Allied Telesyn International

CentreCOM

AT-4016TR
AT-4016F
AT-TS95TR

Ethernet Switch
with ATM Access

AT-S13
AT-S14
AT-S16

Release 2.2
Operations Manual

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Preface

Background

This document represents a discussion of the software operating systems of Allied Telesyn International's (ATI's) *AT-4016TR (or AT-4016F) Ethernet Switch With ATM Access* which uses the optional AT-S13 or AT-S14 PCMCIA Firmware Card (Version 2.2) and the *AT-TS95TR TurboStack Switch With ATM Access and Management* which uses the optional AT-S16 Firmware Cassette (Version 2.2).

NOTE

Differences between the AT-S13 and AT-S14 PCMCIA Firmware Cards are solely based upon the type of chip-set which is used on the mother board. That is, the AT-S13 has been designed to address a Fujitsu chip whereas the AT-S14 was designed to address a NEC ship. *They are not interchangeable.* Therefore, you are reminded to only use the PCMCIA Firmware Card which accompanies the switch.

This manual assumes that you, the user, are familiar with the fundamentals of Asynchronous Transfer Mode (ATM) technology as well as the operation of Ethernet switches. If you are unsure about some of the features included in this document, we refer you to the reference documentation noted in this preface under the subheading "Related Documentation."

We have included the latest available information on ATM Forum UNI 3.0, Switched Virtual Circuits, Q.2931 Signaling and ATM Forum LANE Specification 1.0.

On the other hand, standards for electronic networks in general, and ATM standards in particular, are in transition. They have changed. They are presently changing. They will certainly change in the immediate future. In short, while our criteria is valid as of the date of this publication, this arena of technology is so dynamic that you are cautioned to seek other sources for the latest standards.

Additionally, since you will be implementing LAN Emulation, additional equipment and software must be purchased separately. That is, this software has been engineered to work in conjunction with LANE services. The features of this switch will not be entirely functional without it.

Contents

The contents of each chapter are described below.

- Chapter 1, “Product Description” introduces an overview of functions and features.
- Chapter 2, “Getting Started” describes how an experienced user can quickly and easily configure an ATM network.
- Chapter 3, “Ethernet Administration” tells you how to use ATI’s Omega management Ethernet software.
- Chapter 4, “ATM Administration” tells you how to configure, monitor and manage an ATM network.
- Chapter 5, “Spanning Tree Protocol” tells you how to configure, monitor and manage a Spanning Tree Protocol algorithm.
- Chapter 6, “Software” describes several methodologies for subsequent software support.

Document Conventions

The following conventions are used in presenting information in this manual:

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

```
Current Number of Learned Addresses: 133
Number of Defined Filters: 4
```

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

```
AT-4016TR >status
```

Information that you *need to enter with a command* is enclosed in angle brackets < >. For example, you must enter a port number and an IP address to execute the `ipaddr <port #> <IP address>` command. Note that the IP address shown below is for illustration only and not meant to represent your actual IP address.

```
AT-4016TR <ipaddr 6 192.138.217.40>
```

Field value options appear in bold typeface. For example, an AT-4016TR filter can be either **Entry** or **Exit**.

NOTE

A note provides additional information about, or possible consequence of, a specific action you can perform.

Related Documentation

You may find the following networking reference material helpful:

- *Internetworking with TCP/IP: Principles, Protocols, and Architecture* (2nd edition), Volumes I and II, Douglas Comer, Prentice Hall © 1991.
- *Interconnections, Bridges and Routers,* Radia Perlman, Addison Wesley © 1992.
- *The Simple Book, An Introduction to Management of TCP/IP-based internets,* Marshall T. Rose, Prentice Hall © Second Edition, 1994.
- ATM Forum contributions are only available to Principal Members of the ATM Forum although published Forum specifications are available for purchase. Call the ATM Forum at 415.578.6860, fax server at 415.525.0182, or send e-mail to *af-info@atmforum.com* for details about ATM Forum membership.
- UNI 3.0 and UNI 3.1 specifications are published by Prentice Hall and available at technical bookstores.
- Internet RFCs can be obtained through anonymous FTP or e-mail to *rfc-info@ISI.EDU* with the message: *help: ways_to_get_rfcs*
- Internet drafts are available by anonymous FTP. Internet draft directories are located at:
  - US East Coast: *ds.internic.net*
  - US West Coast: *ftp.isi.edu*
  - Europe: *nic.nordu.net*
  - Pacific Rim: *nunnari.oz.au*
- ATM documentation is also available through Phillips Publishing International: 301.424.3700 or 703.281.1135

Contacting ATI Technical Support

Problems? Questions can be directed to ATI's Technical Support staff by:

- Telephone
- Bulletin board services
- Electronic mail via the Internet
- CompuServe forum
- World Wide Web

When you contact Technical Support, you should have the following information available:

- Firmware Revision number
- Complete description of the problem including any observed errors
- Complete configuration information
- Serial number of your switch
- Power-up and/or diagnostic test codes, *if any*

Phone Numbers

Commercial telephone service is available Monday through Friday from 5:00 AM to 5:00 PM PST:

1-800-428-4835
(North America)

The fax number is:

206-481-3790

For telephone numbers outside of the United States and Canada, contact your reseller or regional ATI office.

Bulletin Board Services

A bulletin board is available. The number is:

206-483-7979

Modem settings for the bulletin board are: 8 bits; no parity; 1 stop bit.

The process is straightforward: Once the BBS is accessed, it requests that you register either as a new user or as a current user. It then provides instructions on the various features and functions available. This is followed by a list and description of all available technical notes and files that can be downloaded.

Internet Mail

You can send electronic mail via the Internet to:

tech_support@centre.com

CompuServe Forum

ATI has a forum on CompuServe. You can reach us by typing **`GO ALLIED`** at the CompuServe prompt (!).

FTP Server

Allied Telesyn has Internet access to an FTP Server in Bothell, WA., for driver and Readme files on our adapter cards and managed products. The server can be accessed through your Internet connection as follows (note — use lower case letters):

Address	gateway.centre.com [lowercase letters]
Login	anonymous [lowercase letters]
Password	your e-mail address [requested by the server when you login]

World Wide Web

You can access Allied Telesyn at our new Web Site using the following:

http://www.alliedtelesyn.com

Chapter 1

Product Description

Overview

Welcome to Allied Telesyn International!

Allied Telesyn's *AT-4016TR Ethernet Switch With ATM Access, AT-4016F Ethernet Switch With ATM Access* and *AT-TS95TR TurboStack Switch With ATM Access and Management* are all Ethernet-to-Ethernet and Ethernet-to-ATM switches. All support 10 Mbps of *dedicated* bandwidth on 16 (AT-4016TR and AT-4016F) or 8 (AT-TS95TR) IEEE 802.3 Ethernet ports. Further, all support a 155 Mbps Asynchronous Transfer Mode (ATM) port for connectivity to an ATM switch.

The release of system software Version 2.2 (or greater) supports bridging between Ethernet and ATM using Switched Virtual Circuits (SVCs). Besides bridging, your switch provides an Emulated LAN (ELAN) capability which, through a Lan Emulation Configuration Server (LECS), allows you to group all Ethernet devices in your switch — as well as additional switches — as if you are in the same physical LAN.

As stated in the Preface, both switches are almost identical in form and function. The differences are primarily physical. The following table summarizes these differences.

Table 2: AT-S13/AT-S14 and AT-S16 Differences

AT-4016TR/AT-4016F	AT-TS95TR
AT-S13/AT-S14 PCMCIA Firmware Card	AT-S16 Flash EPROM Cassette
16 10Base-T or Fiber Optic ports	8 10Base-T ports
No backplane	6-port segmented backplane
ATM media port is in back	ATM media port is in front

Features

The following features are fully implemented:

- An Ethernet switch combined with ATM connectivity
- User defined emulated LAN support (up to 64 ELANs) either by port or MAC address
- Software upgrading and downloading using TFTP or the optional PCMCIA Firmware Card (AT-S13 and AT-S14) for the AT-4016TR as well as the AT-4016F/SC and the AT-4016F/ST
- Software upgrading and downloading using TFTP or the optional Firmware Cassette (AT-S16) for the AT-TS95TR
- Simple Network Management Protocol (SNMP) support
- Switched Virtual Circuit (SVC) and Q.2931 capabilities
- Lan Emulation Client (LEC) ATM Forum compliance
- ATM Forum Interim Local Management Interface (ILMI)
- ATI's Omega local software management through Telnet or a serial connection to a RS232C port
- Omega management for high-level features such as administration, statistics, status and security
- Support For Up To 2,048 Media Access Control (MAC) Addresses

ATI's Solution

If your LAN is reaching the limit of it's bandwidth capacity, then transition your legacy, shared-media traffic, to a switched 10 Mbps network. Then, by introducing ATM functionality to connect that same traffic to a server or backbone (up to theoretically 155 Mbps in this case), bottlenecks will be mitigated.

This value-effective approach enables you to only "upgrade" devices that actually need the increased bandwidth (like the server).

Finally, ATI's ATM switches are the first phase to meet both current and future needs of your expanding networks. These services will enhance the business environment for years to come.

Figure 1 shows the front panel of an AT-4016TR. It is presented as a review of the positioning of the relevant ports.

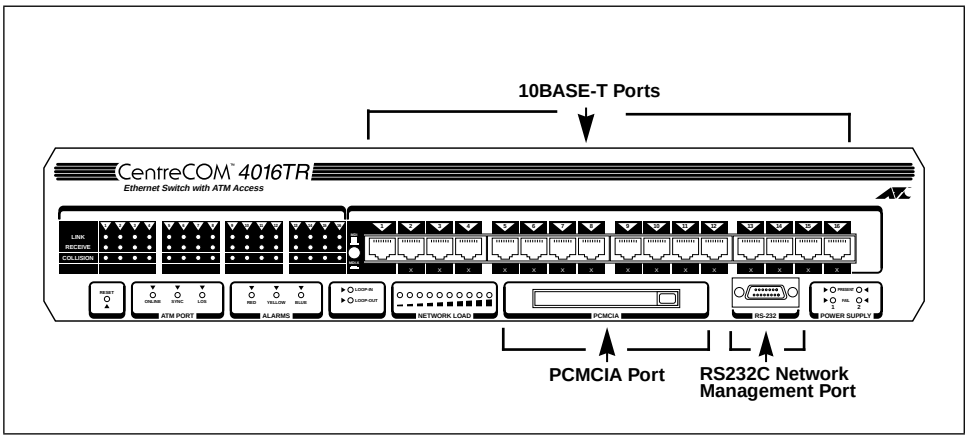


Figure 1: AT-4016TR Front Panel

Figure 2 shows the rear panel of an AT-4016F/SC with the optional dual, load-sharing, power supply installed.

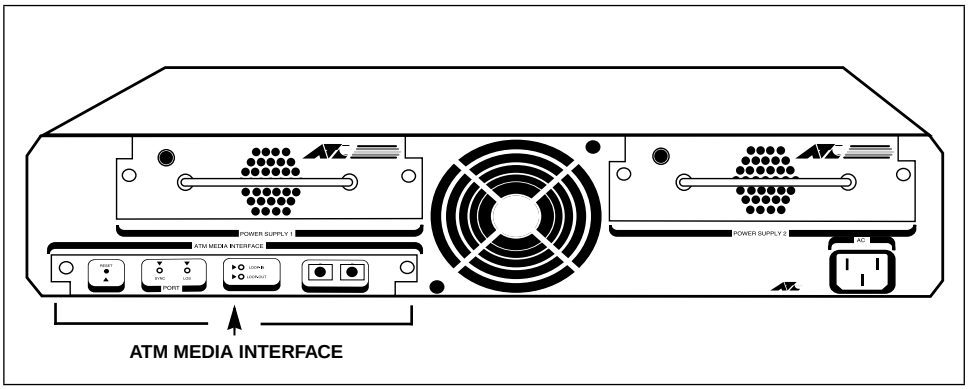


Figure 2: AT-4016F/SC Rear Panel

Figure 3 shows the front panel of an AT-TS95TR.

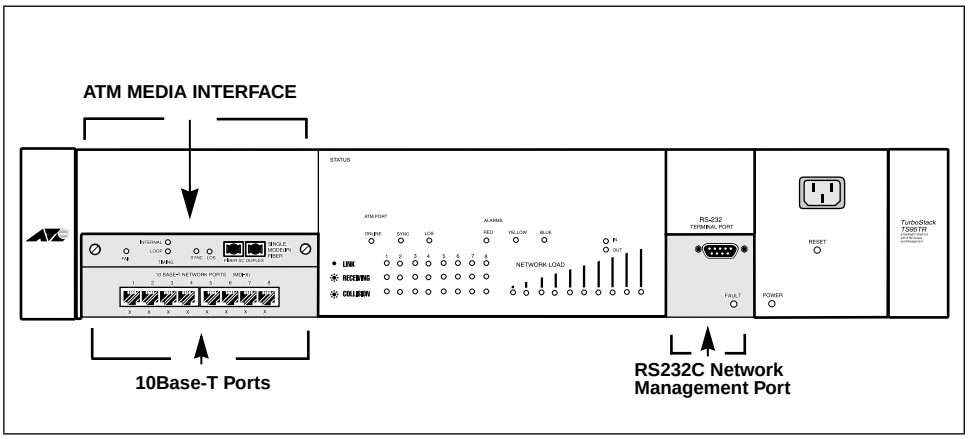


Figure 3: AT-TS95TR Front Panel

Figure 4 shows the rear panel of an AT-TS95TR.

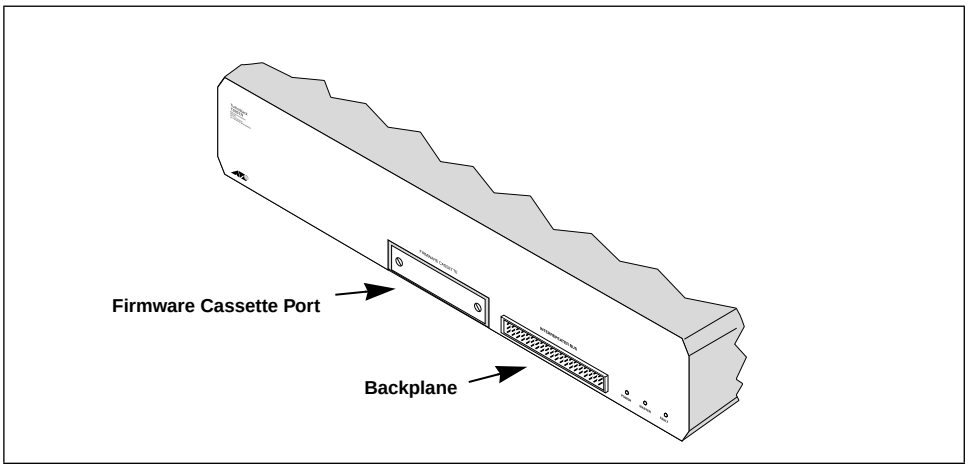


Figure 4: AT-TS95TR Rear Panel

Standards Compliance

The ATI implementation of LAN Emulation (LANE) services is compliant with the following existing standards:

- ATM Forum LAN Emulation specification version 1.0
- ATM Forum UNI specification version 3.0

Note that a full discussion of the interactive components of LANE can be found in Appendix B, LAN Emulation.

