In addition, you are able to specify if GVRP is enabled for these ports. If enabled, GVRP messages are received on these ports and GVRP messages are propagated to these ports.

The access option specifies when operating in 802.1Q mode, that these ports act as access ports. All devices attached to this segment are non-tag aware devices, Therefore, all tags are stripped on egress, and the default tag is always added on ingress. In addition, the firmware creates additional address database entries when needed to ensure connectivity without flooding.

Entering the port command by itself displays the following:

```
ELS10-27>port
```

Port	Speed	Duplex Mode	Storm Threshold	Storm Time	Default VLAN-ID	VLAN Name	Flow Ctl	GVRP	Access Port
1	10	Full	600000	100	0x001	Default	yes	Enabled	yes
2	10	Full	600000	100	0x001	Default	yes	Disabled	no
3	10	Full	600000	100	0x001	Default	yes	Enabled	no
4	10	Full	600000	100	0x001	Default	yes	Enabled	no
5	10	Half	600000	100	0x001	Default	yes	Enabled	no
6	10	Full	600000	100	0x001	Default	no	Enabled	no
7	10	Full	600000	100	0x001	Default	yes	Enabled	no
8	10	Full	600000	100	0x001	Default	yes	Enabled	no
9	10	Full	600000	100	0x001	Default	yes	Enabled	no
10	10	Half	600000	100	0x001	Green	yes	Enabled	no
11	10	Full	600000	100	0x001	Default	no	Enabled	no
12	10	Full	600000	100	0x001	Default	no	Enabled	no

Type <CR> to continue the display ... >

The default setting is auto. To change the speed on a group of ports, enter the following:

```
ELS10-27>port 25-27 speed 10
```

```
Port 25 is 10 Mbps Ethernet
```

```
Port 26 is 10 Mbps Ethernet
```

```
Port 27 is 10 Mbps Ethernet
```

Similarly, to set the duplex mode on a group of ports, enter the following:

```
ELS10-27>port 25-27 duplex auto
```

```
Port 25 is using Auto Negotiation Mode.
```

```
Port 26 is using Auto Negotiation Mode.
```

```
Port 27 is using Auto Negotiation Mode.
```

To set the storm protection, enter the following:

```
ELS10-27>port 1 storm 100000 10
port 1 threshold = 100000,
interval = 10
```

To set the default VLAN ID the following would be entered. In 802.1Q mode, the factory default would be a value of 0x001 on every port.

```
ELS10-27>port 5 vlan 0x003
port 5  vlan id = 0x003
```

Commands cannot be combined. The following is not allowed.

```
port 2-4 duplex half storm 100000 10
```

Community

For security reasons, you are allowed to set a community name. This is similar to a password. Without the password, you are limited in what you are allowed to do. To set a new community name, type community.

```
ELS10-27>community
```

You are prompted for the old community name, then the new name and confirmation of the new name. The default name is 'public'.

```
Old community name>
New community name>
Verify community name>
```

Ident

The Ident command identifies the unit in terms of part number. The first part number displayed is for the ELS10-27 itself, the second part number is for an optional plug-in module. Following this, any Power-up test code and Diagnostic data is displayed. Finally, a list of information related to BootP parameters and the code image configured to be downloaded is displayed.

```
ELS10-27> id
Part Number:          9401911000    973700030748
Power-up test code:   00000000
```

Diagnostic data:	00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
Last Image File name	/etc/bootp/els10-27
Last Server IP Address	192.68.37.1
Flash Size	0x200000
Boot Revision	01.00.02
Operational Status	Normal Operation

Exit or Logout

Either of these commands logs you out of LCM.

Erase

The erase command allows you to erase all of the configuration material and restore the factory defaults to the unit. As a safety mechanism you are prompted to confirm the command. The entire word 'yes' must be typed.

By entering the erase command, the following is displayed.

```
ELS10-27>erase
```

This erases all configuration information and return the unit to factory defaults on the next system reset.

```
Continue? [yes | {no | CR} ]
```

If anything other than 'yes' is entered the command will be canceled.

Reboot

The reboot command allows you to force a system reboot either immediately or to schedule it for some later time. In the event that it was scheduled, the user can prevent the system from rebooting by entering the reboot command with the optional parameter 'off'. Additionally, several optional parameters can be used.

The 'download' parameter specifies not only for the system to reboot, but to also obtain a new code image from the network. In the event that a download is desired, you can specify the necessary parameters or can use parameters obtained via the BootP process. The parameters are the path and file name to be used on the TFTP server, the IP Address of the server and a gateway IP Address in the event that the server is not directly accessible.

```
reboot [SECONDS [down[load]] | off]
[par[ameters] PATH [IP-ADDR [GATEWAY-ADDR]]]
```

If you enter a reboot command, the following is displayed:

```
ELS10-27>reboot 300
Re-boot pending in 300 seconds
```

If you then follow this with the reboot 'off' command within 300 seconds, the following is displayed:

```
ELS10-27>reboot off
No re-boot pending
```

Address Display

The address display command displays the MAC addresses, whether the address has been learned, the port the address is known on, and how old the address entry is. In 802.1Q mode, the following is displayed. If the unit was operating in 802.1D mode, the VLAN ID and VLAN Name are not displayed.

```
ELS10-27> address display
```

Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
00:40:27:00:55:bf	Learned	26	1	0x003	Blue
00:40:27:00:58:17	Learned	26	14	0x003	Blue
00:00:0c:19:ce:35	Learned	26	4	0x003	Blue
00:80:cf:00:02:b7	Learned	26	215	0x003	Blue
00:00:c0:d8:f2:9a	Learned	26	80	0x002	Green
00:40:27:07:b4:9d	Learned	26	134	0x003	Blue
00:00:c0:b7:08:0e	Learned	26	10	0x003	Blue
08:00:20:79:fb:df	Learned	17	1	0x005	Green
00:00:1d:1d:63:3c	Learned	26	0	0x003	Blue
00:00:86:09:99:31	Learned	26	8	0x003	Blue
08:00:20:0f:ca:03	Learned	26	53	0x005	Green
08:00:20:7b:d5:58	Learned	26	223	0x003	Blue

08:00:20:72:0b:1d	Learned	26	55	0x003	Blue
08:00:09:56:01:fe	Learned	26	18	0x003	Blue
00:00:c0:aa:08:0e	Learned	16	10	0x002	Green
00:04:ac:26:bd:8b	Learned	26	170	0x003	Blue
08:00:69:07:19:a8	Learned	26	24	0x003	Blue
00:a0:c9:37:eb:17	Learned	26	130	0x005	Green
00:00:1d:1a:80:d7	Learned	26	0	0x003	Blue
00:00:c0:1a:7a:0e	Learned	26	143	0x003	Blue

Enter <CR> to continue, Cntl-C to exit:

Optionally, you can specify the 'any' option. This will also display any permanent addresses that are configured and any entries that have been created for filtering.

ELS10-27> address display any

Address	Type	Port	Age(secs)
01:80:c2:00:00:00	BPDU	**	2760312
01:80:c2:00:00:01	Reserved	**	2760312
01:80:c2:00:00:02	Reserved	**	2760312
01:80:c2:00:00:03	Reserved	**	2760312
01:80:c2:00:00:04	Reserved	**	2760312
01:80:c2:00:00:05	Reserved	**	2760312
01:80:c2:00:00:06	Reserved	**	2760312
01:80:c2:00:00:07	Reserved	**	2760312
01:80:c2:00:00:08	Reserved	**	2760312
01:80:c2:00:00:09	Reserved	**	2760312
01:80:c2:00:00:0a	Reserved	**	2760312
01:80:c2:00:00:0b	Reserved	**	2760312
01:80:c2:00:00:0c	Reserved	**	2760312
01:80:c2:00:00:0d	Reserved	**	2760312

01:80:c2:00:00:0e	Reserved	**	2760312
01:80:c2:00:00:0f	Reserved	**	2760312
01:80:c2:00:00:10	All LANs	**	2760312
01:40:27:00:54:72	Reserved	**	2760312
00:00:1d:66:88:4e	Port	1	2760312
01:00:0e:00:00:01	Filter	**	5767

Enter <CR> to continue, Cntl-C to exit:

If desired, you can specify a MAC address to be searched for and optionally a mask.

```
ELS10-27> address display 08:00:20:79:fb:df
```

Address	Type	Port	Age(secs)
08:00:20:79:fb:df	Learned	17	0

Bridge

The bridge command allows you to specify whether transparent bridging (Spanning Tree) should be enabled on a per port basis. If only the bridge command is specified, the following is displayed:

```
ELS10-27> bridge
```

```
Usage: bridge [PORT-RANGE [{off | on | noBPDU}]]
```

Port 1 bridging:	Transparent Bridging
Port 2 bridging:	Transparent Bridging
Port 3 bridging:	Transparent Bridging
Port 4 bridging:	Transparent Bridging
Port 5 bridging:	Transparent Bridging
Port 6 bridging:	Transparent Bridging
Port 7 bridging:	Transparent Bridging
Port 8 bridging:	Transparent Bridging
Port 9 bridging:	Transparent Bridging

Port 10 bridging:	Transparent Bridging
Port 11 bridging:	Transparent Bridging
Port 12 bridging:	Transparent Bridging

Type <CR> to continue the display ... >

Optionally, you can select to turn transparent bridging off, or not to send BPDUs out of a group of ports.

```
ELS10-27> bridge 9-10 off
```

Port 9 bridging:	Off
Port 10 bridging:	Off

```
ELS10-27> bridge 9-10 nobpdu
```

┌	Port 9 bridging:	Transparent Bridging, BPDUs suppressed
	Port 10 bridging:	Transparent Bridging, BPDUs suppressed

STTimer

The STTimer (Spanning Tree Timer) command allows you to set the aging period for learned addresses under spanning tree. The default is 300 seconds. The command alone will display the present configured value.

```
ELS10-27> sttimer
```

Spanning Tree Age Time:	300 seconds
-------------------------	-------------

Baud

The baud command allows you to specify the bit transfer rate used on the local communications port. The default value is 9600, and valid values range from 2400 to 19200. When the command alone is typed the configured value is displayed.

```
ELS10-27> baud
```

```
Usage: baud [2400 | 4800 | 9600 | 19200]
```

```
Baud rate is 9600.
```

Ipaddr

The Ipaddr (IP Address) command is used to configure an IP address for the unit. Optionally, a gateway address is configured to act as a default path in the event that a path to the peer cannot be determined. Refer to the Route Command to configure a gateway.

```
ipaddr [IPADDR [MASK] | [vlan id | vlan name]]
```

In 802.1D mode only one IP address can be configured on the unit. Access can be gained to the unit from any port using that one IP address.

In 802.1Q mode multiple IP addresses can be configured in order to access the unit from multiple VLANs. (The VLAN command is used to configure an IP address on a VLAN.)

If only the ipaddr command is entered, the following display is seen:

```
ELS10-27> ipaddr
```

IP Address	Address Mask	VLAN ID	VLAN Name
134.141.110.27	255.255.0.0	0x005	Blue
192.167.38.25	255.255.0.0	0x007	Payroll

Type <CR> to continue the display ... >

If a VLAN ID or VLAN Name is entered, the display is restricted to the relevant entries.