ATI's AT-4016TR, AT-4016F and AT-TS95TR also implement the following services to a connection oriented network:

- Simple Network Management Protocol
- Spanning Tree Protocol 802.1d
- Data encapsulation and transmission
- Address resolution
- Multicast group management

Management Information Base Protocols

The following Management Information Bases (MIBs) are supported. An expanded discussion of selected MIB support is provided in Appendix C.

- SNMP MIB2 (RFC 1213)
- Ethernet MIB (RFC 1643)
- Bridge MIB (RFC 1493)
- SNMP MIB2 (RFC 1573)
- ATM MIB (RFC 1695)
- ATM Forum ILMI MIB
- LANE Client MIB
- ATI Private MIB Extensions

LAN Emulation

In general, LAN Emulation allows you to define a network by the software configuration instead of rearranging physical cables.

ATI's LAN Emulation solution is based on ATM Forum LAN Emulation v.1.0. which consists of two parts: a LAN Emulation Client (LEC) and a LAN Emulation Service. That is, v.1.0 states that each network must include all LAN Emulation Services which, in turn, is composed of an LAN Emulation Configuration Server (LECS), a Lan Emulation Server (LES) and a Broadcast and Unknown Server (BUS).

In ATI's v.2.2 release, ELANs are created and managed by an LECS.

Virtual Circuits

ATM is a connection-oriented technology. This means that a call or virtual connection needs to be established between at least two stations before data can be transferred.

A Switched Virtual Circuit (SVC) automatically establishes this connection by signalling, a process similar to a telephone call involving call set-up, connection and disconnection. With SVC's, virtual channels are established and terminated for each session.

SVC is established by sending a call request message to the network. For example, Virtual Channel Connections (VCCs) between LE Clients and between an LE Client and LE Servers use SVCs — the connection is established when needed and disconnected when it is not.

The advantage of SVC's over Permanent (or Provisioned) Virtual Circuits (PVC's) is straightforward. SVC's permit a "logical" or non-dedicated "on demand" channel connection. A PVC is analogous to a leased or dedicated real circuit.

The bottom line is that SVC's permit dynamic networks using the LECS. They allow any device attached to the network to ask for connection — and permit the network to open connections on the fly — without manual intervention.

Interim Local Management Interface (ILMI)

There is a MIB in the User-Network Interface (UNI) specification, ILMI, which includes sufficient "managed objects" to allow you to control and configure ATM nodes and terminals. As you will recall, the UNI simply consists of ATM Forum-developed specifications which define the procedures and protocols between a user and the ATM network.

ILMI is a link-level management and configuration protocol defined across the UNI. It plays a vital role in the autoconfiguration of many ATM parameters including, in particular, ATM addresses. The address registration mechanisms of the ILMI allow ATM switches to allocate address prefixes to ATM end systems, while ATM end systems supply the ATM switch with their unique 48-bit MAC addresses.

Address Registration Using ILMI. One of the most useful features of ILMI is address registration. This means that your switch can automatically re-register its ATM addresses if the link goes down — and is reinstated. Without ILMI address registration, if a link goes down the switch will remove the addresses from its local Address Table.

The bottom line is that, with ILMI, you do not need to manually configure ATM end systems with ATM addresses. This is very significant, not only because ATM addresses are a very user-unfriendly 20 bytes of hexadecimal symbols but, just as importantly, they allow network administrators to control the allocation of addresses.

Two Modes Of Ethernet Switching

There are two popular methods to forward information: store-and-forward and cut-through. Although your switch employs store-and-forward as the default, you can also choose cut-through.

Store-and-forward

Store-and-forward means that your switch stores the entire packet and then forwards it.

Store-and-forward switching, performed at the MAC layer, allows your switch to temporarily store packets until network resources, typically a congested port, are available. Frames which are incorrect, an invalid CRC for example, are discarded. Store-and-forward switching, therefore, ensures data integrity, thus preventing network error conditions from being generated throughout the network.

Store-and-forward mode is implemented when packets are converted to cells on each ATM transmission.

Cut-through

In a cut-through system, the device starts to forward the incoming packet while the packet is still being received on the inbound link.

Cut-through switching requires software that can both look at the start of the packet and determine which outbound link is to be used to forward the packet. Cut-through does not check for errors before forwarding a packet.

Bridging

Your switch operates as a transparent bridge to the Ethernet ports. As such, it learns the source Media Access Control (MAC) addresses of all incoming packets and ages out devices which have not been heard from for either a user or the default-specified length of time.

The switch maintains a forwarding table with a maximum storage capacity of 2,048 MAC address. These Ethernet addresses are associated with all of the devices that have been detected recently.

Your switch checks all incoming packets from each port for their destination address against a Bridge Address Table. If a packet's destination address is not on the same network segment as the originating packet, the switch forwards the packet to the network segment associated with that destination address. However, if the packet's source and destination address are on the same network segment, known as local traffic, the packet is automatically discarded (ignored) or filtered.

Bridge Address Table

The switch creates and maintains a dynamic database of addresses which are stored in a Bridge Address Table. Port information entries in the Bridge Address Table are, in turn, used as a basis from which to compare and examine every packet to determine its source address, segment origin and port information.

If a packet's MAC address is not already stored in the Bridge Address Table, the switch adds the learned address, the associated port number and a timer value that indicates the age of the dynamic Bridge Address Table entry.

Consequently, the switch knows the address and associated port number the next time it sees that address. By using the information stored in the Bridge Address Table, the switch is able to quickly forward each packet to the correct port.

The switch learns addresses from all packets. When devices are added to the network, removed from it, or relocated, you do not have to reconfigure your switch. Your switch automatically learns all addresses.

An address stored in the Bridge Address Table is discarded if there is no activity from that address after a configured length of time (the default is five minutes). This aging process ensures that the Bridge Address Table is not only continually updated but only includes current entries.

Each entry which is automatically entered (a dynamic entry) includes:

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

Note that the procedure to assign a port number of the LAN for the above address is also contained in the LAN Emulation menu (Port to ELAN configuration screen).

Spanning Tree Protocol

The IEEE 802.1d Spanning Tree Protocol (STP) is both a configuration algorithm and a protocol. As it is fully presented in Chapter 5, you are referred to that discussion.

Chapter 2

Getting Started — The Basics

A *completely* functional ATM network requires the successful integration of several disparate units:

An AT-4016TR or AT-4016F Ethernet-to-ATM switch, *or*

An AT-TS95TR Ethernet-to-ATM switch

ATI's Omega management software which is provided

An optional ATM-to-ATM Switch

An optional ATM Configuration Server (LECS)

Getting started involves the following sequence:

1. *Omega management software.*

   Your switch is controlled by ATI's Omega management software through a terminal, a terminal emulator or a Telnet session.

2. *Unique information.*

   Each switch can be assigned a unique name, location and contact administrator.

3. *Password.*

   Password protection is available *if* network security is required. The default, of course, does not require a password.

4. *ATM configuration.*

   ATM connectivity requires ATM address coordination between your switch's ATM port and a seperate, optional ATM switch. This also requires the LECS to be configured.

Getting Started — Omega

ATI's Omega management software is pre-installed and immediately operational once power is applied. Configuring you network depends, however, upon the requirements of your particular environment.

Your switch can operate either standalone when the backbone port is *not* connected to an ATM network — or as an Ethernet switch/ATM Emulated LAN when the backbone port *is* connected to an ATM network and functioning.

Omega management enables you to access and configure your switch to ELANs through a network accessible LECS.

Omega Main Menu

Omega's **`Main`** menu enables you to access the submenus that are needed to configure your Ethernet and ATM network. Use the following information to access the **`Main`** menu:

1. Connect the serial port of your terminal or PC to the RS232 console port located on the front panel. For a PC connection, use a standard 9-pin serial cable.

2. Access your terminal either directly or through the terminal emulator program in Microsoft Windows.

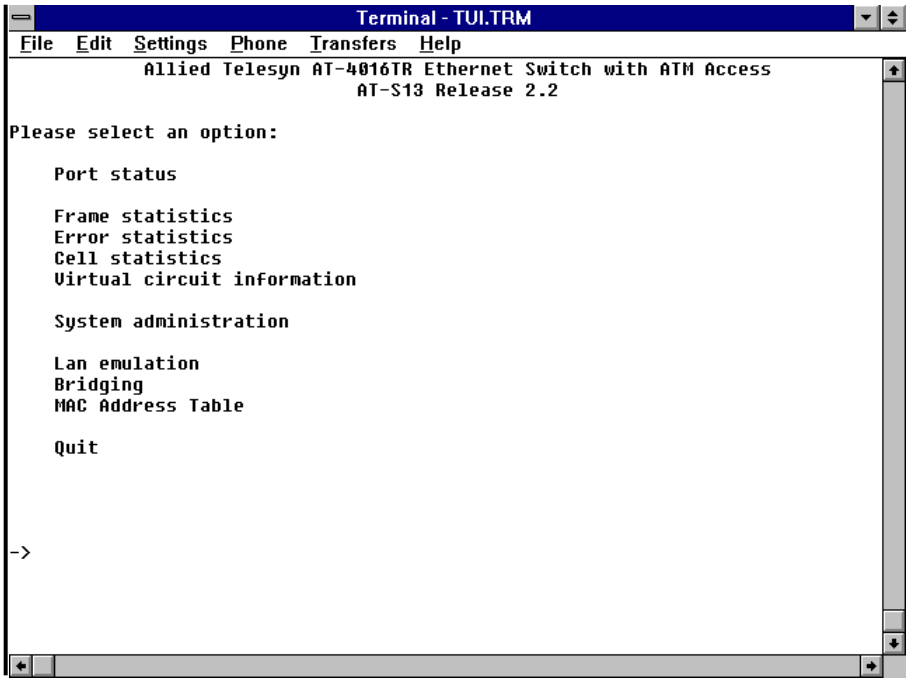
3. Press the **`<RETURN>`** key several times. This will ensure auto configuration of the appropriate baud rate.

NOTE

You do not need to configure Omega if your default terminal is as follows: Data bits: 8, Stop bits: 1, Parity: 0, Connector: Com1/Com2 (PC/terminal dependent)

AT-S13/AT-S14 Main Menu

The **Main** menu of an AT-4016TR switch is shown below.

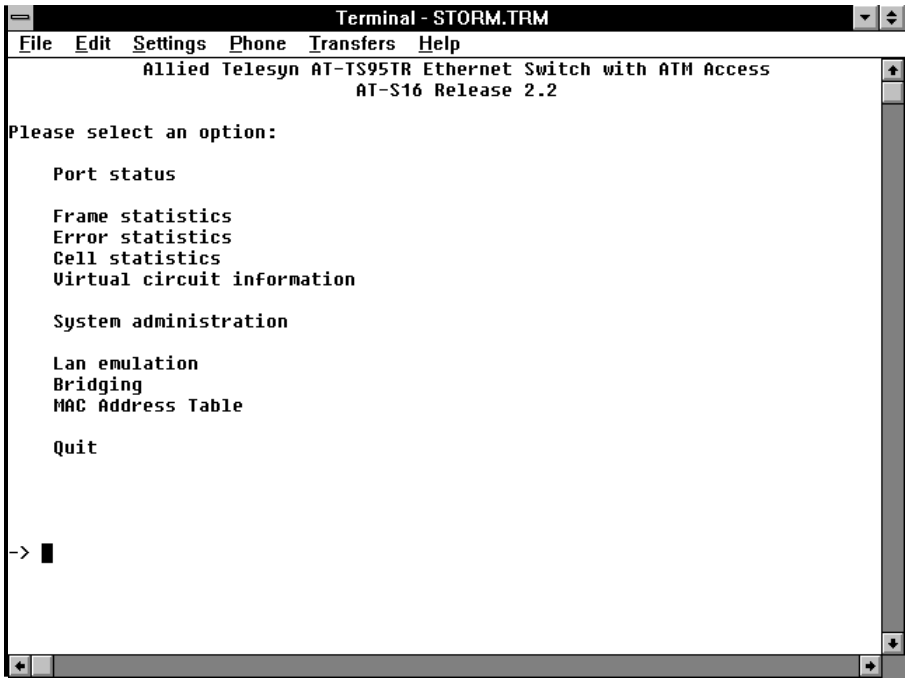


NOTE

The use of the Port, Frame and Error statistics submenus are specifically associated with Ethernet functionality and discussed in Chapter 3, Ethernet Administration. Since they are not used to actually configure an ELAN, they will not be presented here.

AT-S16 Main Menu

The AT-TS95TR **Main** menu is identical to the AT-4016TR except for the header. It is shown below.



Parameter Changes

The parameter changes listed below require the system to be reset before they are recognized.

Ethernet Parameters	ATM Parameters
Store and Forward	Sonet
Cut-Through	SDH
Collision is Indicated on Amber	Internal clocking LED
Transmit is Indicated on Amber	External (loop) clocking LED
	Unassigned cells idle cells
	LECS ATM Address Changed
	UNI 3.1 Signaling

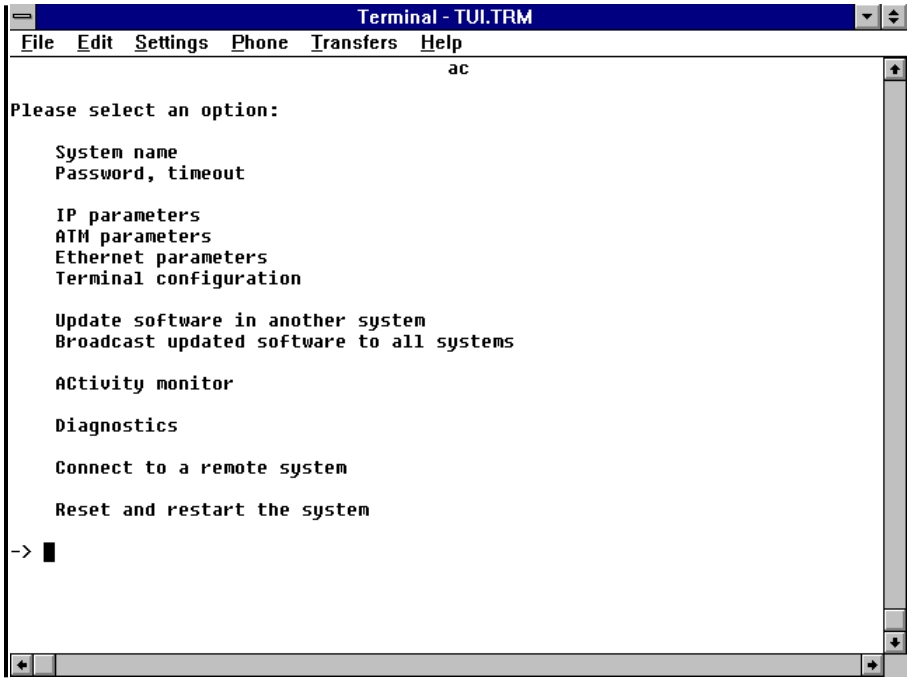
System Administration Menu

The following Omega Menu Map summarizes the functions that are available under the **`System Administration`** menu.

Table 3: Omega Menu Map

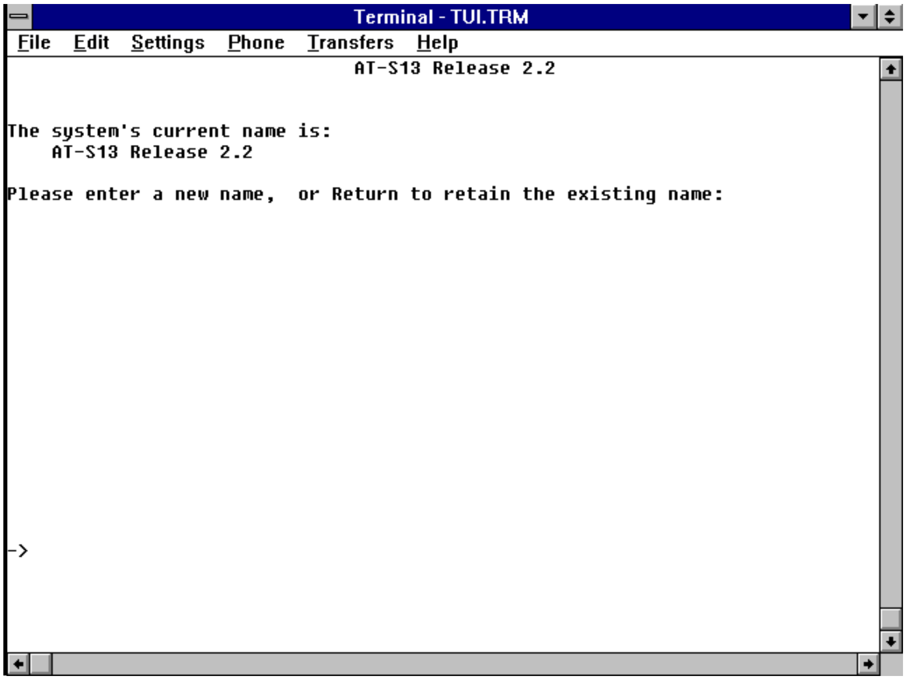
System Administration
System name
Password, timeout
IP parameters
Ip address
SUbnet mask
GAteway address
Manager address
Download Password
GEt community string
SEt community string
Trap community string
Location
Contact
ATM parameters
Framing
Clocking
Transmitter Idle
Sonet / SDH
INternal clocking / External (loop) clocking
Unassigned cells / IDle cells
Ethernet parameters
Store-and-Forward / Cut-Through
Collision is Indicated on Amber LED / Transmit is Indicated on Amber LED
Terminal configuration
ANSI - VT100-compatible / Generic “dumb” terminal / Custom terminal definition...
8 data bits / 7 data bits
1 stop bit / 2 stop bits
No parity / Odd parity / Even parity
Full duplex (echo) / Half duplex (no echo)
Data rate (“baud” rate)...
Update software in another system
Broadcast updated software to all systems
ACtivity monitor
Diagnostics
Connect to a Remote System
Reset and restart the system

From the Main menu, open Omega's **System Administration** submenu by entering the letter **S** from the **Main** Menu. The contents and features of this submenu are shown below.



System Name

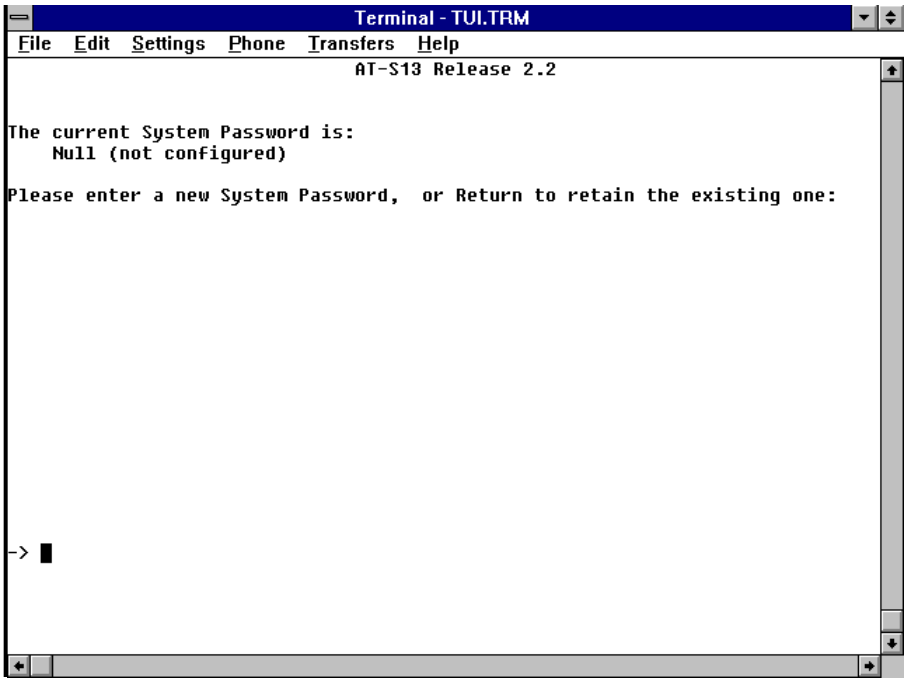
From the **System Administration** submenu, enter the letter **S** for **System name**. The following submenu can be used to enter or change the name of your switch.



You may enter a new name, up to 20 characters in length, or press **RETURN** to keep the existing symbolic name. To delete an existing name, enter one or more space characters (blanks) and then press **RETURN**.

Password, Timeout

To assign or change the password or timeout value, return to the **System Administration** submenu and enter the letter **P** for the **Password, timeout** submenu:



Password. Password protection restricts unauthorized access to Omega management. This is a very different type of password protection than "**Download Password**" which is found within the **IP parameters** submenu and discussed later.

If you choose to use password protection, the management agent prompts for the password when each new session begins.

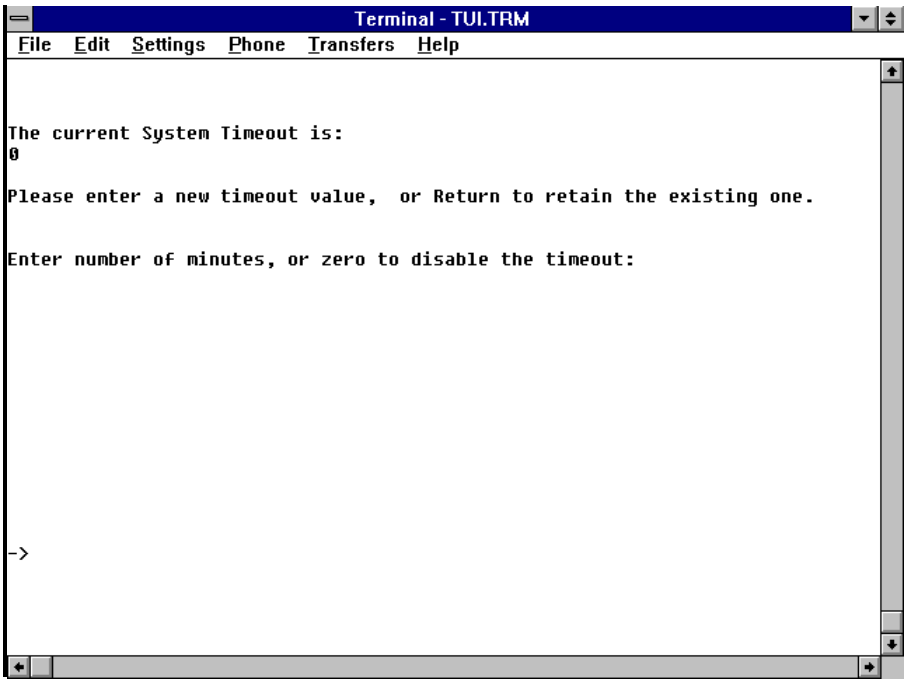
NOTE

The default does not have a password.

You may enter a new password, up to 32 characters in length, or just press **<RETURN>** to keep the existing password if there is one. (The screen does not display your password as you type it; a series of asterisks appears instead.)

To delete your current password, press the spacebar one or more times and then press **<RETURN>**.

Timeout. From the **Password** screen, press **<RETURN>** for the **Timeout** screen.



Timeout may be useful to avoid connection problems due to multiple sessions (for example, you may start a local session and not exit the system before attempting a Telnet session later).

Your switch allows one management session at a time. The **timeout** option will automatically end the session if there is no activity for the length of time you have specified (in minutes).

That is, if you have entered a value the **Activity Monitor** subscreen (accessed by entering the letters **AC** from the **System Administration** menu) will only run until the designated timeout time is reached. The default, Ø, disables the timeout function.

Remember, if your switch is in session there is no access to a new session until the present, active session is terminated.

A session may be terminated in any of three ways:

1. Timeout
2. Rebooting
3. Normal session termination using the Quit option.

IP Parameters Menu

You must choose a protocol for your network: Is it to be a TCP/IP or a nonTCP/IP network?

TCP/IP Network Management

If you have many geographically dispersed subnetworks, each connected to its own department concentrator, you may want to manage these multiple hubs remotely in a central-site configuration. In this case, TCP/IP network management may be optimum.

TCP/IP internet addresses consist of user assigned numbers which identify members of the network.

It normally consists of two fields: network number and host number. TCP/IP addresses are expressed in the form of a.b.c.d., where a,b,c and d are each in the 0-254 range. That is, it adheres to the following notation 192.136.118.3 for example.

NonTCP/IP Network Management

In a nonTCP/IP environment, all switches and devices can be identified by either any name convention of your choice (a switch name) or by a Media Access Control (MAC) address (also known as an Ethernet address) which has been assigned and integrated into each switch by the manufacturer. TCP/IP addresses are not required for local switch management.

To Configure a TCP/IP Address

You can configure an IP Address through the serial port of the switch and implementing Omega management or through a BootP server. The local installation of an IP address requires either a DOS terminal or a Terminal Emulator Program and serial cable.

Local Installation. Attach your device to the RS232 serial port. Enable Omega using either a DOS terminal or the terminal emulator program in Windows. Then enter a TCP/IP address for each device, the format for which was detailed above.

The appropriate TCP/IP configuration path proceeds through Omega's **`Main`** menu and **`System administration`** submenu to the option **`IP parameters`**. Once this destination is reached, enter the IP address.

Note that all switches have to be either configured with, or without, an IP address. They cannot be mixed! For example, a hub with an IP address will not respond to a **`Connect remote system`** query from a hub which does not have an IP address configured.

BootP

You may also use a BootP server to automatically configure TCP/IP parameters.

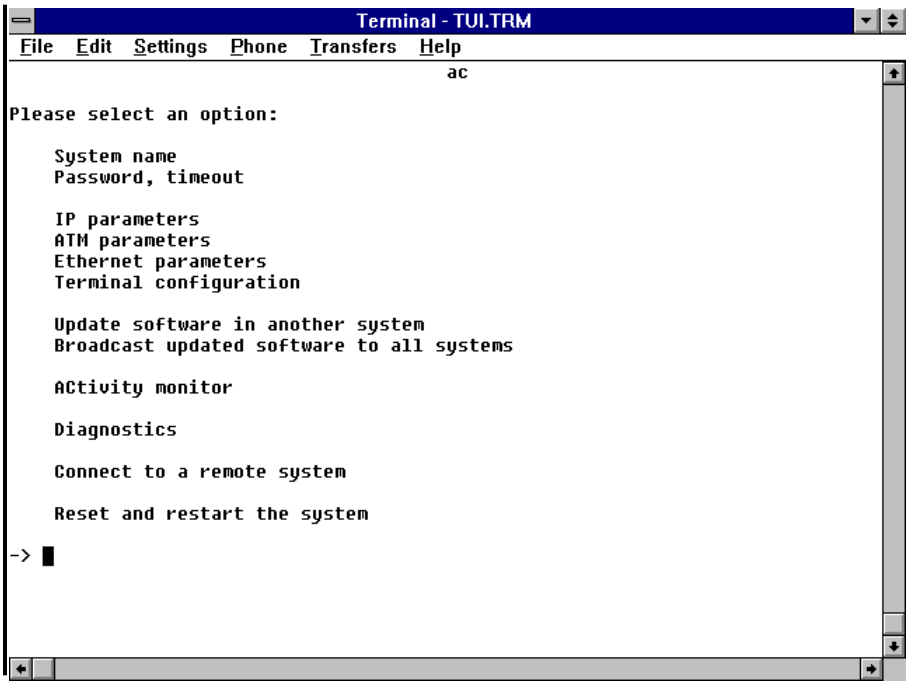
The process is straightforward, at start-up, if an IP address has *not* been configured, your hub will transmit a BootP request to your server approximately every three seconds until a response is received (up to a maximum of three request attempts).

If a BootP response is not received, the network will still operate using either a switch name or a MAC address.

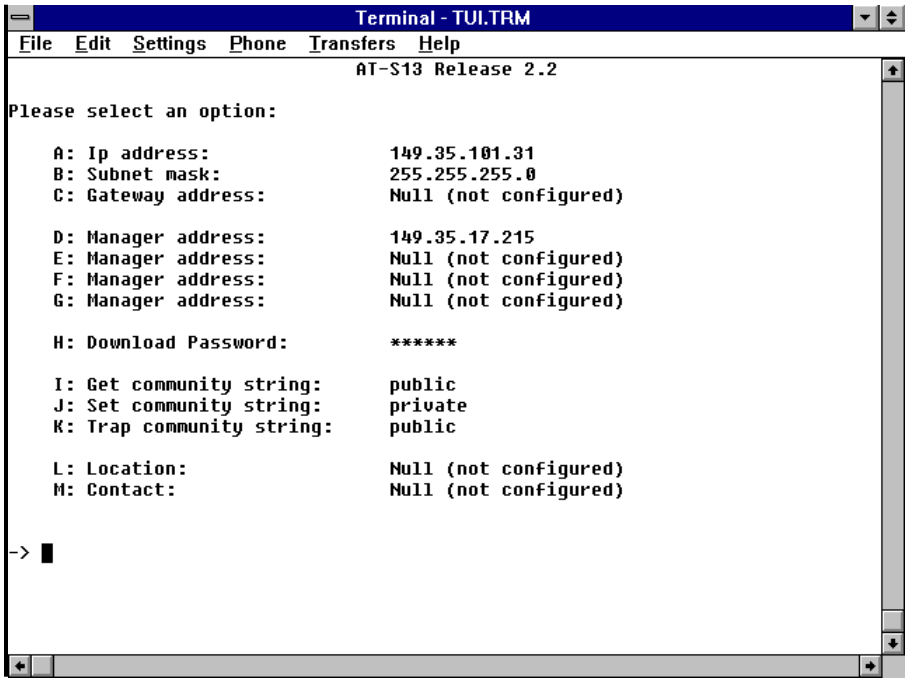
If a BootP response *is* received, then the IP address, Subnet Mask, and/or Gateway/Router address will be extracted from the response packet and used to configure the system until the next power-on/reset.