Arp

The arp command allows ARP entries to be displayed. Static ARP entries CANNOT be configured.

```
ELS10-27> arp
```

Port	MAC Address	IP Address	Type
26	00:00:1d:1d:63:3c	134.141.5.126	Dynamic
26	00:40:27:00:bb:14	134.141.109.18	Dynamic

Route

The route command allows you to display routing entries. Only one static route entry can be configured; the default gateway.

```
route display [IPADDR][ [GATEWAY-ADDR] ] IPADDR ]
```

```
ELS10-27> route
```

```
Gateway    134.141.110.14
```

Destination	Next Hop	Net Mask	Protocol	VLAN ID
000.000.000.000	134.141.109.018	255.000.000.000	rip	0X001
100.000.000.000	134.141.105.153	255.000.000.000	rip	0X001
101.000.000.000	134.141.105.155	255.000.000.000	rip	0X001
102.000.000.000	134.141.105.153	255.000.000.000	rip	0X001
103.000.000.000	134.141.105.154	255.000.000.000	rip	0X001
134.141.000.000	000.000.000.000	255.255.000.000	local	0X001
134.141.110.027	134.141.110.027	255.255.255.255	local	0X001
134.142.000.000	134.141.105.014	255.255.000.000	rip	0X001
172.017.000.000	134.141.075.180	255.255.000.000	rip	0X001
192.168.037.000	134.141.109.018	255.255.255.000	rip	0X001
192.168.038.000	134.141.110.004	255.255.255.000	rip	0X001
198.113.121.000	134.141.110.004	255.255.255.000	rip	0X001
200.200.205.000	134.141.105.153	255.255.255.000	rip	0X001
201.201.209.000	134.141.105.153	255.255.255.000	rip	0X001
202.202.204.000	134.141.105.154	255.255.255.000	rip	0X001
203.203.208.000	134.141.105.154	255.255.255.000	rip	0X001
203.203.209.000	134.141.105.154	255.255.255.000	rip	0X001
204.204.212.000	134.141.105.154	255.255.255.000	rip	0X001

Type <CR> to continue the display ... >

Ping

The ping command allows you to attempt to contact a device using a particular IP address. The HOST parameter is actually an IP Address. Host name to IP address mapping is not available. The command operates in a manner similar to the ping command on an UNIX operating system and is useful in determining connectivity in the network.

```
ping [-rvsx] HOST [DATASIZE [COUNT]]
```

If the command alone is entered the usage statement is displayed.

```
Usage: ping [-rvsx] host [datasize [count]]
```

```
-r = record route
```

```
-v = verbose
```

```
-s = send one packet per second continuously
```

```
-x = send packets continuously w/o delay
```

An example of a ping command and the resulting output is as follows:

```
ELS10-27> ping -s 192.168.37.1
```

```
PING 192.168.37.1: 56 data bytes
```

```
56 bytes from 192.168.37.1 icmp_seq=1 time=99 ms
```

```
56 bytes from 192.168.37.1 icmp_seq=2 time=9 ms
```

```
56 bytes from 192.168.37.1 icmp_seq=3 time=102 ms
```

```
56 bytes from 192.168.37.1 icmp_seq=4 time=9 ms
```

```
56 bytes from 192.168.37.1 icmp_seq=5 time=103 ms
```

```
56 bytes from 192.168.37.1 icmp_seq=6 time=102 ms
```

```
----192.168.37.1 PING Statistics----
```

```
7 packets transmitted, 6 packets received, 14% packet loss
```

Traceroute

The traceroute command is a handy debugging tool used to determine a path taken from the ELS10-27 to another device using its IP address. You are allowed to specify several options. The MAX_HOPS allows you to specify the maximum time that a packet is allowed to live in the network before being discarded. The next option specifies the number of queries that should be used, followed by the length of time to wait for a reply.

When the traceroute command itself is used, the usage statement is displayed.

```
ELS10-27>traceroute ?
```

```
traceroute [-m max_hops] [-q nqueries] [-w wait] host_ip [data_size]
```

The following is a sample traceroute:

```
ELS10-27> traceroute 192.168.37.20
```

```
traceroute to (192.168.37.20), 30 hops max, 40 byte packets
```

```
1 134.141.109.18 6 ms 91 ms 99 ms
```

```
2 192.168.37.20 99 ms 99 ms 99 ms
```

Traplog

Various SNMP traps are sent to an SNMP Manager from the ELS10-27 when certain events occur. The last 50 of these traps are kept in a log within the ELS10-27 and can be displayed to assist in isolating failures. The command entered by itself displays the traplog.

```
ELS10-27> traplog
```

```
Trap 20 4 weeks 4 days, 0:19:00
```

```
The spanning tree topology has stopped changing.
```

```
Trap 19 4 weeks 4 days, 0:17:58
```

```
The spanning tree topology has begun to change.
```

```
Trap 32 4 weeks 4 days, 0:05:18 port 13
```

```
The spanning tree state of the port has changed.
```

```
Trap 3 4 weeks 4 days, 0:05:18 port 13
```

```
The current functional state of the port has changed.
```

```
Trap 20 4 weeks 3 days, 23:47:57
```

```
The spanning tree topology has stopped changing.
```

```
Trap 19 4 weeks 3 days, 23:46:54
```

```
The spanning tree topology has begun to change.
```

```
Trap 32 4 weeks 3 days, 23:41:41 port 15
```

```
The spanning tree state of the port has changed.
```

```
Trap 32 4 weeks 3 days, 23:41:36 port 15
```

```
The spanning tree state of the port has changed.
```

Trap 3 4 weeks 3 days, 23:41:36 port 15

The current functional state of the port has changed.

Trap 32 4 weeks 3 days, 23:39:36 port 15

The spanning tree state of the port has changed.

Type <CR> to continue, Cntl-C to exit...>

VLAN

The VLAN command, when operating in 802.1Q mode, allows you to specify an IEEE 802.1Q VLAN. You must specify a VLAN ID, and a name to associate with that ID. If you want to manage this unit on this VLAN you must also assign an IP Address.

```
vlan [add PORT-RANGE NAME VLAN-ID [IP ADDR] [[IP MASK]]
[del[ete] PORT-RANGE {NAME | VLAN-ID}]
[res[trict] {add | de[lete]} PORT-RANGE VLAN-ID]
```

If the command alone is specified, the existing VLANs are displayed. Two types of VLANs are displayed; the static entries that have been created by this command, and dynamic entries which have been learned by the switch via GVRP.

```
ELS10-27>vlan
```

VLAN-ID	NAME	TYPE	IP Addr	IP MASK	PORTS
0x001	default	STATIC	10.2.7.225	255.0.0.0	1-27

By using the VLAN command, the default VLAN ID for the port WILL NOT be changed. Refer to the port command to change the default VLAN ID for a port.

If the restriction option is specified, the switch will not allow a VLAN to be established for that ID from either a user interface or GVRP.

Workgroup

The workgroup command allows you to group ports together to limit the scope of broadcast, multicast and unicast packets. If there are no user defined workgroups, one default group exists consisting of all ports. As workgroups become defined, ports are removed from the default group and added to the newly defined group.

Note: Workgroups are only valid in 802.1D mode.

```
ELS10-27> workgroup [NAME [del[ete] | PORT_RANGE]]
```

To display all of the present workgroups, simply enter the command.

```
ELS10-27>workgroup
```

```
Name:    default
```

```
Port:    8,10,13-27
```

```
Name:    lab_e
```

```
Port:    9,12
```

```
Name:    lab_a
```

```
Port:    9,11
```

To display a particular workgroup specify the name.

```
ELS10-27>workgroup lab_a
```

```
Name:    lab_a
```

```
Port:    9,11
```

IGMP

You can enter the following command to enable or disable IGMP snooping on the ELS10-27 device. If IGMP snooping is enabled, the ELS10-27 will restrict IP Multicast packets to members of each IP Multicast group. The command syntax is:

```
IGMP [on | off]
```

You can display the status of IGMP snooping by entering the command alone.

```
ELS10-27> IGMP
```

```
IGMP filtering on
```

When IGMP snooping is disabled after being enabled, all filtering databases are deleted. Router port lists and the status of Querying on the device are re-initialized. The factory default for IGMP filtering is on.

IPMRouter

You can enter the following command to specify the ports to be included in all IP Multicast filters. These are expected IGMP Router ports that would be sending IGMP Queries. The command is also used to add non-IGMP capable ports so that they would also be included in all the filters. Once you statically configure the IP Multicast Router ports, any queries that are heard from the network are merged into the router port list.

```
ELS10-27> ipmrouter {add | delete} PORT-RANGE
```

If you re-enter the command with a different PORT-RANGE, the databases are flushed and all filters are re-learned.

```
ELS10-27> ipmrouter add PORT-RANGE
```

To delete some or all of the routers included in all filters, you enter:

```
ELS10-27> ipmrouter delete PORT-RANGE
```

All the Dynamic database entries are flushed and all the filters re-learned.

The command by itself displays the existing list of ports.

```
ELS10-27> ipmrouter
```

```
IP Multicast Routing ports - 1, 5, 6, 9, 23-27
```

Ipmulticast

Use the following command to create an IP Multicast group:

```
ELS10-27> ipmulticast [{add | del[ete]} IPMADDR PORT-RANGE IPMADDR]
```

Create an IP multicast group by entering the IP Group Address along with a list of ports. Enter the following command to statically configure an IP Multicast group. Once a group is configured, any information the firmware has learned dynamically, will not alter the static configuration. Re-enter the command to add to, or change the list of ports in the group.

```
ELS10-27> ipmulticast add PORT-RANGE IPMADDR
```

Enter the following command to delete an IP Multicast group:

```
ELS10-27> ipmulticast del[ete] IPMADDR
```

Display the state of Dynamic IP Multicast Filtering and all the IP Multicast Group entries by entering the command by itself.

```
ELS10-27> ipmulticast
```

Dynamic IP Multicast filtering is ON

GroupAddress	Ports	Class
224.0.0.1	1-27	Permanent
224.0.0.9	2-8,23	Static
224.0.0.200	1-27	Dynamic

Ipfilter

The ipfilter command is used to filter IP Multicast packets from a particular port. It is also used to enable or disable static IP Multicast filter groups created with the ipfilter command.

```
ELS10-27> ipfilter [on | off]
```

```
[{add | del[ete]} PORT-RANGE IPADDR]
```

Enter the following command to specify ports NOT to be included in filters for an IP Multicast Group. Once a filter is in place, the port WILL NOT transmit packets for that group, even if a host attached to that port attempts to join the group.

```
ELS10-27> ipfilter add PORT-RANGE IPADDR
```

Re-enter the command to add to or change the list of ports in the group. Add or change the filters for an IP Multicast group by entering:

```
ELS10-27> ipfilter add PORT-RANGE IPADDR
```

Remove filters from an IP Multicast group by entering:

```
ELS10-27> ipfilter del[ete] IPADDR
```

Enter the following command to allow the firmware to examine IP Multicast UDP traffic and dynamically set up port filters to restrict traffic to specific ports.

```
ELS10-27> ipfilter on
```

The default for ipm filter command is off.

Display the IP filters by entering:

```
ELS10-27> ipfilter
```

IP Multicast filtering is ON

GroupAddress	Ports
224.0.0.24	1-27
224.0.0.9	5
224.0.0.200	1, 9, 13

Query

Use the following command to enable or disable the device to act as a querier. In an 802.1D Workgroup environment, you may specify the name of the workgroup on which to initiate IGMP Queries.

```
ELS10-27>Query [on | off] [wgname]
```

To enable a querier on a workgroup named blue, the following command is issued:

```
ELS10-27>Query on blue
```

To display the state of IGMP Querying on the device or to list the segments that we are sending Queries on, you can enter:

```
ELS10-27> Query
IGMP Query on Default Group
IGMP Query on Blue
IGMP Query on Accounting
```

The factory default for the system to initiate IGMP Query packets is off.

If you change the state, the databases are flushed and all the filters re-learned.

Mirror

The mirror command has two forms. One allows you to mirror all inbound and outbound traffic from one port to another. The second allows all packets with specific destination MAC addresses to be mirrored to a particular port. Up to four destination MAC addresses may be mirrored simultaneously.

```
mirror [port {add | del[ete]} SRC-PORT DEST-PORT]
      [add[ress]{add | del[ete]} MAC-ADDRESS DEST-PORT]
      [on | off]
```

By entering the command alone, the present mirror selections are displayed.

```
ELS10-27>mirror
port 5 is being mirrored to port 25.
ELS10-27>mirror
The mirror port is 7
02:98:10:03:10:09
98:45:82:94:54:76
```

Trunk

The command has the following format:

```
ELS10-27>trunk [PORT-RANGE {on | off}]
```

You are able to enable / disable trunking functionality on a port or a range of ports.

For example:

```
ELS10-27> trunk 25-27 on
```

The above command turns on trunking on ports 25 through 27.

Note: Trunking is only allowed on ports 25-27.

Session

The session command displays the number of active sessions, the session number assigned, the amount of idle time, and the origin of the session. The display appears as:

Session	Idle Time	Origin
0	0:00	Console
1	0:09	10.2.10.161

Kill

The kill command relates to Telnet sessions. You are allowed to kill any of the Telnet session. You are not able to kill the Console session. To kill a session, issue the kill command followed by the session number.

```
kill 1
```

Trap control

Trap control gives you the ability to allow all traps or to disallow all traps. SNMP MIB variables are available to disable a particular trap, or all traps of a particular severity. The default for trap control is “disabled”.

Telnet

Telnet support allows you to telnet to the device and gain access to LCM. The device allows 4 sessions. Passwords for telnet are the RO and RW community names for the device and allow the corresponding level of access. You are not allowed to modify passwords via a Telnet session. If an IP address is added or modified using Telnet, the new address will not take affect until the next reboot.

CHAPTER 2

UNPACKING AND INSTALLING YOUR SMARTSTACK ETHERNET ELS10-27



Only qualified personnel should perform installation procedures.

Carefully unpack the SmartSTACK Ethernet ELS10-27 from the shipping carton and inspect it for possible damage. If any damage is evident, contact your supplier. The shipping carton contains the following:

- The SmartSTACK Ethernet ELS10-27 unit
- One AC power cord
- Console Cable kit
- Two rack-mounting brackets with fasteners (for rack-mount installation)
- Documentation – In addition to this manual, Release Notes are also included.

2.1 SMARTSTACK ETHERNET ELS10-27 FRONT PANEL

The SmartSTACK Ethernet ELS10-27 provides 27 RJ45 ports supporting 24 autonegotiating 10 Mbps ports and 3 autonegotiating 10/100 Mbps ports. The device also features two EPIM-100 slots that allow you to install up to two EPIM-100s to provide multimode fiber uplinks (with potential for single mode fiber). Figure 2-1 shows the front panel of the SmartSTACK Ethernet ELS10-27. The LEDs and buttons are described in Tables 2-1 and 2-2.

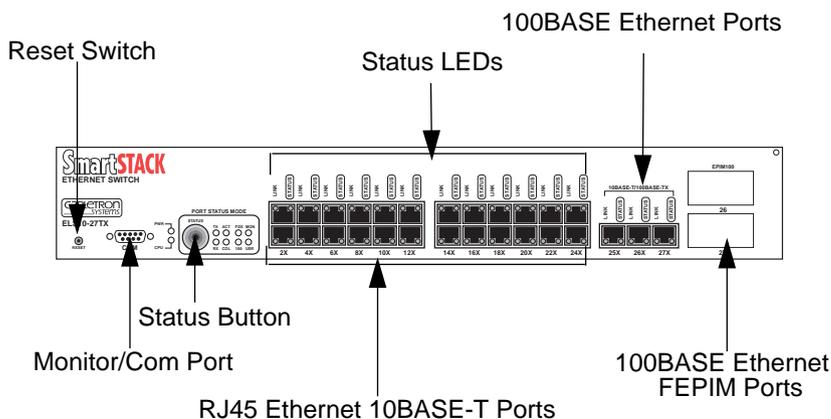


Figure 2-1. SmartSTACK Ethernet ELS10-27 Front Panel

Table 2-1. Meaning of SmartSTACK Ethernet ELS10-27 LEDs

LED	Meaning
Port Status Mode TX	On – Indicates port is transmitting a packet.
RX	On – Indicates port is receiving a packet.
ACT	On – Indicates port is transmitting or receiving.
COL	On – Indicates a collision on a port.
FDX	On – Port is operating in Full Duplex.
100	Off – Port is operating in Half Duplex.
MON	On – Port operating at 100 Mbps.
USR	Off – Port operating at 10 Mbps.
MON	On – Indicates port is copying to the monitor port.
USR	On – Indicates that errored packets were received.
Link (Individual Ports)	On – Indicates the link is good. Off – Indicates there is no link.
Status (Individual Ports)	On/Blinking – Indicates you are monitoring the port for a selected segment status condition. This LED always indicates the selected status mode.
CPU	On – Indicates the SmartSTACK Ethernet ELS10-27 is operational. Blinking – Indicates the SmartSTACK Ethernet ELS10-27 is running power-up diagnostics. Off – Indicates the SmartSTACK Ethernet ELS10-27 is non-operational.
Pwr	On – Indicates the SmartSTACK Ethernet ELS10-27 is receiving power. Off – Indicates the SmartSTACK Ethernet ELS10-27 is not receiving power.

Table 2-2. Description of SmartSTACK Ethernet ELS10-27 Buttons

Button	Function
Status	Cycles through the Segment Status options (TX, RX, Act, Col, FDX, 100, MON, and Usr) for all ports. The right-hand port status LEDs of the ports you are monitoring are activated based on what function you chose with the Select button.
Reset	Restarts the SmartSTACK Ethernet ELS10-27.

2.1.1 Indicators

The SmartSTACK Ethernet ELS10-27 will supply port level and system level information via front panel LEDs.

Port LEDs

There are 54 LEDs on the SmartSTACK Ethernet ELS10-27 built into the RJ-45 harmonica connectors. Each port has a Link LED and a function LED. There are 8 possible functions which can be chosen from using the push button on the front panel. The functions are as follows:

Transmit (TX)

Receive (RX)

Activity (TX + RX)

Collisions (COL)

Full Duplex Operation (FDX)

100 Mbps Operations (100)

Monitor Port (MON)

Errors (ERR)

There is an LED for each of the functions listed above on the front panel.

The EPIM-100FX supports a single green LED which indicates link. When the EPIM slot is active, the Status LED from the corresponding port (26 and \or 27) will be used.

Monitor Port LED Operation

When the port status indicator is selected to “MON” the following defines the operation of the LEDs for ports that are being mirrored.

For ports that have traffic mirrored to the monitor port, the LED is on solid. The status LED for the port which is chosen as the monitor port (the one you connect the analyzer to) will blink.

If address mirroring is selected, only the port which receives the mirrored frames is lit.

System LEDs

Two LEDs provide information about the system. The LEDs are Power and CPU. Power indicates that the device’s power supply is operating properly. The CPU LED indicates that the device’s CPU is operational. For both of these LEDs Green indicates good and off indicates a failure.

2.2 INSTALLING AN EPIM

The SmartSTACK Ethernet ELS10-27 provides a slot for a Cabletron EPIM (Ethernet Port Interface Module). The SmartSTACK Ethernet ELS10-27 is shipped without an EPIM. To install an EPIM, follow the procedure below:

1. Remove the plate covering the EPIM slot.
2. Install the EPIM as shown in Figure 2-2. Ensure that the rear connector is seated firmly by tightening the screw mounted to the EPIM.

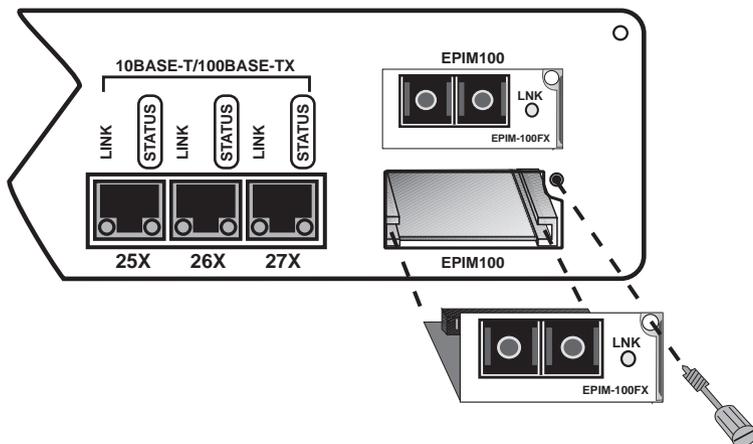


Figure 2-2. Installing an EPIM

Note: Installing an EPIM replaces one of the 100TX ports.

2.3 INSTALLING THE SMARTSTACK ETHERNET ELS10-27

Rack-mounting a SmartSTACK Ethernet ELS10-27

Table 2-3 describes some general considerations you should be aware of before mounting a SmartSTACK Ethernet ELS10-27 in a rack assembly.

Table 2-3. General Considerations for Mounting a SmartSTACK Ethernet ELS10-27

Consideration	Discussion
Temperature	Since the temperature within a rack assembly may be higher than the ambient room temperature, make sure the rack environment temperature is within the Operating Temperature range specified in Appendix A.
Air Flow	Make sure there is at least 2 inches (or more) on both sides of the SmartSTACK Ethernet ELS10-27 to allow for adequate air flow.

Table 2-3. General Considerations for Mounting a SmartSTACK Ethernet ELS10-27 (Continued)

Consideration	Discussion
Mechanical Loading	Do not place equipment on top of a rack-mounted SmartSTACK Ethernet ELS10-27.
Circuit Overloading	Make sure the power supply circuit to the rack assembly is not overloaded.
Grounding (Earthing)	Rack-mounted equipment should be grounded. In addition to the direct connections to the main power supplies, make sure all the other supply connections are also grounded.

The SmartSTACK Ethernet ELS10-27 can be rack-mounted in a standard 19-inch equipment cabinet. To mount the SmartSTACK Ethernet ELS10-27 in a rack assembly, apply the following steps:

1. Attach the rackmount brackets to both sides of the SmartSTACK Ethernet ELS10-27 chassis, as shown in Figure 2-3.

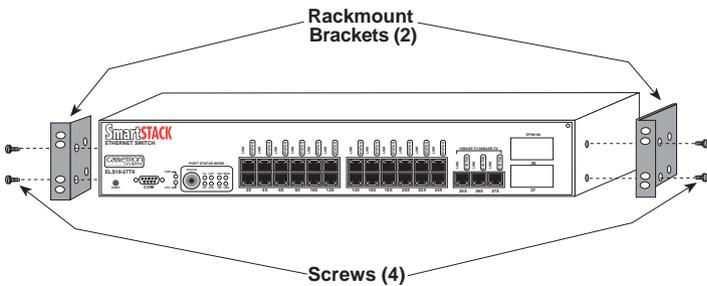


Figure 2-3. Attaching Rackmount Brackets

2. Place the SmartSTACK Ethernet ELS10-27 chassis in the cabinet.

- Secure the SmartSTACK Ethernet ELS10-27 with the rackmount fasteners by inserting and securing a fastener through each of the four slots in the rack-mount brackets, as shown in Figure 2-4.

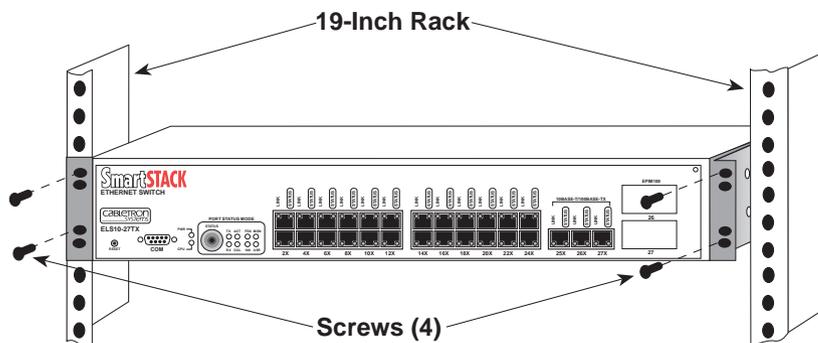


Figure 2-4. Rack-mounting the SmartSTACK Ethernet ELS10-27

- Once the SmartSTACK Ethernet ELS10-27 is installed, plug the AC power cord into the AC power connector on the rear of the SmartSTACK Ethernet ELS10-27 chassis. Plug the other end of the power cord into a three-prong grounded outlet.

2.4 CHECKING THE POWER-UP DIAGNOSTICS SEQUENCE

Before connecting any devices to the SmartSTACK Ethernet ELS10-27, power on the unit and observe the power-up diagnostics sequence to check for proper operation.

To observe the power-up diagnostics sequence completely, you may want to repeat it. To restart the power-up sequence, press the reset button on the front panel.

When you power up the SmartSTACK Ethernet ELS10-27, the following occurs:

- Power LED is ON.
- CPU LED comes on.
- Segment Status LEDs Sequence as Initialize Progresses.

4. All Segment Status LEDs remain on.
5. All remaining LEDs turn on for several seconds.
6. All LEDs turn OFF, leaving the PWR and CPU LEDs ON.
7. In addition, the Port Link LEDs will turn on for those ports with good links and the Segment Status LEDs will turn on (or flash) when the selected status condition is present.

Note: *If a critical component fails diagnostics, the CPU LED will turn off and the SmartSTACK Ethernet ELS10-27 will attempt to reboot. If the CPU LED does not stay on, contact Cabletron Systems. Refer to Section 1.2.*

2.5 CONNECTING THE LOCAL CONSOLE MANAGER

The Local Console Manager (LCM) is a command-line interface for configuring, monitoring, and managing the SmartSTACK Ethernet ELS10-27 via a VT 100 style terminal.

To connect the LCM:

1. Connect your ASCII terminal or terminal emulator to the out-of-band management RS232C port on the front panel of the SmartSTACK Ethernet ELS10-27 using the standard console cable shipped with the unit. (Only three wires are necessary: Receive Data, Transmit Data and Ground.)
2. Set the terminal to 9600 baud, 8N1: 8 data bits, 1 stop bit, and no parity, XON/XOFF flow control.
3. Press the Enter key several times. If the SmartSTACK Ethernet ELS10-27 and terminal are operational, LCM responds with the `ELS10-27 >` prompt.
4. LCM is now ready to use.

Refer to Section 1.6, **Local Console Manager**, for a general overview of LCM and the command syntax. LCM commands for configuring, monitoring, and managing the SmartSTACK Ethernet ELS10-27 are provided in the chapters dealing with those topics.

2.6 CONNECTING TO THE NETWORK

This section provides the procedures for connecting UTP and multimode fiber optic segments from the network or other devices to the SmartSTACK Ethernet ELS10-27.

Ports 1 through 24 have RJ45 connectors for UTP connections. Ports 25-27 support FE-100TX UTP connections, with ports 26 and 27 being transferable to optional EPIM100-FX Fast Ethernet Interface Modules.

Refer to Section 2.6.1 to make UTP connections.

Refer to Section 2.6.2 to make a fiber optic connection to an EPIM100-FX.

2.6.1 Connecting UTP Cables

Before connecting a segment to the SmartSTACK Ethernet ELS10-27, check each end of the segment to verify wire crossover.