Although the BootP server file format differs from server to server, your switch nevertheless expect a response packet to contain an IP address, Subnet Mask and Gateway address.

From the **`Main`** menu, enter the letter **`S`** to reaccess the **`System administration`** submenu:



Enter the letter **I** for **IP parameters** to access the following submenu:



Choose those parameters you want to change by simply entering **A** for IP address, **B** for subnet mask, **C** for gateway address or **D** through **G** for manager addresses.

A minimal configuration requires only an IP address and Subnet mask.

NOTE

In an ATM nework environment, ensure that the Omega management workstation is connected to a port with the same ELAN as the management network port: either Port 9 for the AT-TS95TR or Port 17 for the AT-4016TR and AT-4016F. If it is not the same, you will lose contact with the switch via Telnet. If you lose contact, either Telnet in from a station on the management port's ELAN, or initiate an Omega local session and reassign the management station's port to be on the same ELAN as the network port. ELANs are discussed in Chapter 4 and Appendix B.

Setting an IP Address for Telnet

The **IP parameters** submenu can be used to set the IP address, Subnet mask and Gateway address for Telnet.

1. Set the Manager address in the IP submenu. Enter **D through G** for a selection of up to four manager addresses and enter the IP address of the SNMP management server. Press **RETURN** to save the new address.
2. Set the 'Get' community string. Enter **I** and the string value. Press **RETURN** to save the new value.
3. Set the 'Set' community string. Enter **J** and the string value. Then press **RETURN** to save the new value.
4. Set the 'Trap' community string. Enter **K** and the string value. Then press **RETURN** to save the new value.
5. Set the 'Location' string. Enter **l** and the string value. Then press **RETURN** to save the new value.
6. Set the 'Contact' string. Enter **c** and the string value. Then press **RETURN** to save the new value.

Press **<RETURN>** to save your configuration.

Download Password

Download password is a security device that can be used with TFTP commands to download software from your switch to other switches in your network. Download password is *not* associated with the password used for Omega management.

If you change the password, ensure that you configure the same download password for all of the switches that are to be downloaded. That is, the switch downloading the software and the switches receiving the software must use the same password. In short, when you use TFTP, the file name for the switch must be the same as the downloaded password.

The process is as follows: enter the password for the hubs to be downloaded. For example, if the current download password is ATS13 (all uppercase) then, upon entering the command **H**, you will be asked "Please enter a new string, or **<RETURN>** to retain the existing one."

Please refer to Appendix A for a discussion of TFTP and how the download password is used.

Chapter 3

Ethernet Administration

Accessing Omega

To start a session with the management agent, either:

1. Press the **<RETURN>** key twice on a PC connected to the RS232 port, or
2. If your switch has been assigned an IP address, use Telnet to access the management agent.

A session begins when either of the above events occur. Once in session, the management agent and the Statistical Database program are "locked" against other session requests. This prevents unwanted simultaneous access to the database.

If you have configured a password, the management agent will require it at the beginning of the session. If you have misplaced the password, you can unlock the management agent by inserting the optional AT-S13/AT-S14 PCMCIA card into the PCMCIA port on the AT-4016TR or AT-4016F or by inserting the optional AT-S16 Firmware Cassette into the appropriate port on the AT-TS95TR.

Selecting Menu Options

When in session, the management agent offers a series of menus. You may select from a variety of options to view statistics or control hub activities.

- If the options are numbered, type the appropriate number and press the **<RETURN>** key.
- If the options are not numbered, type enough of the option name to distinguish it from the other options (usually only the first letter). That is, type the letter(s) which are capitalized; e.g., P (for Port Status) or F (for Frame statistics).

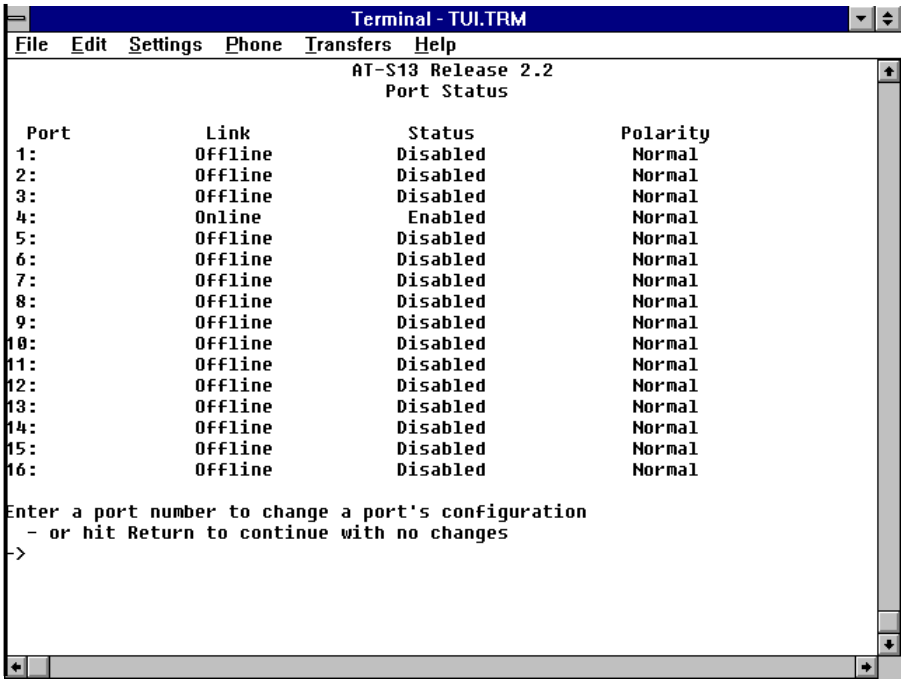
Except for Quit, choosing a menu usually leads to a submenu which, in turn, usually leads to yet another submenu.

You can make a choice from the present menu or return to the previous menu by pressing **<RETURN>** or **<ESC>**.

Some of the submenus cannot fit on a single screen. In this case follow the instructions on the screen to obtain additional information or to go to the next page.

AT-S13/AT-S14 Port Status Screen

Choose the AT-S13 (or AT-S14) **Port Status** submenu by entering the letter **P**. The system will then display the screen shown below.



This screen shows the status and configuration of each Ethernet port. At the top of the screen, you see the system name (if any). Each port is identified by number and name (if any). Note that the port name can be user-determined through the **Port Configuration** screen which is discussed later.

The columns provide the following information:

Port. The **Port** column shows each port number and its user-assigned name, if any.

Link. The **Link** column shows the status of each port's Link Integrity Test: either **Online** or **Offline**.

> **Online** indicates that IEEE 10Base-T standard Link Integrity pulses have been detected on this port.
>
> **Offline** indicates that Link Integrity pulses have not been detected. Either the device is not operational (powered down, etc.), or there is a physical problem with the wiring.
>
> "- -" indicates that Link Integrity Tests are not to be performed on this port — Link Test has been turned OFF by the management agent.

Status. The **Status** column basically shows whether the port participates, or does not participate, in the transmission and/or reception of frames or, more exactly, Bridge Protocol Data Units (BPDUs) which is defined as a data unit transmitted as part of the STP algorithm. The exchange of BPDUs allows bridges within a network to logically configure the network as a single spanning tree.

The state of each port governs the processing of frames received from the individual MAC entity associated with the port, the submission of frames to the MAC entity for transmission, and the possible inclusion of the port in the active topology of the bridged LAN.

Five possible states may be shown in the status column: **Enabled (**which includes **Blocking, Listening, Learning, Forwarding) and Disabled**

Enabled indicates a port that is currently forwarding frames — a ready (but not necessarily currently active) — port.

Blocking indicates a port that is NOT PARTICIPATING in forwarding packets thusly preventing the creation of multiple topology paths. A port enters the blocking state because it has received information that another bridge is the designated bridge for the LAN to which the port is attached. Received packets are discarded and packets are not submitted for transmission. Station locations are not added to the database.

Listening A port in this state is PREPARING TO PARTICIPATE in packet transmission but is temporarily disabled to prevent temporary loops. Learning is *disabled* since changes in the active topology may lead to incorrect information when the active topology becomes stable.

Received packets are discarded and packets are not submitted for transmission. Station location information *is not* added to the database

Learning indicates a port is PREPARING TO PARTICIPATE in frame relay but it is temporarily disabled in order to prevent temporary loops. Learning is *enabled* to allow information to be acquired prior to frame relay in order to reduce the number of frames unnecessarily relayed.

Received frames are discarded and frames are not submitted for transmission. Station location information *is* added to the database

Forwarding indicates a port that is PARTICIPATING in packet transmission. It is both forwarding and submitting packets. The learning process incorporates station location information into the filtering database.

Received BPDUs will be submitted for transmission. They will also be processed as required by the STP algorithm.

Disabled indicates a port that is NOT PARTICIPATING in packet transmission. Nor is it participating in the operation of the STP algorithm and protocol.

Received packets *are* discarded. Submitted packets *are not* forwarded for transmission.

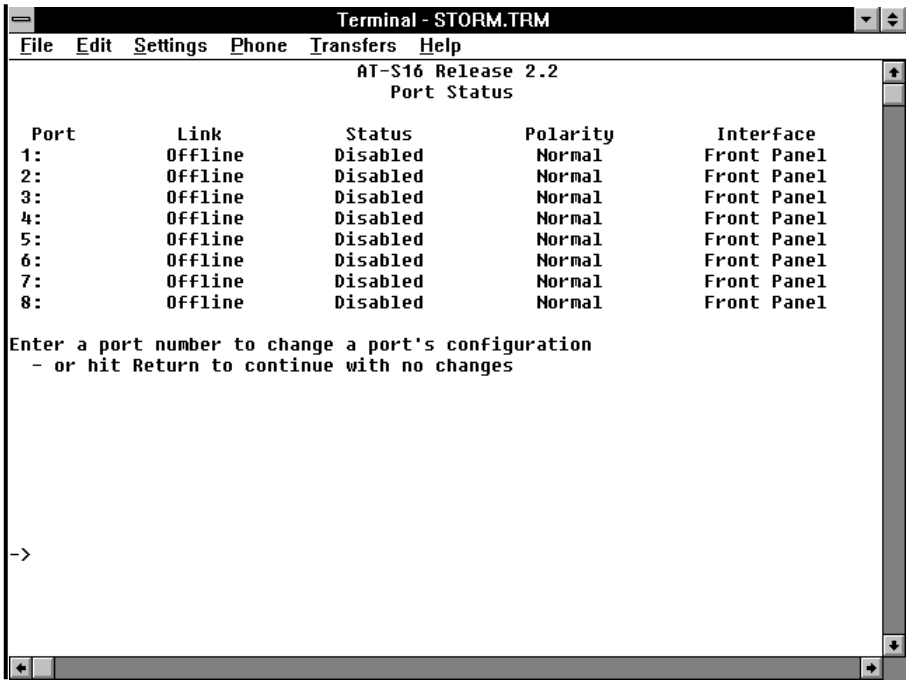
Polarity. The **Polarity** column shows the state of each UTP port's receive pair polarity: either **Normal** or **Reversed**.

Normal indicates correct polarity.

Reversed indicates incorrect polarity — software has detected that your wiring has been installed with reversed polarity. It has also subsequently corrected it. Operator intervention is not required.

AT-S16 Port Status Screen

Choose the AT-S16, AT-TS95TR, **Port Status** screen. Note that it only has eight (8) ports and includes an Interface column. The Port, Link, Status and Polarity columns are identical to the AT-S13/AT-S14 screen. Only the Interface column is added.



You can change any port's configuration by entering the port number then pressing **<Return>**. Pressing **<Return>** without entering a port number exits this dialog and returns you to the **Main** menu.

Interface. There are two options for this column: Backplane and Front Panel.

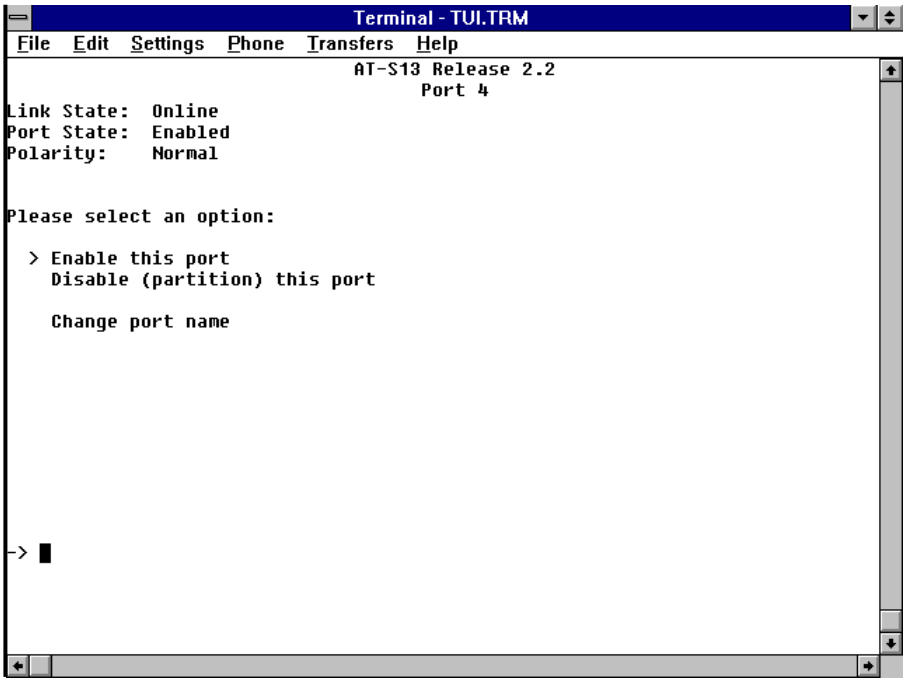
Backplane. Backplane would indicate that a port of the AT-TS95TR switch is connected via the TurboStack Segmented Backplane to a unit installed in the port that is indicated.

Front Panel. This is the default. In this state, the unit is connected to other units installed in the TurboStack via the Segmented Backplane unless there is also a connection to the AT-TS95TR switch via the front panel RJ-45 connector. If there is a front panel connection, *the connection made via the front panel takes over the port and any connection to the port via the TurboStack's Segmented Backplane is disconnected.*

The Changing Port Configuration screen allows you to modify the Management Software default configuration settings.