Caution: *To establish a link, you must have an odd number of crossovers (preferably one) between 10BASE-T devices of the same type (i.e., from repeater to repeater or transceiver to transceiver).*

Connect a twisted pair segment to the SmartSTACK Ethernet ELS10-27 as follows:

1. Ensure that the device at the other end of the segment is connected to the segment and is powered ON.
2. Refer to Figure 2-5. Connect the twisted pair segment to the SmartSTACK Ethernet ELS10-27 by inserting the RJ45 connector on the twisted pair segment into the desired RJ45 port.

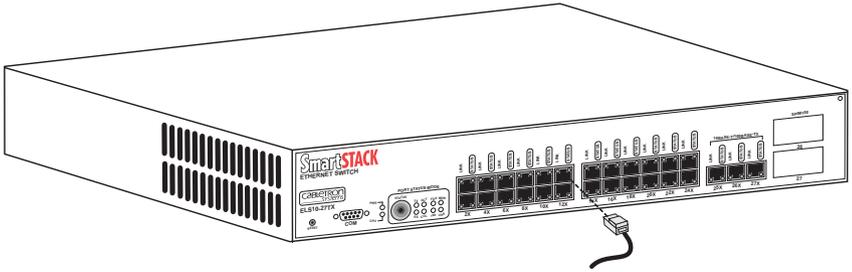


Figure 2-5. SmartSTACK Ethernet ELS10-27 Twisted Pair Connection

3. Verify that a Link exists by checking that the port **LINK** LED is on (solid green). If the **LINK** LED is off, perform the following steps until it is on:
 - a. Check that the 10BASE-T device at the other end of the twisted pair segment is ON and connected to the segment.
 - a. Verify that the RJ45 connectors on the twisted pair segment have the proper pinouts (Figure 2-6) and check the cable for continuity.

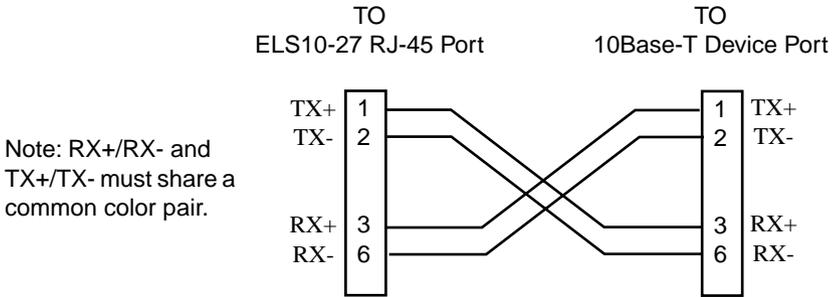


Figure 2-6. Cable Pinouts - (RJ45) Crossover Cable

- b. Check that the twisted pair connection meets the dB loss and cable specifications.
- If a link is not established, contact Cabletron Systems. Refer to Section 1.2, **Getting Help**, for details.
4. Repeat step 2, above, until all connections have been made.

2.6.2 Connecting a Multimode Segment to the EPIM100-FX

The EPIM100-FX has an SC style network port (see Figure 2-8). Cabletron Systems supplies fiber optic cable that uses SC style connectors that are keyed to ensure proper crossing over of the transmit and receive fibers.

Caution: *An odd number of crossovers (preferably one) must be maintained between devices so that the transmit port of one device is connected to the receive port of the other device and vice versa.*

If the fiber optic cable being used has SC style connectors that do not resemble MIC style connectors, or has SC connectors on one end and a different type on the other, such as ST connectors, ensure that the proper crossing over occurs.

Fiber Optic Network Connection

1. Remove the protective plastic covers from the fiber optic ports on the applicable port on the module and from the ends of the connectors.

Caution: *Do not touch the ends of the fiber optic strands, and do not let the ends come in contact with dust, dirt, or other contaminants. Contamination of the ends causes problems in data transmissions. If the ends become contaminated, clean them with alcohol using a soft, clean, lint-free cloth.*

2. Insert one end of the SC connector into the EPIM100-FX installed in the SmartSTACK Ethernet ELS10-27. See Figure 2-7.
3. At the other end of the fiber optic cable, attach the SC connector to the other device.

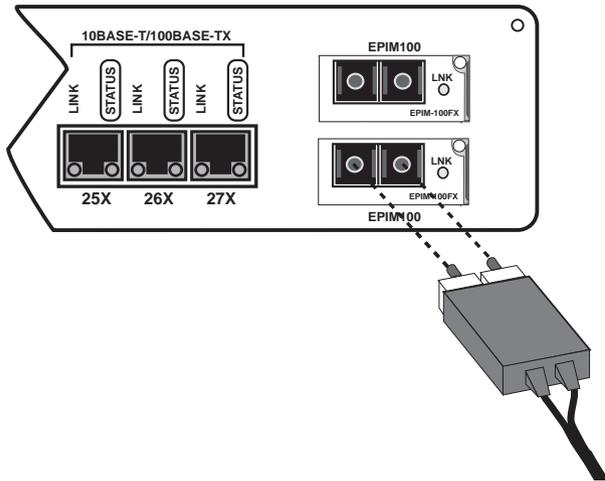


Figure 2-7. EPIM100-FX Port

4. Verify that a Link exists by checking that the port **LINK** LED is solid green. If the **LINK** LED is off, perform the following steps until it is on:
 - a. Check that the power is turned on for the device at the other end of the Link.
 - b. Verify proper crossing over of fiber strands between the applicable port on the SmartSTACK Ethernet ELS10-27 and the fiber optic device at the other end of the fiber optic link segment.
 - c. Verify that the fiber connection meets the dB loss specifications.

If a Link has not been established, contact Cabletron Systems. Refer to Section 1.2, **Getting Help**, for details.

The SmartSTACK Ethernet ELS10-27 is now ready to be set up through Local Management. Refer to Chapter 4, **Monitoring and Managing Your SmartSTACK Ethernet ELS10-27**, to configure the SmartSTACK Ethernet ELS10-27.

CHAPTER 3

CONFIGURING YOUR SMARTSTACK ETHERNET ELS10-27

The SmartSTACK Ethernet ELS10-27 does not require any additional configuration to operate as a standard, transparent switch. However, if you want to use any of the SmartSTACK Ethernet ELS10-27's advanced functions, you must first assign an IP (Internet Protocol) address on the SmartSTACK Ethernet ELS10-27 to communicate with a Simple Network Management Protocol (SNMP) manager.

To initially assign an IP address, you can use the Local Console Manager (LCM). LCM is a command-line interface built into the SmartSTACK Ethernet ELS10-27 that allows you to configure and manage the SmartSTACK Ethernet ELS10-27 through the out-of-band RS232C connection attached to any non-intelligent terminal, or a PC emulating a non-intelligent terminal. (See Section 3.1, **Assigning IP Addresses**.)

Once you have assigned an IP address, you can use SNMP-compliant network management tools to configure and manage the SmartSTACK Ethernet ELS10-27.

Configuration parameters are stored in an SNMP standard Management Information Base (MIB). All SmartSTACK Ethernet ELS10-27 MIB variables are listed and described in the SmartSTACK Ethernet ELS10-27 *MIB Reference Guide*.

Note: *There are some configuration options that cannot be configured using LCM commands. You may need to modify your configuration using an NMS. See Section 3.14, **Modifying MIB Variables**.*

The following sections describe how to configure the optional parameters of the SmartSTACK Ethernet ELS10-27 using LCM commands, including:

- Assigning IP addresses
- Enabling and disabling bridging
- Displaying bridging functions
- Enabling and disabling trunking
- Displaying trunking status
- Defining and deleting virtual workgroups

- Assigning a community name

Note: You can use the LCM **erase** command to erase all configuration information and return the unit to default settings on the next system reset.

If you are using a network management tool other than LCM, refer to its accompanying documentation.

3.1 ASSIGNING IP ADDRESSES

You can assign an IP that can be used for the the entire device. IP addresses are divided into classes based on what portion of the address is network or port information. The address classes are A, B, and C.

- Class A addresses are used in very large networks that support many ports. The first byte identifies the network and the other three bytes identify the node. The first byte of a class A address must be in the range 1-126. The address 100.125.110.10 would identify node 125.110.10 on network 100.
- Class B addresses are used for medium sized networks. The first two bytes identify the network and the last two identify the node. The first byte of a class B address must be in the range 128-191. The address 128.150.50.10 identifies node 50.10 on network 128.150.

Class C addresses are used for small networks. The first three bytes identify the network and the last byte identifies the port. The first byte of a class C address must be in the range 192-223. The address 192.138.217.10 identifies node 10 on network 192.138.217.

3.1.1 IP Address Configuration

SmartSTACK Ethernet ELS10-27 offers two basic methods to configure the IP address for the device. These two methods are BOOTP and the user interfaces. An IP address can also be learned by receiving an SNMP packet from the network. This IP address will be used solely to communicate with the network manager host.

User Interfaces (Telnet)

If the IP address is modified via Telnet you are prompted to ensure this change is desired. If this mechanism is used to make the change, the change will not take affect until the next reboot.

In 802.1d mode the SmartSTACK Ethernet ELS10-27 allows for a single IP address set for the entire device. The single IP is accessible from any front panel port.

You are also able to configure a default gateway. The default gateway is used to send IP packets to an end system that does not have an entry in the SmartSTACK Ethernet ELS10-27's ARP cache. The default gateway is usually a router and the parameter set for default gateway is the IP address of the router interface to which the SmartSTACK Ethernet ELS10-27 is connected.

In 802.1Q mode, an IP address per vlan is allowed. You must specify a VLAN ID to use to access that IP subnet. Only one VLAN ID per IP subnet is allowed.

To assign an IP address, at the LCM prompt:

Type **ipaddr** <IP ADDRESS>

For example, **ipaddr 192.138.217.40** will set the IP address 192.138.217.40. LCM responds by displaying the IP address table, as shown under the **ipaddr** command.

BOOTP

If there is not an in-band IP address assigned to the device in non-volatile memory, the runtime image attempts to determine an in-band IP address from the network. The runtime image will send out a BOOTP request to determine its IP address. The requests will be sent out periodically until a response is received. An interval of which BOOTP requests will be issued is per the BOOTP specification. This retry mechanism goes on for approximately two minutes. If after two minutes a response is not received, the system waits for approximately five minutes before starting the process over again. The first response the device receives is stored in non-volatile memory as the in-band IP address. As soon as an IP address is received via BOOTP, the module will cease sending out BOOTP requests completely. If the device has an IP address in non-volatile memory the module will not send out BootP requests.

BOOTP is not supported in 802.1Q mode. If the system is running in 802.1Q mode, and a reboot of the unit takes place, the unit begins operating from Flash Boot sectors. While in Flash Boot sectors, the BOOTP function will not tag packets. When the unit becomes fully operational, it resumes operation in 802.1Q mode and tags packets.

3.1.2 Displaying IP Addresses

To display IP addresses, subnet masks, and MAC addresses of all ports on the SmartSTACK Ethernet ELS10-27 you are configuring, at the LCM prompt:

Type **address display**

The address display command will display the MAC addresses, whether the address has been learned, the port the address is known on, and the age of the address entry.

Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
00:40:27:00:55:bf	Learned	26	1	0x003	Blue
00:40:27:00:58:17	Learned	26	14	0x003	Blue
00:00:0c:19:ce:35	Learned	26	4	0x003	Blue
00:80:cf:00:02:b7	Learned	26	215	0x003	Blue
00:00:c0:d8:f2:9a	Learned	26	80	0x002	Green
00:40:27:07:b4:9d	Learned	26	134	0x003	Blue
00:00:c0:b7:08:0e	Learned	26	10	0x003	Blue
08:00:20:79:fb:df	Learned	17	1	0x005	Green
00:00:1d:1d:63:3c	Learned	26	0	0x003	Blue
00:00:86:09:99:31	Learned	26	8	0x003	Blue
08:00:20:0f:ca:03	Learned	26	53	0x005	Green
Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
08:00:20:7b:d5:58	Learned	26	223	0x003	Blue
08:00:20:72:0b:1d	Learned	26	55	0x003	Blue
08:00:09:56:01:fe	Learned	26	18	0x003	Blue

00:00:c0:aa:08:0e	Learned	16	10	0x002	Green
00:04:ac:26:bd:8b	Learned	26	170	0x003	Blue
08:00:69:07:19:a8	Learned	26	24	0x003	Blue
00:a0:c9:37:eb:17	Learned	26	130	0x005	Green
00:00:1d:1a:80:d7	Learned	26	0	0x003	Blue
00:00:c0:1a:7a:0e	Learned	26	143	0x003	Blue

Enter <CR> to continue, Cntl-C to exit:

3.1.3 Deleting an IP Address

To delete an IP address, at the LCM prompt:

Type `ipaddr 0.0.0.0`

LCM responds by redisplaying the current IP address table.

3.1.4 Changing a Subnet Mask

You can optionally set the subnet mask. A subnet mask is a 32-bit address mask used in IP to specify a particular subnet. If the subnet mask is 0.0.0.0, the SmartSTACK Ethernet ELS10-27 will automatically convert the displayed mask to the standard default, based on the IP address class. (Class A address masks are 255.0.0.0, Class B address masks are 255.255.0.0, Class C address masks are 255.255.255.0.)

To change the subnet mask, at the LCM prompt:

Type `ipaddr <IP ADDRESS> <SUBNET MASK>`

For example, `ipaddr 192.138.217.40 255.255.240.0` would set the subnet mask to 255.255.240.0. LCM responds by redisplaying the current address table.

3.1.5 Setting the Default Gateway

The Default Gateway is set using the Route command. Refer to the Route command on page 1-35.

3.2 OPERATIONAL IMAGE

SmartSTACK Ethernet ELS10-27 supports the in-band TFTP loading of firmware images. The method for downloading firmware into flash is an “on-line” download method. Functionality of the download process is supported by the `ctdownload` mib.

On-line download means that the operation of the device is not affected by the downloading process. The operational image operates out of RAM and the downloading process erases flash and loads the new image directly into flash. If the download is unsuccessful and flash is not programmed properly, the device will use a BOOTP upon the next boot cycle to attain an image.

In the situation where the device boots up and finds an empty or corrupt flash, the device will use BOOTP to discover an image for downloading.

The device allows you to set a BOOTP Gateway address. This allows the device to pass BOOTP requests through a router that does not support proxy ARP. This process allows you to execute runtime downloads and be certain that if a failure during download occurs, the device is able to send BOOTP requests through the router.

BOOTP (RFC 951) and the Client side of **TFTP** are implemented to support automatic and **SNMP** controlled downloading.

The **BOOTP** protocol is a simple request/reply protocol that allows a network station to dynamically learn boot information from a Boot parameter server. SmartSTACK Ethernet ELS10-27 uses **BOOTP** to discover any unknown items on the following list.

- Our IP Address
- Download Filename
- Download Server IP Address
- Gateway IP Address to Download Server (if needed)

Once any unknown boot information is acquired via BOOTP, the TFTP Protocol is used to request *Download Filename* from *Download Server* and store it in the Flash file system.

IDENT Command

The IDENT command is enhanced to support displaying the following variables:

Part Number:

Power-up test code:

Diagnostic data:

Last Image File Name

Last Server IP Address

Flash Size

Boot Revision

Tephra Revision

Operational Status

Error String

3.3 IGMP

The Internet Group Management Protocol allows the establishment of IP multicast groups. IGMP is supported by snooping on IGMP messages to add entries to the forwarding table to limit the forwarding of multicast packets only to ports where IP Multicast devices have been heard from.

The SmartSTACK Ethernet ELS10-27 acts as an IP Multicast filter and will not forward IP Multicast packets onto segments that do not have any group members. It does this by listening for IGMP packets and creating and/or modifying the appropriate filters. It makes use of a combination of polling and a time-out functions on groups and segments to decide when to delete all members of the group.

SmartSTACK Ethernet ELS10-27 does not act as an IGMP router, meaning it **WILL NOT**:

- decrement the TTL value
- specifically filter out packets with TTL's of 1
- filter packets with IP Multicast source addresses
- participate in IGMP Routing Protocols
- keep statistics on IP Multicast packets filtered or forwarded

In order to ensure awareness of all ports where routers reside that are interested in IP Multicast packets, we will also monitor IP Multicast

routing protocols to determine their location and adjust the filters accordingly.

When subsequent queries are heard by the CPU, the CPU notes if any response is heard for each group. A count is kept for each group indicating the number of times a query was heard and there was no response received. When the count reaches its maximum value of 5 the group entry is modified and packets for that group are only forwarded to the CPU and to the query port. If an IGMPv2 specific query is heard, this is not counted as having received a general query. It only counts as a valid query for that group.

If an IP Multicast/UDP packet is received by the CPU that has not had a response issued for it, an entry is placed in the data base restricting forwarding of those packets to just the CPU. The idea is, rather than place entries in the data base for all unwanted entries, wait until traffic is heard from the unwanted entries and then restrict it. The number of entries should therefore be smaller, and based on how quickly the CPU can respond, a limited amount of unwanted traffic will leak through initially. This is known as Dynamic IP Multicast filtering and the use of it is user selectable. The default value for this selection is off. If, after creating this dynamic filter, there is a response, the response port is added to the filter. Once the response has been heard, if a querier is known, or is later heard from, it too is added to the entry. This is done with both the presence and absence of a querier.

If this feature is not selected (the default), a hardware filter is set to filter out all IP Multicast packets that are UDP packets from being received by the CPU.

You are also able to select whether you want the unit to act as an IGMP querier. This feature is used in the absence of any other IGMP queriers on the network.

Five commands are used to control the following functions:

- Enable/Disable IGMP filtering - the default is enabled.
- Add/Delete a static IP Multicast filter on a group of ports.
- Enable/Disable Dynamic IP Multicast filtering - the default is disabled.
- Enable/Disable the unit to act as a querier - the default is disabled.
- Specify ports to be included in all filters (expected querier ports).

3.4 ENABLING BRIDGING

The LCM `bridge` command allows you to set bridging options for a single port or a range of ports. The options include:

- off
- on (the default with BPDU enabled)
- noBPDU

BPDU (Bridge Protocol Data Unit) is a data unit transmitted as part of the IEEE 802.1d Spanning Tree protocol. The exchange of BPDUs allows bridges within a network to logically configure the network as a single spanning tree.

***Note:** Selecting the `noBPDU` option could make your network inoperable because the SmartSTACK Ethernet ELS10-27 would be unable to detect loops.*

Using LCM to enable bridging for a port or port range, at the LCM prompt:

1. Type `bridge [PORT-RANGE [{off|on|noBPDU}]]`

For example, `bridge 2 on` would enable bridging on port 2.

LCM responds:

```
Port 2 bridging: Transparent Bridging
```

3.5 DISABLING BRIDGING

To turn off the bridging function for a port or port range, at the LCM prompt:

1. Type `bridge [PORT-RANGE] off`

For example, `bridge 2 off` would disable bridging on port 2.

LCM responds:

```
Port 2 bridging: off
```

3.6 DISPLAYING BRIDGING FUNCTIONS

To display the bridging functions that are enabled for all ports, at the LCM prompt:

1. Type **bridge**

LCM responds with a list of all ports and the bridging function that is enabled. For example, typing **bridge** would display the bridging status for all ports.

```
Usage: bridge [PORT-RANGE [{off|on|noBPDU}]]
Port 1 bridging: Transparent Bridging
Port 2 bridging: Transparent Bridging
Port 3 bridging: Transparent Bridging
Port 4 bridging: Transparent Bridging
      ⋮
Port 27 bridging: off
```

You could also type **bridge [PORT-RANGE]** to look at a specific range of ports. For example **bridge 2-4** would display bridging functions for ports 2, 3, and 4.

3.7 ENABLING TRUNKING

If your network configuration requires you to connect two or more SmartSTACK Ethernet ELS10-27s (or other devices capable of trunking) together, but the applications you are running over the network require more than 100 Mbps of bandwidth per connection, you can use the built-in trunking feature to increase bandwidth up to 600 Mbps, without installing additional hardware on your network.

Trunking is a Cabletron Systems proprietary extension to the 802.1D Spanning Tree algorithm. It enables you to use multiple segments to connect SmartSTACK Ethernet ELS10-27s together, while maintaining first-in, first-out ordering of Ethernet packets. In addition, if any of the Ethernet segments configured for trunking become inoperable, those Ethernet segments are automatically bypassed.

Figure 3-1 shows two SmartSTACK Ethernet ELS10-27s connected by three 100BASE-TX crossover cables. You can connect up to three ports for sharing the traffic load. The connections must be point-to-point. That is, there cannot be any other devices on the Ethernet segments.

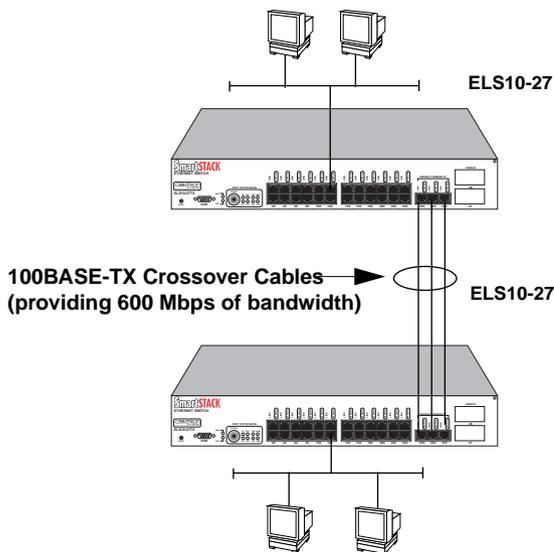


Figure 3-1. Trunk Connections

Trunk Groups

Each set of connections between two SmartSTACK Ethernet ELS10-27s is called a *Trunk Group*. You can create one Trunk Group, having up to three ports, to interconnect your SmartSTACK Ethernet ELS10-27s.

Each SmartSTACK Ethernet ELS10-27 determines which ports are part of which Trunk Group. After Trunk Group configuration, the SmartSTACK Ethernet ELS10-27s complete the standard 802.1D Spanning Tree state changes, treating each Trunk Group as a single 802.1D Spanning Tree port.

802.1D Spanning Tree takes about thirty seconds to resolve which SmartSTACK Ethernet ELS10-27 ports are to become forwarding ports. As ports within a Trunk Group become forwarding ports, traffic within the Trunk Group is momentarily halted to guarantee the first-in, first-out ordering of the Ethernet packets.

Note: *The SmartSTACK Ethernet ELS10-27-to-SmartSTACK Ethernet ELS10-27 connections must be point-to-point. There cannot be any other devices on those Ethernets. The ports used for trunking can be in any order. However, both ends of the SmartSTACK Ethernet ELS10-27-to-SmartSTACK Ethernet ELS10-27 connections must have trunking turned on for the ports that are being used for the connections.*

3.8 DISABLING TRUNKING

To turn off trunking, at the LCM prompt:

Type `trunk <PORT-RANGE> off`

For example, `trunk 25-27 off`

3.9 DISPLAYING TRUNKING STATUS

To check the status of your current trunking configuration, at the LCM prompt:

1. Type `trunk <PORT-RANGE>`

The display could look like the following:

Note: *IP Addresses are not required for trunking to function.*

```
ELS10-27 > trunk 25-27
```

```
Port 25 trunking joined to Bridge MAC Addr 00:40:27:00:06:1f IP Addr 0.0.0.0
Port 26 trunking joined to Bridge MAC Addr 00:40:27:00:06:c3 IP Addr 0.0.0.0
Port 27 trunking joined to Bridge MAC Addr 00:50:36:00:07:4a IP Addr 0.0.0.0
```

To check the status for ports configured for trunking, at the LCM prompt:

1. Type `status <PORT-RANGE>`

The display could look like the following:

```
ELS10-27 > status 1

          Port 1 Status
Type/Speed:          10B-TPX/10Mbits
Port Mirroring:      No
Duplex Mode:         Half Duplex
Bridging:            Transparent Bridging
Enabled/Disabled:    Enabled, Rip listening
Spanning Tree:       Forwarding
Trunking State:      Off
Pkts Transmitted:    1693
Pkts Received:       0
Carrier Losses:      1693
Total Collisions:    0
Excess Collisions:   0
RX Missed pkts:     0
RX Runt pkts:        0
RX FCS/Align Errs:  0
Internal TX Errs:    0

Type <CR> to display port 2 status...>
```

The following conditions can be displayed:

- Broken — Trunking is enabled, but the port is non-operational.
- Closed (or Oneway) — Trunking is enabled, and the Trunking Protocol is attempting to establish a trunk connection.
- Heldown — Trunking is enabled, but the trunk connection was rejected. After a short time-out period, another attempt is automatically initiated to establish a good trunk connection.
- Joined — Trunking is enabled, and the Trunking Protocol has established a good trunk connection.
- Off — Trunking is not enabled.
- Perturbed — Trunking is enabled, and a good trunk connection has been established. However, the forwarding of data packets is temporarily suspended to allow for a change in the membership of the Trunk Group.

3.10 PORT MIRRORING

The mirror command has two forms. One will allow the user to mirror all inbound and outbound traffic from one port to another. The second will allow all packets with specific destination MAC addresses to be mirrored to a particular port. Up to four destination MAC addresses may be mirrored simultaneously.

```
mirror [port {add | del[ete]} SRC-PORT DEST-PORT]
      [add[ress]{add | del[ete]} MAC-ADDRESS DEST-PORT]
      [on | off]
```

By entering the command alone the present mirror selections will be displayed.

```
ELS10-27>mirror
```

```
port 5 is being mirrored to port 25.
```

```
ELS10-27>mirror
```

```
The mirror port is 7
```

```
02:98:10:03:10:09
```

```
98:45:82:94:54:76
```

3.11 DEFINING AND DELETING WORKGROUPS

The SmartSTACK Ethernet ELS10-27 allows you to define logical groups of associated ports (virtual workgroups) to provide a more efficient flow of traffic across your Ethernet network.