AT-S13/AT-S14 Port Configuration Screen

To change port information, enter a port number from the Port Status menu. The Port Configuration Menu for the AT-S13 appears. In this case, port #4 was selected.

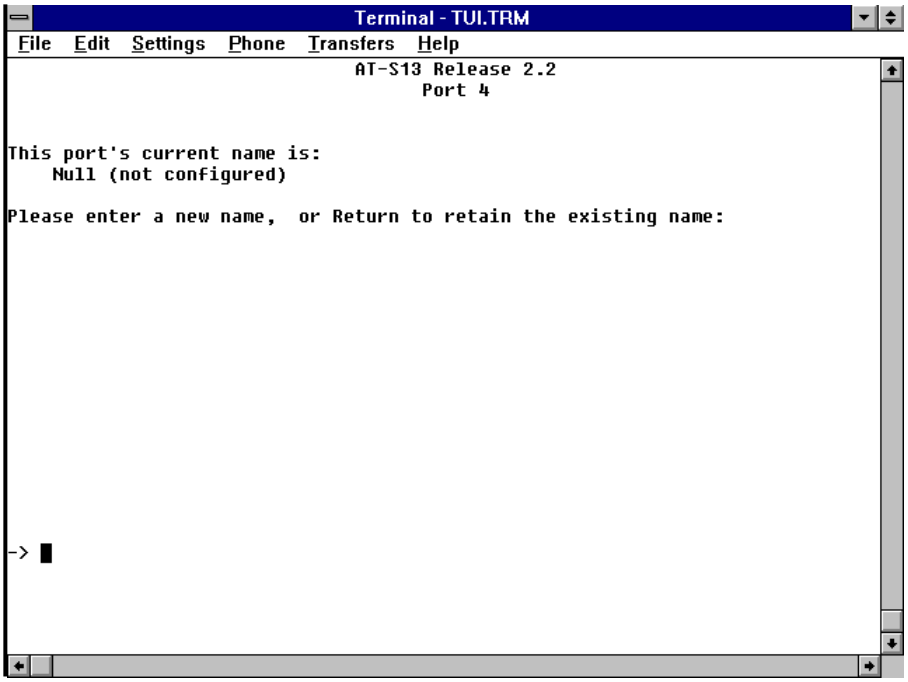


The system and port name appear at the top of the screen. Below that is the port's status and configuration. And, below that, you see several menu options.

The following configuration options are available:

Select an Option. Selecting **Enable** changes the port's state to allow it to transmit or receive data. Selecting **Disable** turns the port logically off, thus preventing port traffic.

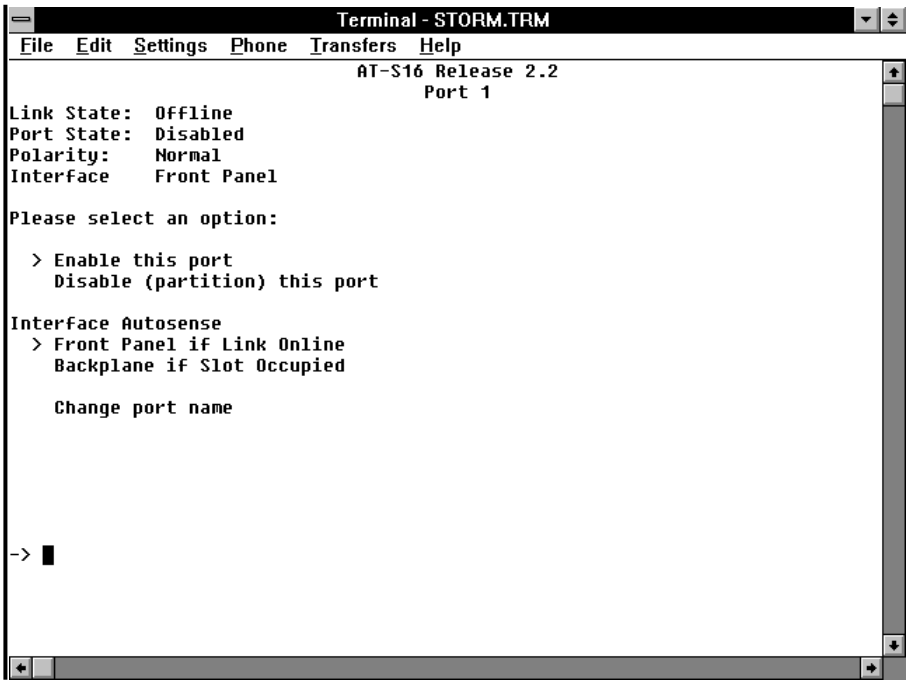
Change port name. The option **Change port name** allows you to specify a new symbolic name for the port or change an existing one. If selected, the following screen appears:



You can enter a new name for the port, up to 20 characters in length, or press **RETURN** to keep the existing name (if any). To delete an existing name, enter one or more space characters (blanks) and then press **RETURN**.

AT-S16 Port Configuration Screen

The Port Configuration Menu for the AT-S16 follows. It is identical to the AT-S13/AT-S14 screen except for the Interface feature. In this case, port #1 was selected.



Interface Autosense. Only one connection at a time may be made to any port in the AT-TS95TR switch. The first six ports (ports 1 through 6) have two possible connections: front Panel and Segmented Backplane. This potential conflict is resolved with Interface Autosense logic.

NOTE

10Base-T ports 7 and 8 are not connected to the Segmented Backplane. Therefore, they are not affected by the Interface Autosense setting. You may only make connection to these ports through their front panel RJ-45 connectors

Front Panel if Link Online. The default state, "Front Panel if Link Online," means the unit is connected to other units installed in the TurboStack via the segmented backplane — unless there is also a connection to the AT-TS95TR switch via the front panel RJ-45 connector. If there is a front panel connection, *the connection made via the front panel takes over the port and any connection to the port via the TurboStack's Segmented Backplane is disconnected.*

Backplane if Slot Occupied. This option reverses the logic such that the connections through the segmented backplane take precedence. Inserting a unit into the segmented backplane make connections to the port corresponding to the slot accessible only via the segmented backplane and *disconnect any connections made via the front panel to the corresponding front panel connection.*

Ethernet Parameters

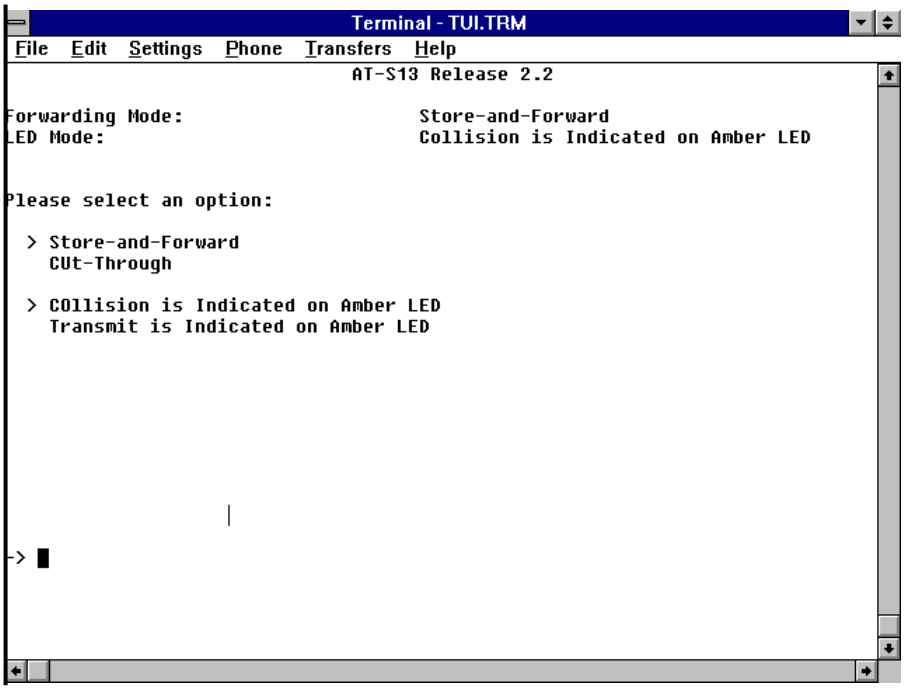
Choose the **`System Administration`** submenu.

The following Omega Menu Map (see Table 3) summarizes the functions that are available under the **`System Administration`** menu.

Table 3: Omega Menu Map

System Administration
System name
Password, timeout
IP parameters
Ip address
SUbnet mask
GAteway address
Manager address
Download Password
GEt community string
SEt community string
Trap community string
Location
Contact
ATM parameters
Framing
Clocking
Transmitter Idle
Sonet / SDH
INternal clocking / External (loop) clocking
Unassigned cells / IDle cells
Ethernet parameters
Store-and-Forward / Cut-Through
Collision is Indicated on Amber LED / Transmit is Indicated on Amber LED
Terminal configuration
ANSI - VT100-compatible / Generic “dumb” terminal / Custom terminal definition...
8 data bits / 7 data bits
1 stop bit / 2 stop bits
No parity / Odd parity / Even parity
Full duplex (echo) / Half duplex (no echo)
Data rate (“baud” rate)...
Update software in another system
Broadcast updated software to all systems
ACtivity monitor
Diagnostics
Connect to a Remote System
Reset and restart the system

Enter the letter **E** for **Ethernet parameters** to access the following submenu:



NOTE

All changes to Ethernet parameters require a system reset to be activated.

Your switch offers the choice of store-and-forward (the default) or cut-through switching strategies. In store-and-forward, the switch stores the entire packet before it is forwarded.

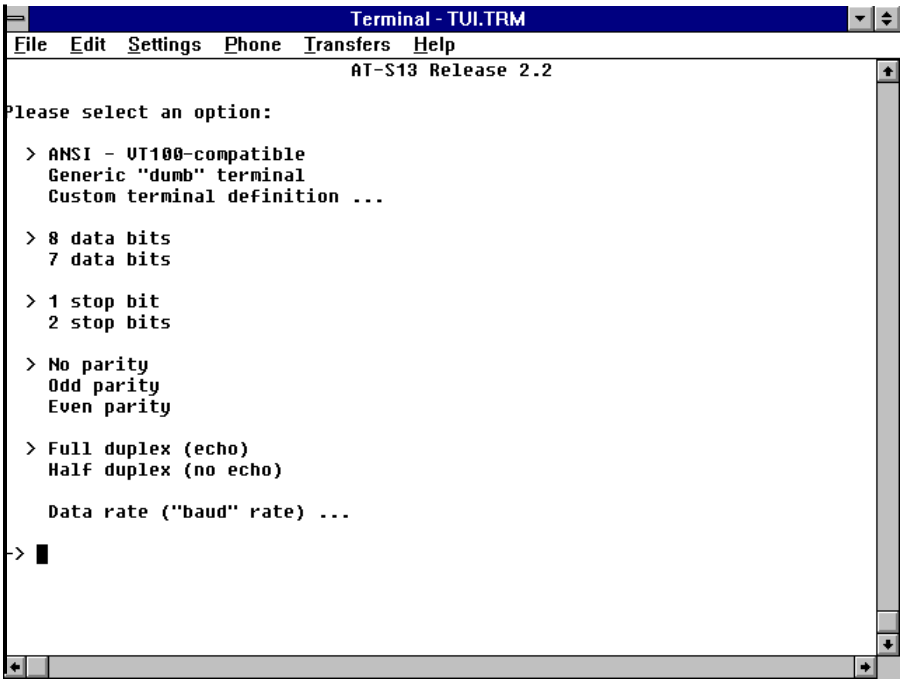
The **Ethernet parameters** screen shows the current choices for forwarding and for LED modes of operation. At the bottom you see a list of menu options. Each currently configured choice is highlighted with an arrowhead (“>”).

Enter the letter **S** or the letters **CU** if you wish to change the forwarding mode. Enter the letter **T** or the letters **CO** if you wish to change the LED mode.

Terminal Configuration

Choose the **System Administration** submenu.

Enter the letter **T** for **Terminal Configuration** to access the following submenu:



Presently configured (or default) options are highlighted with an arrowhead ("**>**").

Changes to the *configured terminal characteristics* (terminal type and half/full duplex) take effect immediately. For example, changing from half duplex to full duplex will cause the management agent to begin echoing your input immediately. The management agent "remembers" all changes and retains them in the event of a power failure.

Any changes to *serial interface options* (data bits, stop bits, parity, data rate) are "remembered," but do *not* take effect until the next management agent session; i.e., you must select **Quit** from the Main Menu and then press **RETURN** to begin a new session. When you are connected to the management agent through a virtual circuit connection, these serial interface options have no effect; they will, however, affect any later sessions with a directly connected terminal.

ANSI—**ANSI** "auto configures" the management agent in accordance with the requirements of an ANSI-standard terminal (essentially the same as a DEC VT-100 or one of the multitude of terminals emulating the VT-100). ANSI is also used if you want your screen to be continuously updated.

Generic—The **Generic** terminal option configures the management agent for the lowest common denominator terminal. In this configuration, the management agent makes very few assumptions about the terminal's capabilities and is compatible with almost all terminals.

Custom Terminal Configuration—**Custom terminal definition...** enables the same full-screen display characteristics as the **ANSI** option, but with a non-ANSI terminal.

If you select the **Custom terminal definition...** option, you are led through three screens to specify the control or escape sequences used by the terminal. On each screen, you must enter the actual control character sequence, either by typing control characters individually or by pressing the terminal's appropriate function key (if it has one). For example, if the terminal's sequence to "home" the cursor is **ESC-H**, you can either press the **ESC** key followed by the **H** key or simply press the "Home Cursor" function key on the terminal.

Control sequences may contain common character codes such as "backspace" or "carriage return" that are also used for input editing. Your input, therefore, for these screens is handled differently. You must first enter a delimiter character (choose any character desired). The control sequence is then entered—normal editing characters are ignored. Finally, to signal the end of the sequence and to terminate input, you must enter the same delimiter character again.

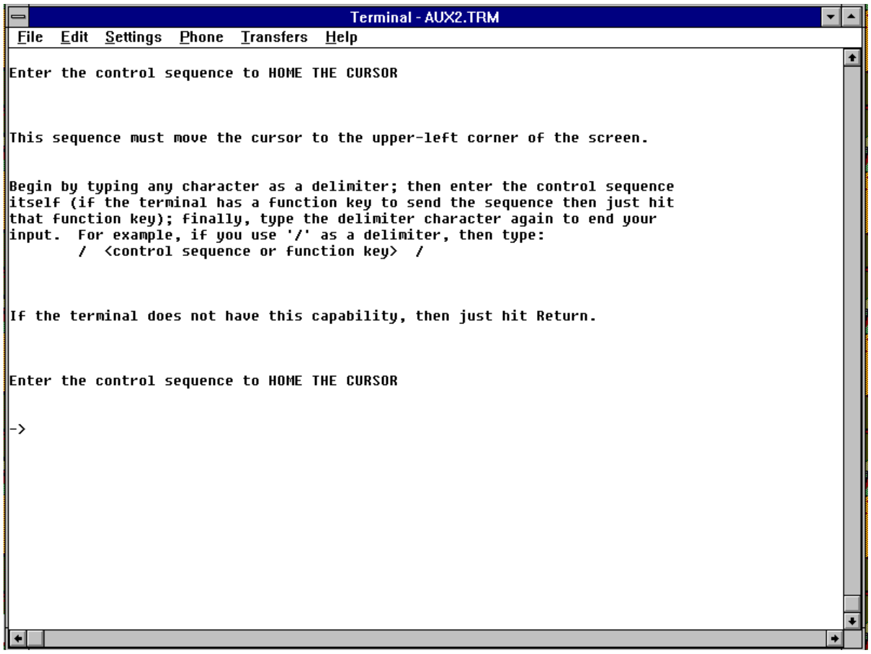
Obviously the control sequence cannot contain the delimiter character itself—you must choose a delimiter character that is known not to occur within the terminal's escape sequence. Also, the flow control characters XON (^Q) and XOFF (^S) may not appear within any sequence.