Virtual workgroups offer you the ability to limit broadcasts and unicasts to logical domains within the network. Workgroup destinations are recognized by the SmartSTACK Ethernet ELS10-27 and packets are routed directly to ports within the workgroup, eliminating the need to perform a general broadcast across each segment of the network to find specific host addresses.

Figure 3-2 shows an SmartSTACK Ethernet ELS10-27 that has been programmed to identify workgroups A and B. Workgroup A uses ports 3 through 5, 13 and 16 and workgroup B uses ports 7, 11, 16 and 24. Port 16 connects a segment that contains both workgroup A and workgroup B hosts.

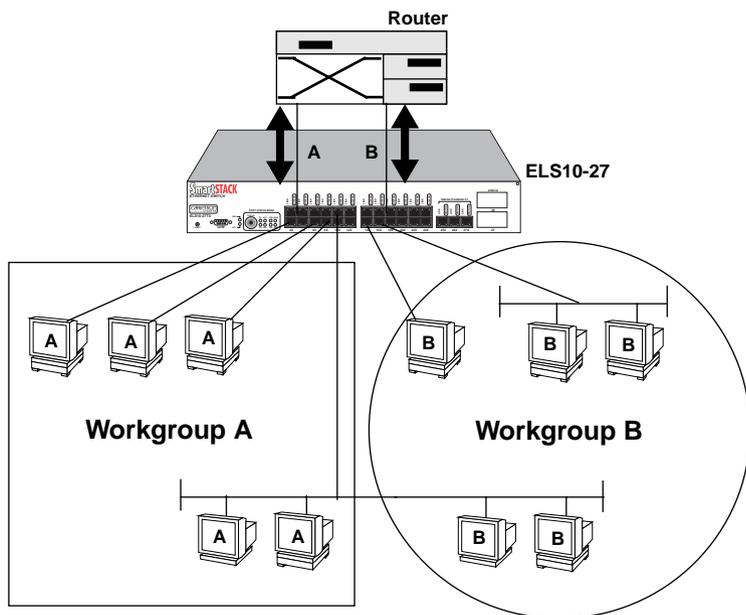


Figure 3-2. Defining Virtual Workgroups

The LCM commands used to create the previous configuration are as follows:

1. To create workgroup A on ports 3, 4, 5, 13, and 16:

```
SmartSTACK Ethernet ELS10-27 > workgroup A 3-5,13,16
```

LCM responds with the following display:

```
Name: a
Ports: 3, 4, 5, 13, 16
```

2. To create workgroup B on ports 7, 11, 16, and 24:

```
SmartSTACK Ethernet ELS10-27 > workgroup B 7,11,16,24
```

LCM responds with the following display:

```
Name: b
Ports: 7, 11, 16, 24
```

Port 16 has been assigned to a segment that includes ports that belong to workgroup A and workgroup B. Port 13 connects workgroup A to the router and port 24 connects workgroup B to the router.

All packets remain within the workgroup.

Use the LCM command, *workgroup*, to create, modify, and delete virtual workgroups. The full syntax of the command is as follows:

```
workgroup [NAME [{delete | PORT-RANGE}]]
```

To display all of the workgroups defined by the SmartSTACK Ethernet ELS10-27, at the LCM prompt:

Type **workgroup**

To display information about a specific workgroup, at the LCM prompt:

Type **workgroup NAME**

To create or modify a workgroup, at the LCM prompt:

Type **workgroup NAME PORT-RANGE**

To delete a workgroup, at the LCM prompt:

Type **workgroup NAME delete**

To create or modify the port list for a specific workgroup, at the LCM prompt:

Type **workgroup NAME PORT-RANGE**

To display the network classification of a specific workgroup, at the LCM prompt:

Type **workgroup NAME**

3.12 ASSIGNING A COMMUNITY NAME

A community name is similar to a password. You use the same steps to assign a new community name or to change an existing community name. You can then enter a community name to perform any SNMP *sets*. The default password is *public* the first time you access the device.

To assign a community name, at the LCM prompt:

1. Type **community**
2. Enter the old community name.

3. If one has not been assigned, `public` is the default name.
4. Enter the new community name.
5. LCM prompts you to verify the new community name by retyping it.
6. Retype the new community name.

3.13 CONFIGURING BROADCAST/MULTICAST STORM PROTECTION

The SmartSTACK Ethernet ELS10-27 provides automatic protection against broadcast/ multicast storms. Broadcast storms are excessive broadcasts to all ports, typically caused by a malfunctioning device. They can result in severe network performance problems, including causing the network to crash.

To protect against broadcast/ multicast storms, you must define an acceptable rate for multicast traffic across a port. In many ways, this feature is similar to filtering.

Each SmartSTACK Ethernet ELS10-27 port can be individually configured for automatic multicast storm protection. You define what level of multicasts the SmartSTACK Ethernet ELS10-27 will recognize as a multicast storm by specifying the number of multicast packets that can be received within a given time period.

For example, if you configure SmartSTACK Ethernet ELS10-27 to receive onto Port 3 no more than 50,000 multicasts per 10 seconds, any multicasts destined for Port 3 are discarded after the first 50,000 multicasts. After 10 seconds have elapsed, another 50,000 multicasts to Port 3 will be allowed. This maintains an effective maximum rate of 50,000 multicast packets per 10 seconds.

3.14 MODIFYING MIB VARIABLES

Specific instructions for controlling SmartSTACK Ethernet ELS10-27 operations, modifying parameters, and so on, depend on the NMS you are using. This manual provides instructions for using LCM commands. However, LCM commands do not exist for all configuration options. You may need to modify your configuration using an NMS.

This section provides several common MIB variables you may want to change. Refer to the SmartSTACK Ethernet ELS10-27 *MIB Reference Guide* for a complete listing and description of MIB variables.

Each variable is first described in words, and is then identified in MIB form, for example, `els10-27adminGetPass - {els10-27admin 3}`. The Display String line shows the range of values that can be used for the given parameter. In each case, the DisplayString is a string of ASCII characters.

3.15 SYSTEM CONTACT

The system contact parameter identifies the contact person who is responsible for operating the SmartSTACK Ethernet ELS10-27. Typically, this parameter includes the person's name, company or division name, and telephone number.

```
sysContact - {system 4}
DisplayString (SIZE (0..255))
```

3.16 SYSTEM NAME

The system name is a name assigned to the SmartSTACK Ethernet ELS10-27 by the network administrator. By convention, the system name is the fully qualified domain name. (This name then becomes the LCM prompt.)

```
sysName - {system 5}
DisplayString (SIZE (0..255))
```

3.16.1 System Location

The system location identifies the physical location of the SmartSTACK Ethernet ELS10-27.

```
sysLocation - {system 6}
DisplayString (SIZE (0..255))
```

3.16.2 Community Names

The set community name variable (from the Cabletron proprietary MIB), must be initialized with the correct community name passwords.

All requests from any SNMP manager contain a community name field. For set requests, the community name must match the set password; otherwise, the request will be rejected by the SmartSTACK Ethernet ELS10-27. For get requests, the community name must match either the set or the get community name.

Set Community Name

The set community name variable (`els10-27adminAnyPass`) and get community name variable (`els10-27adminGetPass`) must be set to the value of the community name used by the SNMP manager for performing either set or get operations. A zero length community name means that any community name is acceptable.

```
els10-27adminAnyPass - {els10-27admin 2}
DisplayString (SIZE (0..24))
els10-27adminGetPass - {els10-27admin 2}
DisplayString (SIZE (0..24))
```

3.16.3 Aging Parameter

Dynamic (learned) addresses are automatically deleted from the SmartSTACK Ethernet ELS10-27 Bridge Address Table after a certain length of time. The aging time default is five minutes, as set by the IEEE 802.1d standard. However, you can change the aging parameter with the MIB variable `dot1dTpAgingTime`.

The SmartSTACK Ethernet ELS10-27 continually compares the actual age of each dynamic address against the age specified by the `dot1dTpAgingTime` parameter, and deletes any addresses that are older than the age specified (or older than five minutes if you are using the default). Typically, there is no need to set the aging time to a very small number because the SmartSTACK Ethernet ELS10-27 Bridge Address Table supports 979 addresses.

CHAPTER 4

MONITORING AND MANAGING YOUR SMARTSTACK ETHERNET ELS10-27

Monitoring the SmartSTACK Ethernet ELS10-27 consists of collecting and analyzing statistics and system status information.

You can use the Select button on the front panel of the SmartSTACK Ethernet ELS10-27 to monitor segment status on any of the Ethernet ports. Refer to Section 2.1 for a description of the segment status options.

Basic management of the SmartSTACK Ethernet ELS10-27 consists of disabling or enabling Ethernet ports, setting the community name for the SmartSTACK Ethernet ELS10-27, and changing the baud rate for your Local Console Manager (LCM) connection.

4.1 SMARTSTACK ETHERNET ELS10-27 MANAGEMENT TOOLS

LCM is a command-line interface built into the SmartSTACK Ethernet ELS10-27 that enables you to monitor and manage the SmartSTACK Ethernet ELS10-27 through the out-of-band RS232C connection attached to any non-intelligent terminal. You can also use one of the following Cabletron Systems Network Management Stations (NMSs), or a standard SNMP-based NMS to manage the SmartSTACK Ethernet ELS10-27:

- SPECTRUM
- SPMA
- SPEL
- Any SNMP-based NMS

4.2 MIB SUPPORT

This section lists the SNMP MIBs supported by SmartSTACK ELS10-27. These MIBs allow the user to configure virtually all features and functions of the product. These MIBs also allow this device to be managed by an SNMP management application.

RFC1213	MIBII
RFC1757 Event)	RMON (Statistics, History, Alarm, and
RFC1493	Bridge MIB
ctmib2ext	
ctbridge	ctBridgeStp only
ctdownload	
ctfastethernet mib	
stacktrunk-mib	
FlowControl	

4.3 RMON SUPPORT

SmartSTACK Ethernet ELS10-27 has the ability to support four of the nine RMON MIB groups. The four groups are Ethernet Statistics, History, Alarms, and Events. RMON is supported on all ports at all times.

- Ethernet Statistics:
- The History Group: The History Group consists of two sub groups.

- The History Control Group

The History Control Group controls the periodic statistical sampling of data from the system. This group stores configuration entries that each define, an interface, a polling period, and needed control parameters.

- The Ethernet History Group

The Ethernet History Group records periodic statistical samples from the system and stores them for later retrieval.

- The Alarm Group: The Alarm Group periodically takes statistical samples from variables in the system and compares them to thresholds that have been configured. This group stores configuration entries that each define, a variable, polling period, and threshold parameters.
- The Event Group: The Event Group consists of two groups.
 - The Event Group

The Event Group: The Event Group controls the generation and notification of events from this device. Each entry in this group describes the parameters of the event that can be triggered.

and a sub group known as the

- Log Group:

The Log group is nothing more than a list of events. Each entry in this group is a set of data describing a given event that has been logged.

4.3.1 RMON High Level Description

The History Control Group and the Ethernet History Group

These two groups work together to collect and save statistics for later viewing. You can, via SNMP commands, create entries in the History Control Group. Each control group identifies a source (data source) that statistics are taken from, an interval to control how often the statistics are taken, and a requested number of statistical snapshots that should be saved (these snapshots are known as buckets).

Up to 30 snapshots (buckets) per control group entry can be configured and will be saved in memory. You are allowed to request up to a maximum of 400 buckets. Up to 30 buckets may be assigned to a Control Group as long as the total number of buckets does not exceed the maximum of 400.

Each control group requires a timer to go off and trigger the collection of data. Once the data is collected it is stored in the next available bucket of the Ethernet History Group. Statistics are polled from the hardware and stored in memory. The RMON function does not collect statistics from the hardware directly, but rather references the copy in memory.

As soon as you create a History control group, a timer is set up and the process of collecting statistics begins. Waiting for the system clock to reach a special time does NOT happen.

Alarm Group, the Event Group, and the Log Group

These three groups work together to take statistical samples and process them. You can, via SNMP commands, create entries in both the Alarm Group and the Event Group. The Alarm group periodically takes statistical samples from variables in the system memory and compares them to thresholds that are configured. If a sample is found to cross a threshold value, an event is generated. The Event Group is called to mark this as a significant event. The operator entered Event Group input decides what to do with the event. Its choices are, ignore the event, log the event via the Log Group, send an SNMP trap, or both log the event and send the trap. The Log Group's only function is to log and maintain the given events for later retrieval.

***Note:** When a threshold in one direction is passed an event is triggered. Another event for this alarm will not be triggered until the threshold in the other direction is passed. You are allowed to enter a total of 60 alarms. A total of 128 events are stored in the Log Group. No Log Group entry is stored in non volatile memory. If power on the box is cycled, all entries in the Log Group are lost.*

You have a choice of how to sample the selected variable. The choice is absolute value and delta value. With absolute value, the value of the selected variable is compared directly with the thresholds at the end of the sampling interval. With delta value, samples are taken twice per interval, each time samples are taken the delta value of the last two samples are added and then compared to the threshold. This allows the detection of threshold crossings that span the sampling boundary.

4.3.2 RMON Details

Creating A New Group Entry

Two methods of creating a new entry in a group exist. The first is the standard and approved method. It is an operator request (SNMP) to set the status of a non existing entry to create (CREATE_REQUEST). The second is an operator request (SNMP) to set any read write variable in an entry that does not exist.

You are, when creating entries in these groups, under no obligation to make sure they are in chronological order. However, to make the output display more readable they should be in chronological order. This means, when the entries for the groups are created or restored they should be made into some type of linked list, so new entries can be placed where they are needed to make a more understandable or readable output.

Whenever a request to create or modify a group entry is accepted, a ten minute timer will be set. If the entry is not completely updated (status set to VALID) when the timer goes off, the group entry is flushed. As soon as the entry is validated and the status set to VALID, the above set timer is canceled. This step is done to ensure that memory and nonvolatile memory do not get filled with entries that cannot be used.

Modifying Any Group Entry

Entries in the above mentioned groups cannot be modified (even if the access is read / write) unless the status is set to something other than VALID. This means you must go through a three step process to modify a group entry.

1. Send a set command to set the status of a given group entry to UNDER_CREATION.
2. Send set commands to modify all other needed values in this entry.
3. Send a set command to change the status of the given entry back to VALID.

When a set status to VALID request is received, the message must be checked for other set requests for this group entry. If any are found, they must be processed before the set status to VALID request or they will be returned as an error. This must be done because it cannot be guaranteed that the set status to VALID command will be the last command in the message. It is possible for it to come first followed by all other requests. When the set status to VALID request is being processed the entire group entry must be validated and appropriate action taken to return an error or success. If an error is found the error_status field should be set to BAD_VALUE and the error_index field should be set to point to the first offending entry. If no error is found the status of the entry is set to VALID, the clean up timer is canceled, and the group entry is stored in nonvolatile memory.

Modifying The Number Of Statistic Samples Saved

The number of buckets (snapshots) of Ethernet statistics saved is set via an SNMP command. The number may be modified at any time. When the number of buckets reaches the value set, the saved statistics in the oldest bucket associated with this History Control Group entry are replaced by the values of the current statistics. If the number of buckets changes to a number that is less than what is currently stored, enough of the oldest buckets are deleted, and any allocated memory is freed. If the number of buckets changes to a number greater than the current value, the number of entries is allowed to grow (i.e. more memory is allocated).

Each entry of the History Control Group requires statistics to be collected at a given interval (`HistoryControlTable.Interval`). The needed timers must now be setup. Also, memory must be allocated for each needed entry of the Ethernet History Group. The value of `HistoryControlTable.BucketsRequested` must be checked and the code should attempt to allocate this number of Ethernet History Group entries. If this amount of memory cannot be allocated the `HistoryControl.BucketsGranted` must be updated to reflect the correct value.

4.4 SMARTSTACK ETHERNET ELS10-27 STATISTICS

The SmartSTACK Ethernet ELS10-27 gathers statistics that can help you build a comprehensive profile of the network traffic flow between each Local Area Network (LAN) you are connecting, as well as the network traffic flow between each Ethernet port on the SmartSTACK Ethernet ELS10-27.

SmartSTACK Ethernet ELS10-27 statistics are divided into four groups:

- System statistics
- Ethernet port statistics
- Traffic analysis statistics
- SNMP statistics

You can use this information to analyze your overall network performance and to make configuration changes as necessary. For example, Ethernet port statistics can help you identify network devices that require high bandwidth, and therefore should be connected through

a dedicated, rather than a shared, network connection. In addition, Ethernet port statistics can help you identify a network device that is the source of numerous multicast packets due to a possible malfunction.

4.4.1 Gathering Statistics

For purposes of network management, managed objects must be identified. Creation of a managed object is achieved by placing its identifier, and a set of management information appropriate to its class, in the Management Information Database (MIB).

4.4.2 System Statistics

For each SmartSTACK Ethernet ELS10-27, the following system statistics are available:

- The number of seconds since the SmartSTACK Ethernet ELS10-27 was last reset.
- The number of spanning tree topology changes that have occurred since the SmartSTACK Ethernet ELS10-27 was last reset.
- The time since a topology change was last initiated.
- The physical location of the SmartSTACK Ethernet ELS10-27.
- The name and address of the contact person for the SmartSTACK Ethernet ELS10-27.
- The name of the SmartSTACK Ethernet ELS10-27.
- The current number of dynamic (learned) addresses.

Note: To check SmartSTACK Ethernet ELS10-27 system status using LCM, see Section 4.5.

4.4.3 Ethernet Port Statistics

For each Ethernet port connection on the SmartSTACK Ethernet ELS10-27, a number of statistics are available. They can help you analyze both network activity and utilization, and in some cases, indicate faulty equipment or cabling.

The following statistics are available with SNMP:

- The number of non-unicast (multicast and broadcast) and unicast packets received from the port.
- The number of bytes in the packets that were forwarded.
- The total number of packets transmitted to the LAN.

4.5 USING LCM TO CHECK SMARTSTACK ETHERNET ELS10-27

The LCM commands that enable you to quickly check on the status of the SmartSTACK Ethernet ELS10-27 include:

- Status
- Address display
- Ipaddr
- Ident

These LCM commands are described in the sections that follow.

4.5.1 Displaying Status

The `status` command displays the status of the SmartSTACK Ethernet ELS10-27 and automatically pages through the status of all of the Ethernet ports, pausing at each screen of information.

***Note:** You can also use the `status` command to display status for individual Ethernet ports by typing `status` and specifying a port number.*

At the LCM prompt:

Type `status`

LCM displays the following type of information.

```
Software Currently Running: version xx.xx.xx software, Tue 08/23/94 15:0
Next Bootstrap: version xx.xx.xx software Tue 08/23/94 15:03:09
Power-up test failures: none
System Up Time: 2:25:57
Current Number of Learned Addresses: 133
CPU utilization is light.
```

Port	RX Packets	TX Packets	Collisions	Erred Packets
1	0	1676	0	1676
2	6978	8	0	0
3	0	0	0	0
4	0	0	0	0
.
.
.
24	0	0	0	0

Type <CR> to display port 1 status...>

If you do not want to view the status of each Ethernet port, use the Ctrl-C keys to return to the LCM prompt.

```
Port 1 Status
Type/Speed:          10B-TPX/10Mbits
VLAN ID:             Blue    0X001
GVRP:                Enabled
Port Mirroring:      No
Duplex Mode:          Half Duplex
Bridging:             Transparent Bridging
Enabled/Disabled:    Enabled, Rip listening, port w/o link
Spanning Tree:        Without link
Trunking State:       Off
Pkts Transmitted:    0
Pkts Received:        0
Carrier Losses:       0
Total Collisions:     0
Excess Collisions:    0
RX Missed pkts:      0
RX Runt pkts:         0
RX FCS/Align Errs:   0
Internal TX Errs:    0
```

Type <CR> to display port 2 status...>

If you do not want to view the status of port 2, use the Ctrl-C keys to return to the LCM prompt.

You can view the status for multiple of ports by typing **status** and indicating the range of port numbers, for example **status 2-6**.

4.5.2 Displaying MAC Addresses

The addresses `display` command displays all MAC addresses in the SmartSTACK Ethernet ELS10-27 Bridge Address Table. The display includes:

- The MAC address
- VLAN ID
- VLAN Name

- Type of address, including:
 - Dynamic (learned)
 - Ethernet port (for the MAC address of an Ethernet port)
 - BPDU (the MAC address to which all BPDUs are directed)
 - Reserved (an address reserved by 802.1d, but not yet assigned)
 - All LANs (addresses reserved by 802.1d for network management)
- Port number
- Age (in seconds since a packet was last received from that address)

The display automatically pauses with each screen of information. Addresses are displayed in random order; for example, address 02:00:00:00:00:00 may appear after address 04:00:00:00:00:00.

The age will be the time since a packet was last received from that address.

To display all MAC addresses, at the LCM prompt:

Type **addresses display any**

LCM responds with a list of all MAC addresses, their associated ports, the type, age, and number of frames from and to that address.

Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
08:00:20:02:3a:44	Learned	3	26		

Enter <CR> to continue, Ctrl-C to exit:

If you do not specify **any**, only the learned addresses are displayed.

To display a specific address, at the LCM prompt:

Type **addresses display <MAC-ADDRESS>**

For example, if you typed, **addresses display 02:04:06:03:2a:43**, LCM would display the following information:

Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
02:04:06:03:2a:43	Learned	5	21		

You can display a range of addresses by using a net mask. This is helpful when determining the status associated with stations containing the same make of Ethernet network interface cards. At the LCM prompt:

Type **addresses display** <MAC-ADDRESS> <NET-MASK>

For example, to see all addresses that begin with 02:04:06, you would enter:

```
addresses display 02:04:06:00:00:00 ff:ff:ff:00:00:00
```

LCM would display:

Address	Type	Port	Age(secs)	VLAN ID	VLAN Name
02:04:06:03:2a:43	Learned	5	21		
02:04:06:00:2a:67	Learned	4	1		
02:04:06:a3:70:2b	Learned	6	0		

Enter <CR> to continue, Ctrl-C to exit:

The **ipaddr** command displays the IP addresses, subnet masks, and MAC addresses of all SmartSTACK Ethernet ELS10-27 ports. At the LCM prompt:

Type **ipaddr**

LCM displays the current IP address table, for example.

Port	IP Address	Address Mask
1	192.138.217.1	255.255.255.0
2	0.0.0.0	255.0.0.0
3	192.138.217.10	255.255.255.0
4	0.0.0.0	255.0.0.0
5	0.0.0.0	255.0.0.0
6	192.138.217.20	255.255.255.0
7	192.138.217.50	255.255.255.0
8	192.138.217.30	255.255.255.0

4.5.3 Displaying Manufacturing Information

The `ident` command identifies SmartSTACK Ethernet ELS10-27 manufacturing information, including the part number and any power-up test codes and diagnostic data. To display the manufacturing information, at the LCM prompt:

Type `ident`

LCM displays the following type of information:

```
Part Number: 501-3000-002 X70002e4-0006891
Power-up test codes: 00000000 00000000 00000000 00000000
Diagnostic data: 00000000 00000000 ffffffff ffffffff
                  00000000 ff006000
```


CHAPTER 5

SMARTSTACK ETHERNET ELS10-27 DIAGNOSTICS AND TROUBLESHOOTING

The SmartSTACK Ethernet ELS10-27 incorporates built-in diagnostic and testing capabilities which are convenient to use and cause minimal or no disruption to the rest of the operational network. These capabilities are effective for isolating problems within the SmartSTACK Ethernet ELS10-27 unit. Built-in diagnostic capabilities include:

- System-wide power-up diagnostics, which are run every time the system is powered up or reset.

5.1 POWER-UP DIAGNOSTICS

The SmartSTACK Ethernet ELS10-27 performs an extensive set of diagnostic self-tests whenever any of the following events occur:

- Power-up
- Resetting using the front panel Reset Button (a hard reset)
- Reset via the NMS (a soft reset)
- Reboot Command through LCM

The power-up diagnostics test processors, memory, and other critical hardware components of the SmartSTACK Ethernet ELS10-27. All diagnostic software is stored in non-volatile memory.

5.1.1 Power-up LED Sequence

When you power-up the SmartSTACK Ethernet ELS10-27, the following occurs:

1. Power LED is ON.
2. CPU LED comes on.
3. Segment Status LED's Sequence as Initialize Progresses.
4. All Segment Status LEDs remain on.
5. All remaining LEDs turn on for several seconds.
6. All LEDs turn OFF, leaving the PWR and CPU LEDs ON.

7. In addition, the Port Link LEDs will turn on for those ports with good links and the Segment Status LEDs will turn on (or flash) when the selected status condition is present.

Note: *If a critical component fails diagnostics, the CPU LED will turn off and the SmartSTACK Ethernet ELS10-27 will attempt to reboot. If the CPU LED does not stay on, contact Cabletron Systems Global Call Center. Refer to Section 1.2.*

5.1.2 Specific Power-up Tests

The power-up diagnostic tests performed on the SmartSTACK Ethernet ELS10-27 include:

- Flash Boot sector Checksum Test.
- Instruction and Data Memory Tests.
- Main FLASH Checksum Test.
- Ethernet Loopback Test, internally to the PHY.