If you configure a terminal with an Erase Screen capability, the management agent will not scroll the screen but will instead erase and paint the screen from the top. This is generally more pleasant than scrolling.

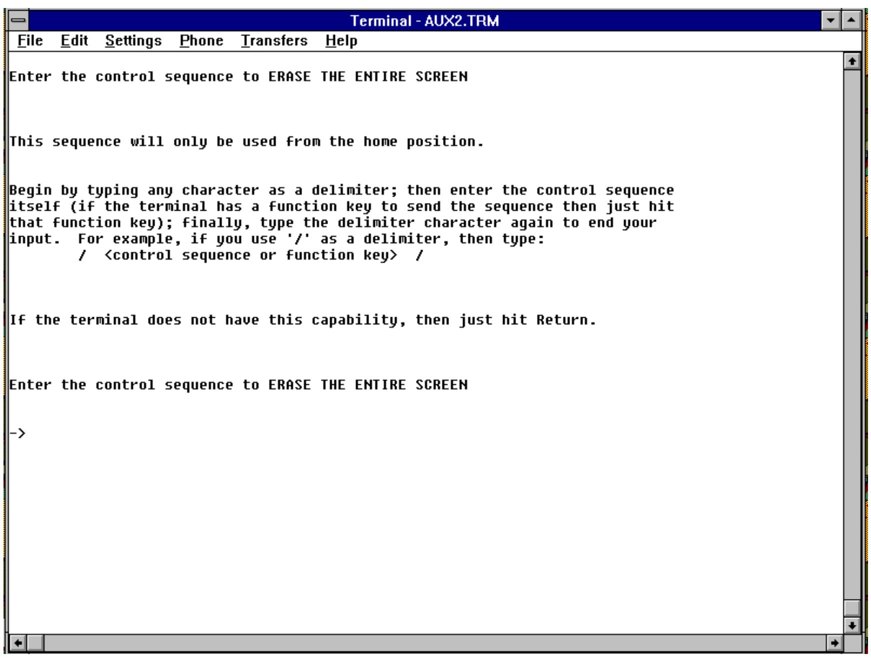
If the terminal has a Home Cursor capability, the management agent will not erase or scroll the screen to update an existing display, but will instead "home" the cursor and then display updated information. This avoids the appearance of screen "flicker."

The Erase End Of Line (EOL) capability provides an efficient method for the management agent to erase old information when updating an existing display. If Erase EOL is not configured, the management agent will use an appropriate number of space characters to erase old information.

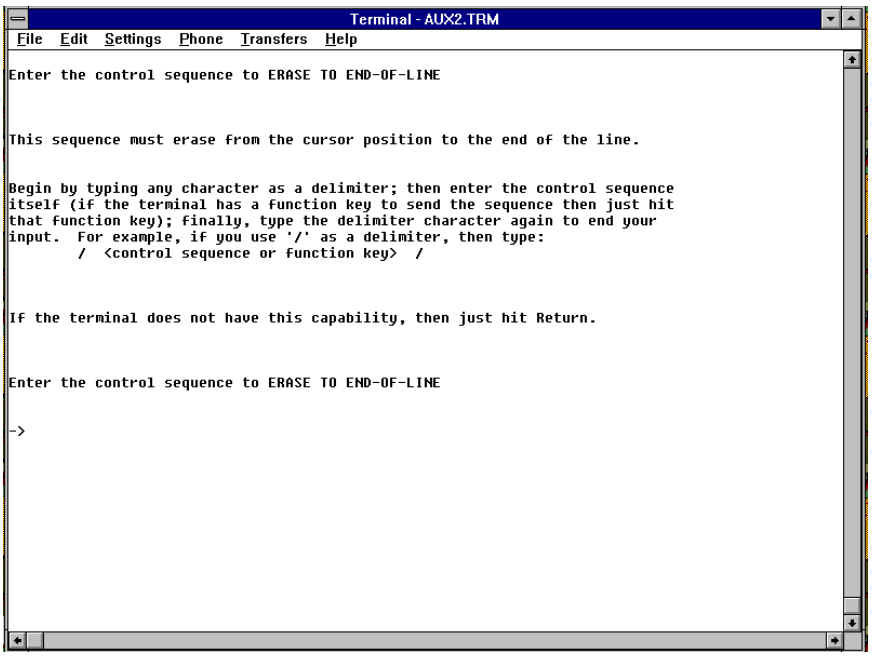
Under **Custom Terminal Configuration...** the first sequence to be configured is **HOME THE CURSOR**.



This is followed by the **ERASE THE ENTIRE SCREEN**.



Finally, you enter the **ERASE TO END-OF-LINE**.



Data Rate—Return to the **Terminal Configuration** screen and select **Data rate (baud" rate)....** The screen consists of selectable baud rates.

If you select **Automatic baud rate detection**, you will have to press **RETURN** *twice* to begin future management agent sessions. Two **RETURNs** are required in order to determine the terminal's actual data rate.

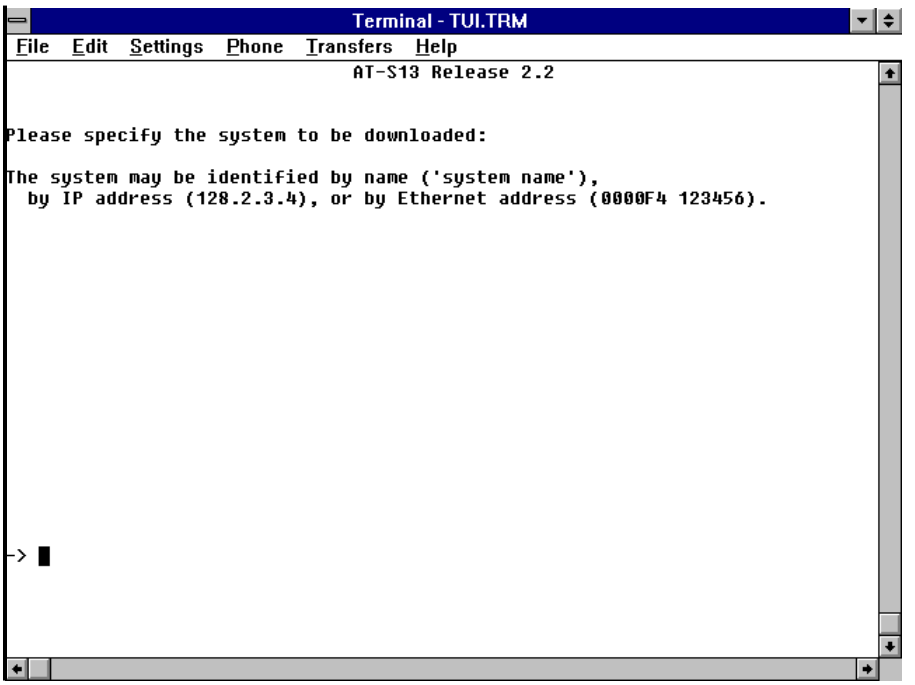
Update Software In Another System

There are two prerequisites *before* you can update software to another system:

1. Software cannot be upgraded if either an AT-S13/AT-S14 PCMCIA card or an AT-S16 Firmware Cassette is installed in the remote device, and
2. All systems must have the same downloaded password.

Return to the **`System Administration`** submenu.

Enter the letter **`U`** for **`Update software in another system.`** The following submenu will be displayed.



Next, you are prompted to select a specific switch to download with new software.

Enter the IP address of the target switch, the target switch name (if configured), or the target switch's MAC address. The MAC address can be obtained from the **`Diagnostics`** screen. It may also be found on an external label above the RS232 port (or the console port, in some instances).

Broadcast Updated Software To All Systems

Choose the **System Administration** submenu.

Enter the letter **B** for **Broadcast updated software to all systems**. A message is broadcast to all other Allied Telesyn switches informing them that software is to be downloaded if they are not already running the current software release (the software running on the hub from which you issued this command is, by definition, the current software release).

NOTE

You can issue this request at any time without impacting your hubs since only those with 'old' software will respond. Also, if you have many hubs, they may not be upgraded with the first update request. Therefore, to insure that all of your hubs are upgraded, the command should be repeated several times.

After this message is broadcast, the management agent switches to the activity mode to enable you to monitor downloading.

Note that software should not be upgraded to hubs across routers (different subnets).

To upgrade switches on a remote subnet:

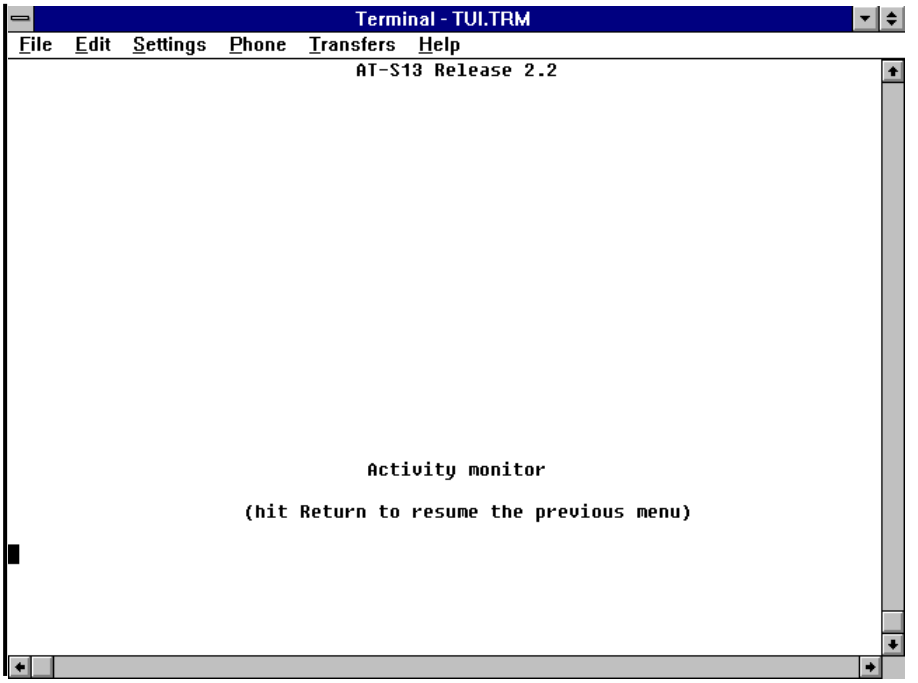
1. Upgrade one switch on the remote subnet with the AT-S13/AT-S14 PCMCIA card or the AT-S16 Firmware Cassette.

2. Connect to the remote upgraded hub and then update software in all hubs. One subnet can be upgraded at a time.

Activity Monitor

This option is used for troubleshooting purposes as well to indicate the completion of downloaded software. Further, technical support personnel have the ability to retrieve this information and, subsequently, use it towards the determination and resolution of problems.

Open the **System Administration** menu and enter the letters **AC** for the **Activity monitor**.

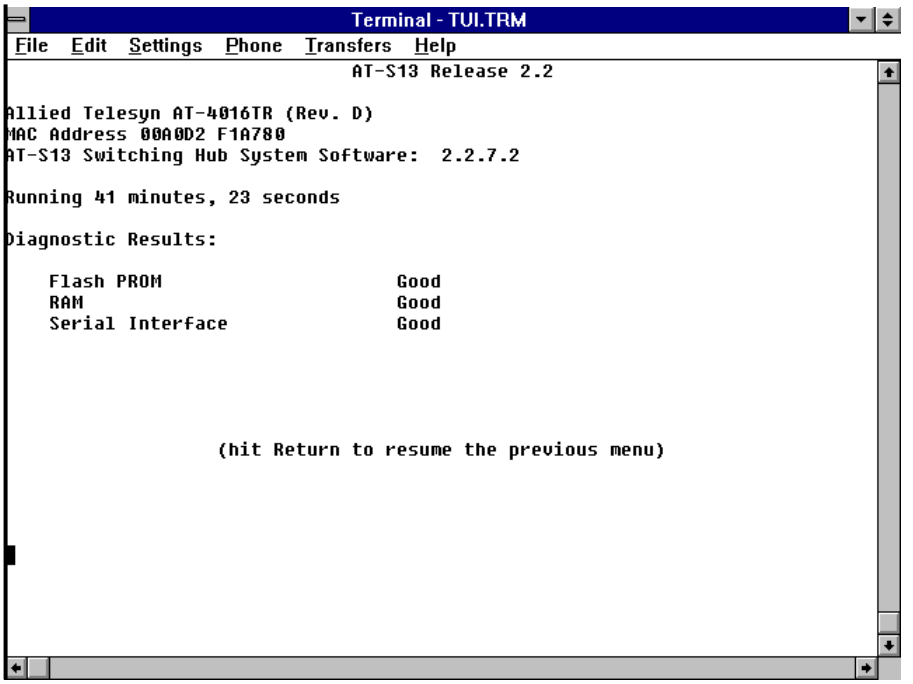


This option displays a variety of messages showing system activity as it occurs. The screen above shows no activity.

Diagnostics

Diagnostics enables you to run a limited set of diagnostic tests on currently selected groups. The results for each test will indicate either **Good** or **Failed**.

Choose the **System Administration** submenu. Enter the letter **D** for **Diagnostics** to access the following AT-S13 submenu:

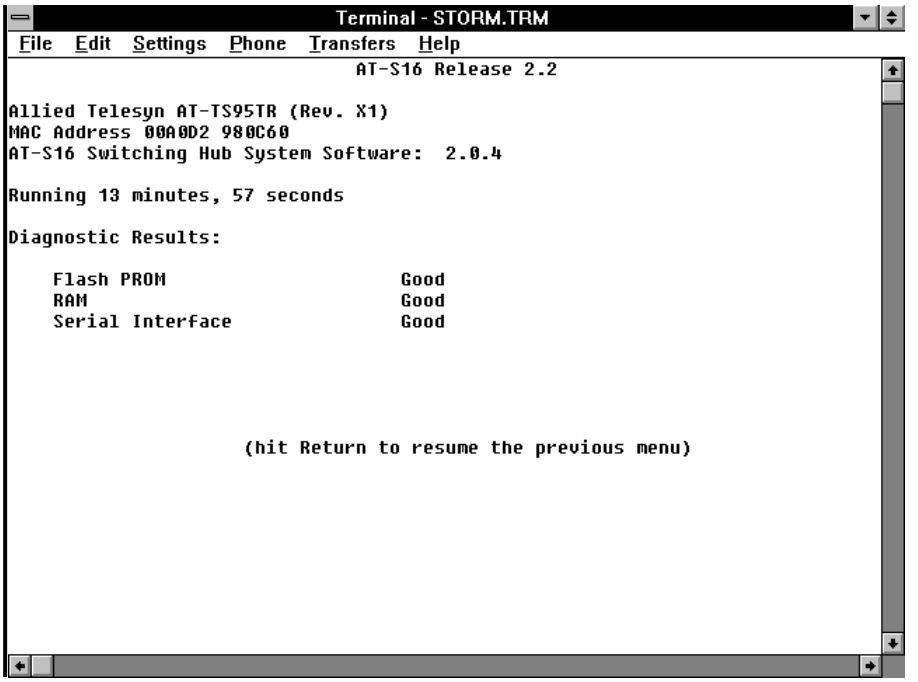


The top of the screen shows the user-configured hub name and selected group name. Below is the group's product identifier. The group's unique MAC address is displayed as a hexadecimal string (this is actually the group's Ethernet address), followed by a version identifier for the group's firmware and current version of the software.

NOTE

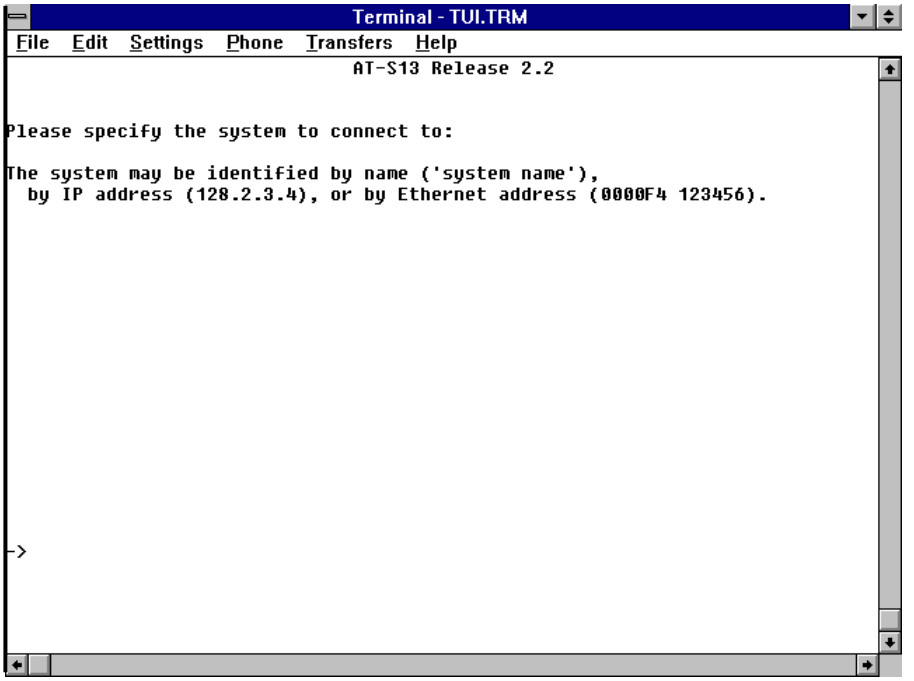
This is the only screen that shows the MAC/Ethernet address and the only place that you can view the software level.

Enter the letter **D** for **Diagnostics** to access the following AT-S16 submenu:



Connect to a Remote System

Select **System Administration** from the **Main** Menu. Next, select **Connect to a remote system. T**he following screen will be shown:



For IP Networks. Enter the IP address of the target hub.

This option initiates a Telnet session to another ATI managed hub. This option is useful when you are managing remote networks.

NOTE

If you are specifying the system by its alias, be sure to enclose the name in single quotation marks (for example, '**name**').

When the Telnet connection is established, you will see the remote system's Main Menu. Note that a thorough discussion of Telnet and remote connectivity was discussed in Chapter 2 and you are referred to that information.

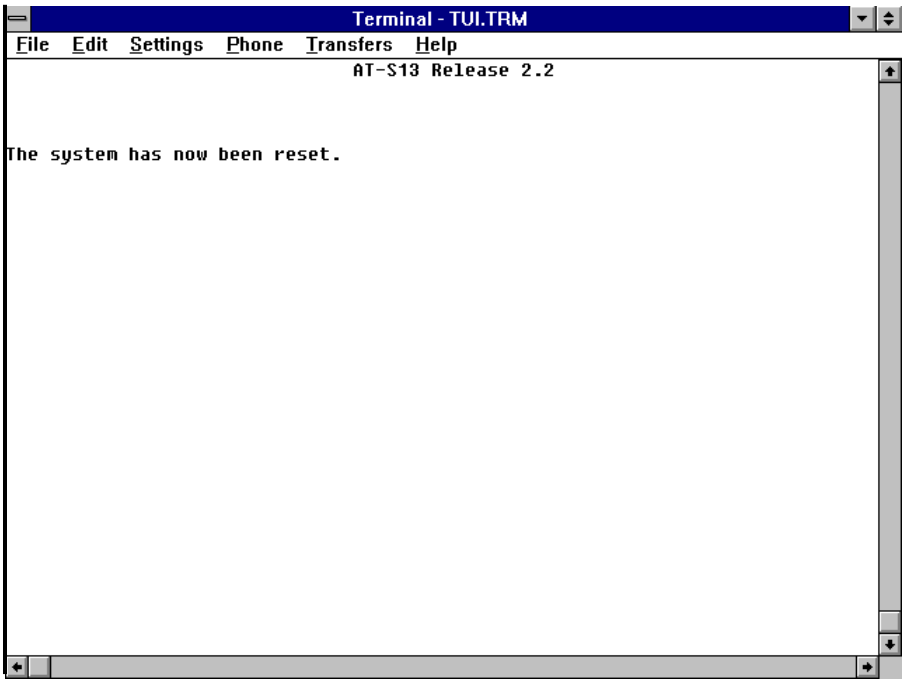
Local hub management does not require TCP/IP addresses. If you are NOT going to have a TCP/IP network then all hubs and devices can be identified by either a name convention of your choice or by a MAC address which is assigned and integrated into each hub by the manufacturer).

The switch displays its name at the top of the screen in an Omega session. This is particularly useful if you have more than one system. You can also use the name when initiating an Omega session via Telnet from another switch.

Reset and Restart the System

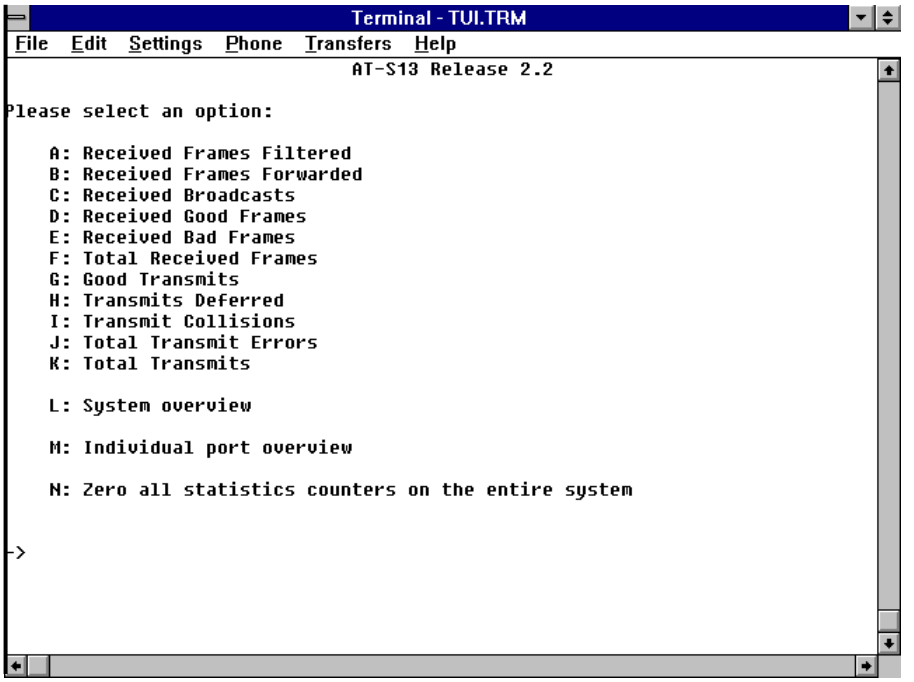
Choose the **System Administration** submenu.

Enter the letter **R** for **Reset and restart the system** to access the following submenu.



Frame Statistics

When you select **`Frame statistics`** from the **`Main menu`**, the following screen appears:



Options

Statistics Counters. Options A through K will display a graph for a particular statistics counter. See Single Counter Graph below.

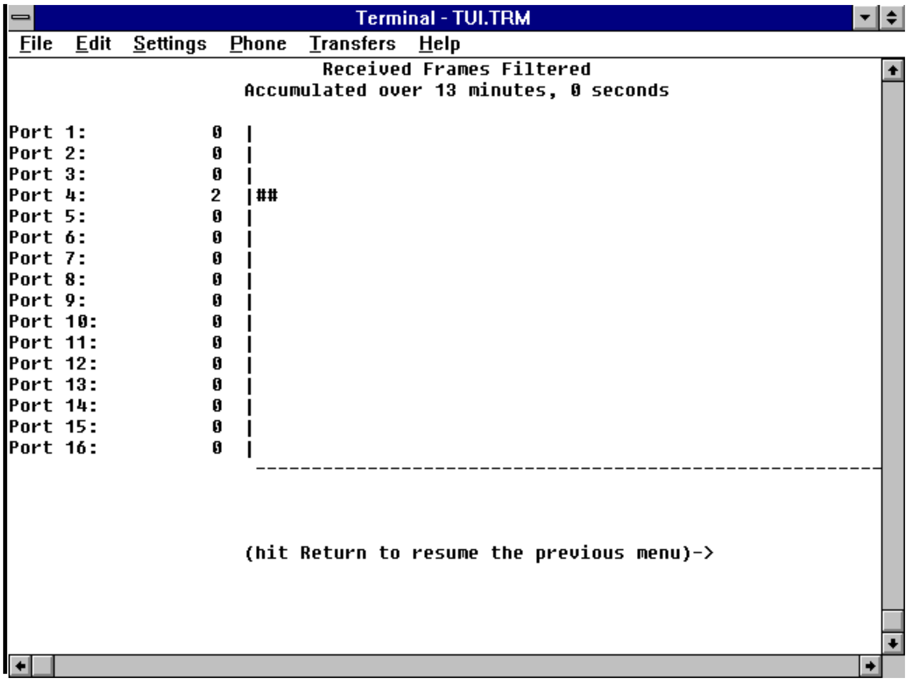
System Overview. This option (L) displays the System Overview Graph - Frames (see below).

Individual Port Overview. This option (M) displays the Individual Port Menu (see below).

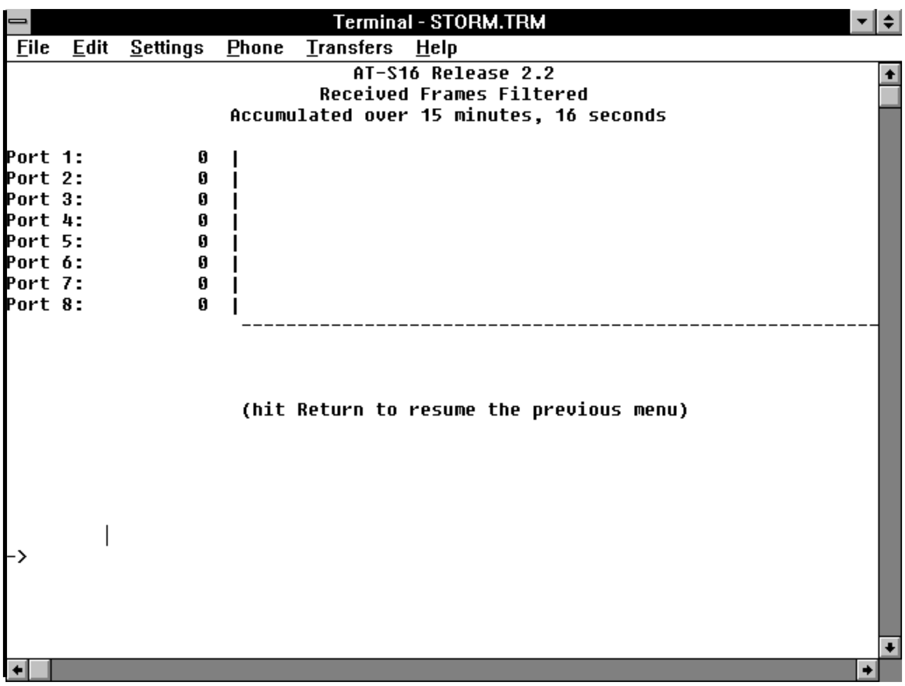
Zero all . . . This option (N) clears all statistics counters.

Single Counter Graph

If you select one of the individual Statistics Database counters from the **`Frame statistics`** submenu (options A through K), the following display (option A, in this case) appears for the AT-S13:



If you select one of the individual Statistics Database counters from the **`Frame statistics`** submenu (options A through K), the following display appears for the AT-S16:



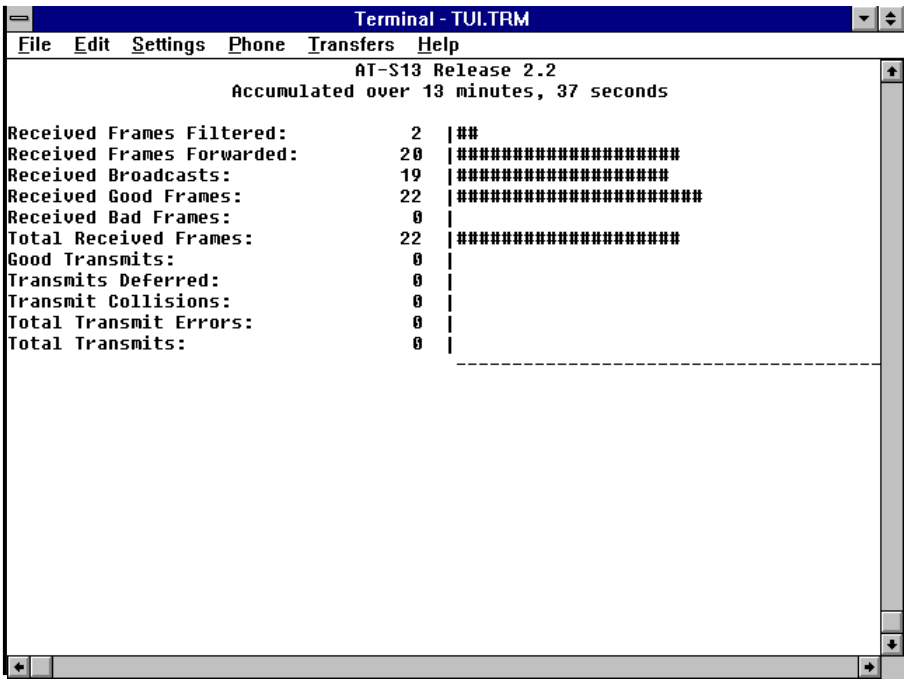
The selected statistics counter (Received Frames Filtered, option A, in this example) is graphed on a port-by-port basis. Each port's counter value is shown to the left of the graph, and the graph itself provides a visual comparison of each port.