5.1.3 Power-up Diagnostics Results

After completion of the power-up diagnostic sequence, both the Power (Pwr) and CPU LEDs located on the front panel of the SmartSTACK Ethernet ELS10-27 should be on.

5.2 RESPONSES TO FAILURES AT POWER-UP

How the SmartSTACK Ethernet ELS10-27 responds to failures detected during power-up depends on the seriousness of the failure. For example, it will operate if a non-critical component, such as the out-of-band management port, fails diagnostics. However, in the event of a critical failure, such as a failure of the Microprocessor or Flash Boot Sector Checksum, the SmartSTACK Ethernet ELS10-27 will halt execution and will not become operational. In the event of a Main Flash Checksum failure, the SmartSTACK Ethernet ELS10-27 will attempt to Bootp/TFTP a new image into the unit.

5.3 STATUS AND ACTIVITY INDICATORS

The front panel of the SmartSTACK Ethernet ELS10-27 includes LEDs that indicate the status or activity of various system components. Figure 5-1 shows the SmartSTACK Ethernet ELS10-27 front panel LEDs and buttons. The LEDs and buttons are described in Tables 5-1 and 5-2.

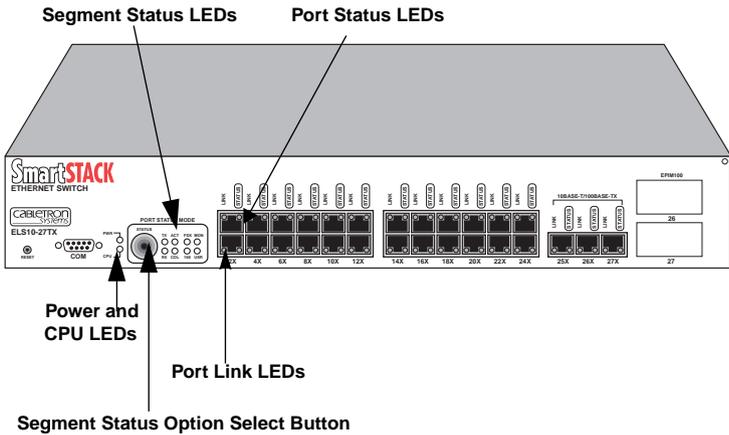


Figure 5-1. SmartSTACK Ethernet ELS10-27 Front Panel LEDs

Table 5-1 describes the SmartSTACK Ethernet ELS10-27 LEDs.

Table 5-1. Meaning of SmartSTACK Ethernet ELS10-27 LEDs

LED	Meaning
Port Status Mode TX RX ACT COL FDX 100 MON USR	On – Indicates port is transmitting a packet. On – Indicates port is receiving a packet. On – Indicates port is transmitting or receiving. On – Indicates a collision on a port. On – Port is operating in Full Duplex. Off – Port is operating in Half Duplex. On – Autonegotiation status, port operating at 100 Mbps. Off – Port operating at 10 Mbps. On – Indicates the port is copying to the monitor port. On – Indicates that errored packets were received.
Link (Individual Ports)	On – Indicates the link is good. Off – Indicates there is no link.
Status (Individual Ports)	On/Blinking – Indicates you are monitoring the port for a selected segment status condition. This LED always indicates one of the status modes.

Table 5-2 describes the SmartSTACK Ethernet ELS10-27 buttons.

Table 5-2. Description of SmartSTACK Ethernet ELS10-27 Buttons

Button	Function
Status	Cycles through the Segment Status options (TX, RX, Act, Col, and Usr) for all ports. The lower port status LEDs of the ports you are monitoring are activated based on what function you chose with the Select button.
Reset	Restarts the SmartSTACK Ethernet ELS10-27.

5.4 TROUBLESHOOTING

This section lists several situations that could happen while using the SmartSTACK Ethernet ELS10-27, and suggests appropriate action. Because every situation is potentially unique, the corrective actions suggested here should be considered as guidelines only.

5.5 SMARTSTACK ETHERNET ELS10-27 DOES NOT POWER UP

If your SmartSTACK Ethernet ELS10-27 does not power up, check each one of the following:

- Make sure the power source is operational.
- Make sure the power cord is securely connected.

If the SmartSTACK Ethernet ELS10-27 still does not power up, contact Cabletron Systems. Refer to Section 1.2 for more information.

5.5.1 Connectivity Problems

- Check for LED abnormalities.
- Check port status using LCM.
- Check for loose port connections.
- Check to see if the number of carrier losses is increasing using LCM. This indicates that the connection is suspect.
- Check to see if the number of total collisions has dramatically increased using LCM.

5.5.2 SmartSTACK Ethernet ELS10-27 Has Rebooted

- Use the LCM `ident` command to check the SmartSTACK Ethernet ELS10-27 diagnostic codes, and call your authorized Cabletron Systems representative.

5.5.3 SmartSTACK Ethernet ELS10-27 Does Not Respond to NMS

- Check the port status using LCM.
- Check to see if the Spanning Tree topology is stable using LCM.
- Check that a pathway to the SmartSTACK Ethernet ELS10-27 exists.
- Verify the SmartSTACK Ethernet ELS10-27's IP address using LCM.

APPENDIX A

TECHNICAL SPECIFICATIONS

A.1 SMARTSTACK ETHERNET ELS10-27 SPECIFICATIONS

Physical

Height	1.75 in (4.45 cm)
Width	17 in (43.18 cm)
Depth	15.75 in (40 cm)
Weight	9 lb (4.1 kg)
Installation options	Tabletop or rack-mount

Electrical

Input voltage	Auto-ranging from 100-120, 200-240 Vac
Frequency	50/60 Hz
AC power consumption	80 watts

Connector Ports

- 24 RJ45 Ethernet ports (MDI-X)
- 3 RJ45 Fast Ethernet port
- 1 RS232C port for Local Console Manager (LCM)
- 2 slots for optional Ethernet Port Interface Module

Environmental Requirements

Operating temperature	5° to 40° C (41° to 104° F)
Storage temperature	-30° to 73° C (-22° to 164° F)
Operating relative humidity	5% to 90% (non-condensing)

Diagnostic LEDs

Individual port link status

Individual port segment status

Segment status, specifying:

- Transmit activity
- Receive activity
- Both Transmit and Receive activity
- Collision
- 100 (Mbps)
- Duplex
- MON (monitor)
- User-defined

CPU

Power (Pwr)

Standard Support

- IEEE 802.1 Part D
- IEEE 802.1Q
- IEEE802.2 (Logical Link Control)
- IEEE 802.3 (CSMA/CD, 10BASE-T) Ethernet
- Transparent Bridging with Spanning Tree
- Ethernet Version 2
- EIA RS232C (DTE-to-DCE Interface Specification)
- EIA RS-310-C (Rack-mount Specification)

Address Table Size

2048 users available, minus those in use by the system.

Management Support

- MIB II, 802.1d, 802.3, and Cabletron Enterprise MIB
- Cabletron Systems Local Console Manager (LCM)
- Any SNMP-based network management system

Regulatory Compliance

Safety

This equipment meets the safety requirements of UL 1950, CSA C22.2 No. 950, EN 60950, IEC 950, and 73/23/EEC

Electromagnetic Compatibility

This equipment meets the requirements of FCC Part 15, EN 55022, EN 50082-1, 89/336/EEC CSA C108.8, VCCI V-3, AS/NZS 3548

A.2 SERIAL CABLE PIN ASSIGNMENTS

For a PC running a Windows terminal connected to the RS232C Network Management Port on the front panel of the SmartSTACK Ethernet ELS10-27, the following serial cable pin assignments (tables A-1 and A-2) are required to manage the SmartSTACK Ethernet ELS10-27 using the Local Console Manager (LCM).

Table A-1. DB25 Pin Assignments

SmartSTACK Ethernet ELS10-27 RJ45 (female)	DB25-pin (female)
Pin 1 (Tx)	Pin 3
Pin 4 (Rx)	Pin 2
Pin 5 (GND)	Pin 7

Table A-2. DB9 Pin Assignments

SmartSTACK Ethernet ELS10-27 RJ45 (female)	DB9 pin (female)
Pin 1 (Rx)	Pin 2
Pin 4 (Tx)	Pin 3
Pin 5 (GND)	Pin 5

A.3 10BASE-T PIN ASSIGNMENTS

An Ethernet twisted-pair link segment requires two pairs of wires. Each wire pair is identified by solid and striped colored wires. For example, one wire in the pair might be red and the other wire, red with white stripes.

Connectors

Refer to the diagram below and note how the pins are numbered. Be sure to hold the connectors in the same orientation when connecting the wires to the pins.

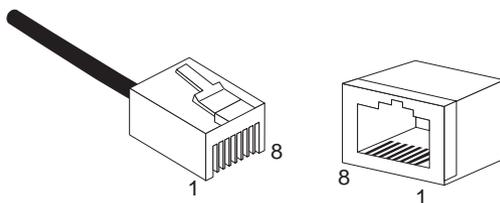


Figure A-1. Connector Pin Numbers

Each twisted-pair link segment must have a male connector attached to both ends. According to the 10BASE-T specification, pins 1 and 2 on the connector are used for receiving data; pins 3 and 6 are used for transmitting data, as shown in Table A-3.

Table A-3. 10BASE-T Pin Assignments

Pin	Assignment ^a
1	Rx+
2	Rx-
3	Tx+
6	Tx-

a. The “+” and “-” signs are used to represent the polarity of the two wires that make up each wire pair.

A.4 STRAIGHT-THROUGH WIRING

If the twisted-pair link segment is to join two ports on a switch, and only one of the ports has an internal crossover, the two pairs of wires must be straight-through, as shown in Table A-4.

Table A-4. Straight-Through RJ45 Pin Assignments

SmartSTACK Ethernet ELS10-27 (Crossed)	Device (Not Crossed)
1 (Rx+)	1 (Tx+)
2 (Rx-)	2 (Tx-)
3 (Tx+)	3 (Rx+)
6 (Tx-)	6 (Rx-)

A.5 CROSSOVER WIRING

Two SmartSTACK Ethernet ELS10-27s can communicate only if the transmitter on one unit is connected to the receiver on the other unit. This reversal, or crossover function, can be implemented either in the wiring or in the device itself. When connecting SmartSTACK Ethernet ELS10-27s, a crossover must be implemented in the wiring. Refer to Table A-5 for crossover pin assignments.

Table A-5. Crossover RJ45 Pin Assignments

SmartSTACK Ethernet ELS10-27	SmartSTACK Ethernet ELS10-27
1 (Rx+)	3 (Tx+)
2 (Rx-)	6 (Tx-)
3 (Tx+)	1 (Rx+)
6 (Tx-)	2 (Rx-)

A.6 5 - 4 - 3 RULE

Between any two nodes (i.e., PCs or other stations) on the network, there can be:

- Up to five segments in series.
- Up to four repeaters or multi-port hubs.
- Up to three populated segments (that is, segments attached to two or more PCs). The remaining two segments are unpopulated; these are known as inter-repeater links or IRLs. This distinction between populated and unpopulated segments is significant for coax networks only.

Note: This rule is completely consistent with the IEEE 802.3 specification, and is meant only to summarize the configuration specification.

A.7 EPIM-100FX

The EPIM-100FX shown in Figure E-2 supports Multimode Fiber Optic cabling. The EPIM-100FX is equipped with an SC style connector. Specifications for the EPIM-100FX are listed in Table E-3.

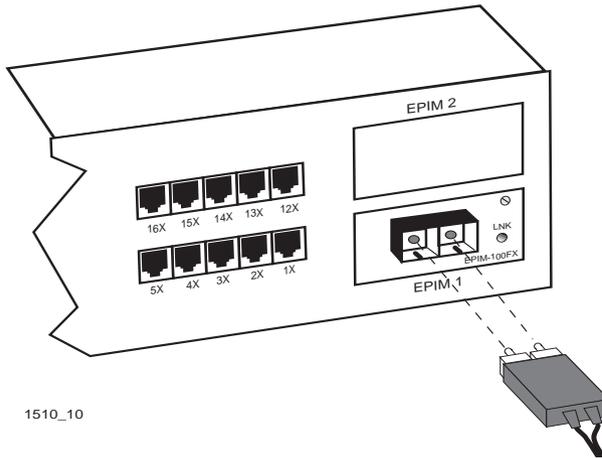


Figure E-2 EPIM-100FX

Table E-3 Transmitter Power (EPIM-100FX)

Cable Type	Worst Case Budget	Typical Budget
50/125 μm fiber optic	6.0 dB	9.0 dB
62.5/125 μm fiber optic	9.0 dB	12.0 dB
100/140 μm fiber optic	15.0 dB	18.0 dB

The transmitter power levels listed above are peak power levels after optical overshoot. A peak power meter must be used to correctly compare the values given above to those measured on any particular port. If power levels are being measured with an average power meter, add 3 dBm to the measurement to compare the measured values to the values listed above.

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