NOTE

This display will be automatically updated if the type of terminal has been configured. The counter will not increase if ANSI is not selected. Rather they will be updated each time you enter the statistics screen.

System Overview

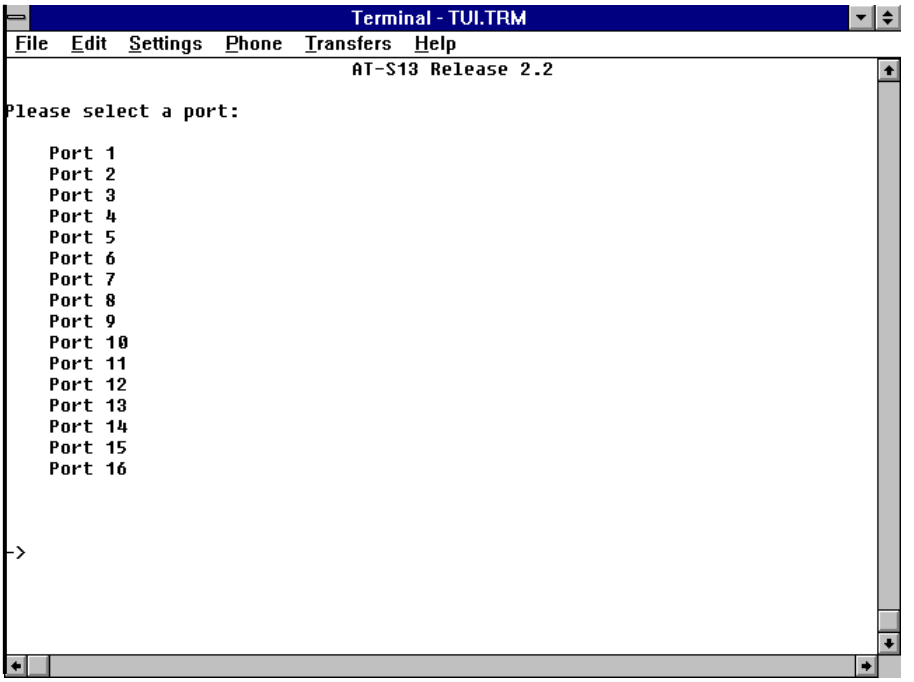
If you select the **System overview** option **(L)** from the **Frame statistics** submenu, the following display appears:



All system-wide statistics counters are graphed. Each counter value is shown to the left of the graph while the graph itself provides a visual picture of system-wide network activity.

Individual Port Overview

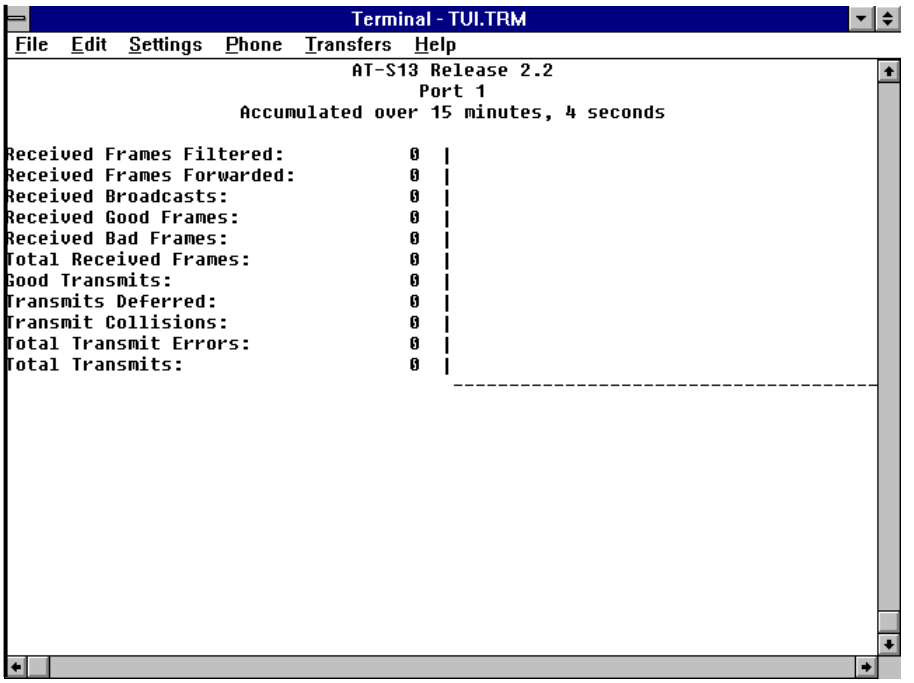
If you select the **Individual port overview** option **(M)** from the **Frame statistics** submenu, the following submenu appears and you are asked to select a desired port:



To select a port, you enter the port number, followed by **RETURN**. A graph similar to the following **Individual Port Graph - Frames** will then appear.

Individual Port Graph — Frames

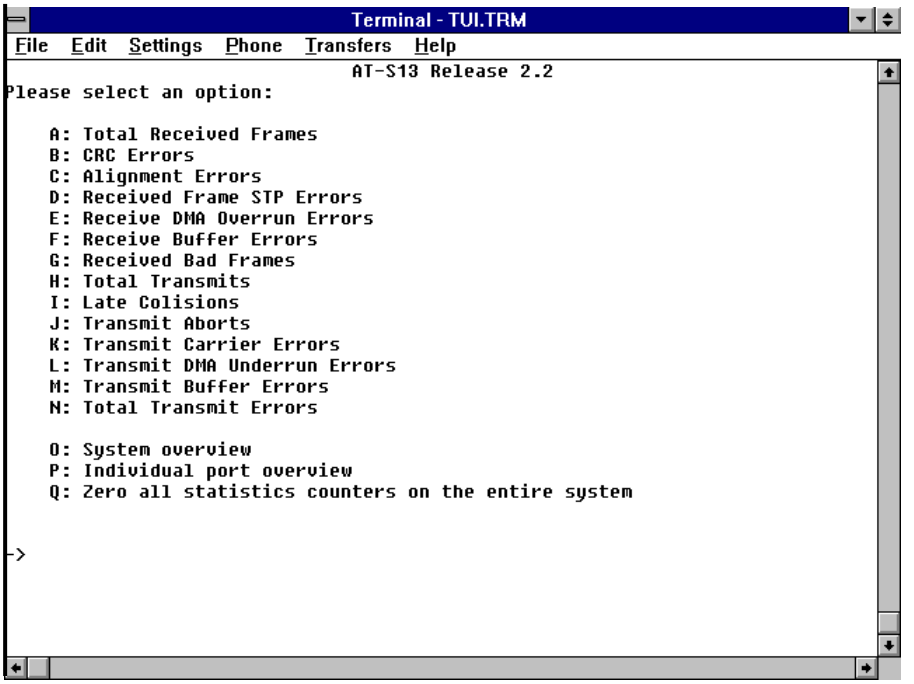
If you select a port number from the **`Individual Port Statistics`**, the following display appears. Note that Port #1 was selected.



This display is identical to the System Overview Graph except it is for a selected port and not the overall system. Each counter value is shown to the left of the graph and the graph itself provides a visual picture of the port's network activity.

Error Statistics Menu

When you select **`Error statistics`** from the **`Main menu`**, the following menu appears:



Options

Statistics Counters. Options A through N will display a graph for a particular statistics counter. See Single Counter Graph above.

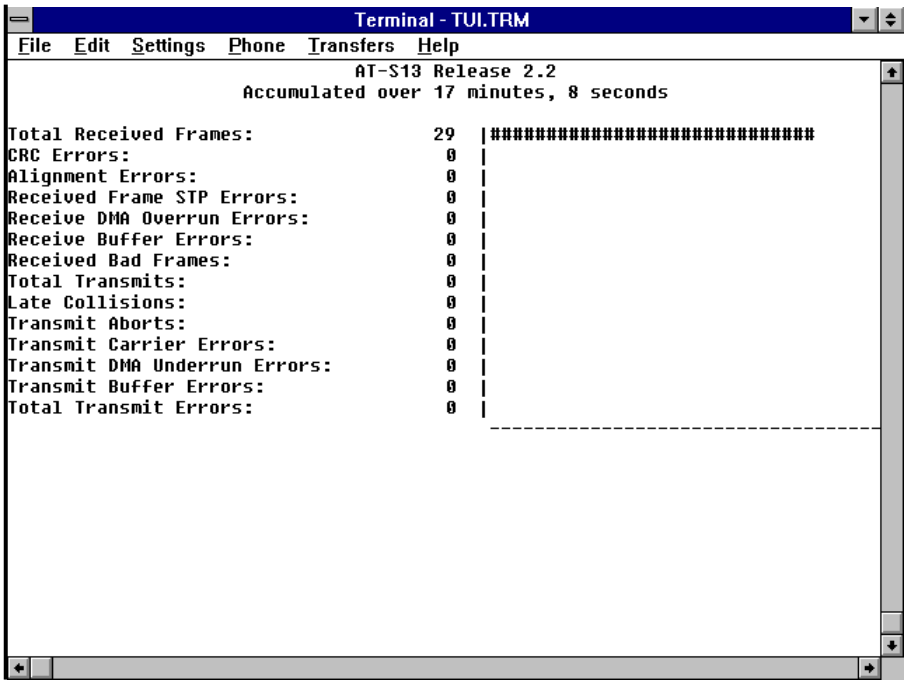
System Overview. This option (O) displays the System Overview Graph - Errors (see below).

Individual Port Overview. This option (P) displays the Individual Port Menu (see above).

Zero Counters. This option (Q) clears all of the statistics counters on the entire switch to zero.

System Overview

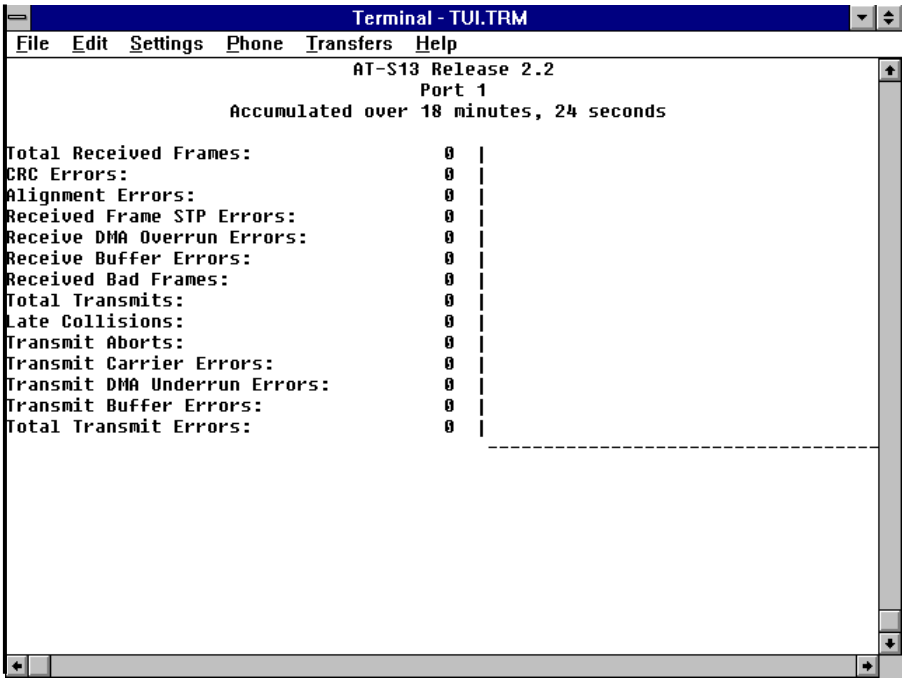
If you select the **System Overview** (option **O**) from the **Error Statistics** menu, the following display appears:



All of the system-wide statistics counters are graphed. Each counter value is shown to the left of the graph, and the graph itself provides a visual picture of system-wide network activity.

Individual Port Overview

If you select a port number from the **Individual Overview Port** menu **(P)**, the following display (Port 1 is shown in this example) appears:



This display is identical to the System Overview Graph - Errors, but reflects only the statistics for the selected port. All of the selected port's statistics counters are graphed. Each counter value is shown to the left of the graph, and the graph itself provides a visual picture of the port's network activity.

Chapter 4
ATM Administration

Getting Started

Upgrading a legacy Ethernet network to an Ethernet network with ATM backbone access provides higher throughput as well as the benefits of added bandwidth. On the other hand, it also brings the problem of compatibility. For example, legacy LAN networks and ATM networks have two differences that must be resolved by any protocol which attempts to interface the two technologies:

- LAN (MAC) address are defined by the IEEE 802.x specification (48 bits, preassigned at the time of manufacture). ATM addresses, on the other hand, are larger and hierarchal, with ATM station addresses derived from either the ATM switch itself or the ATM network at large.

- Legacy LAN networks broadcast to all devices that are attached to the network. ATM networks must set up connections to all member stations before broadcasting data.

The resolution of these differences is to be found in LAN Emulation (LANE). The bottom line is straightforward: LANE allows legacy LANs to communicate across ATM switches.

LANE is implemented in either of two configurations:

1. As an intermediate system such as a bridge or a router which enable communication among legacy LANs over ATM backbone networks.

2. As an End Station such as hosts, workstations, servers, or PCs which enable communication between End Stations on a legacy LAN or among ATM End Stations.

An ELAN has two primary functions which are directly relevant to this presentation of ATM Addresses:

- It provides a broadcast data path in a connection-based ATM network.
- It provides address registration and resolution to the LES and LEC. It also matches MAC addresses to ATM addresses.

LANE has been subdivided into the four major components shown below and, as each is discussed in Appendix B, they will not be duplicated here.

1. LAN Emulation Client (LEC)
2. LAN Emulation Services
   - — Lan Emulation Server (LES)
   - — Broadcast and Unknown Server (BUS)
   - — Lan Emulation Configuration Server (LECS)

Briefly. The LECS maintains configuration parameters and a membership table of LECs for all ELANs in your ATM network. This membership table contains a list of ELAN members as well as their associated MAC to ATM addresses. The LECS also provides these addresses to requesting clients (LECs).

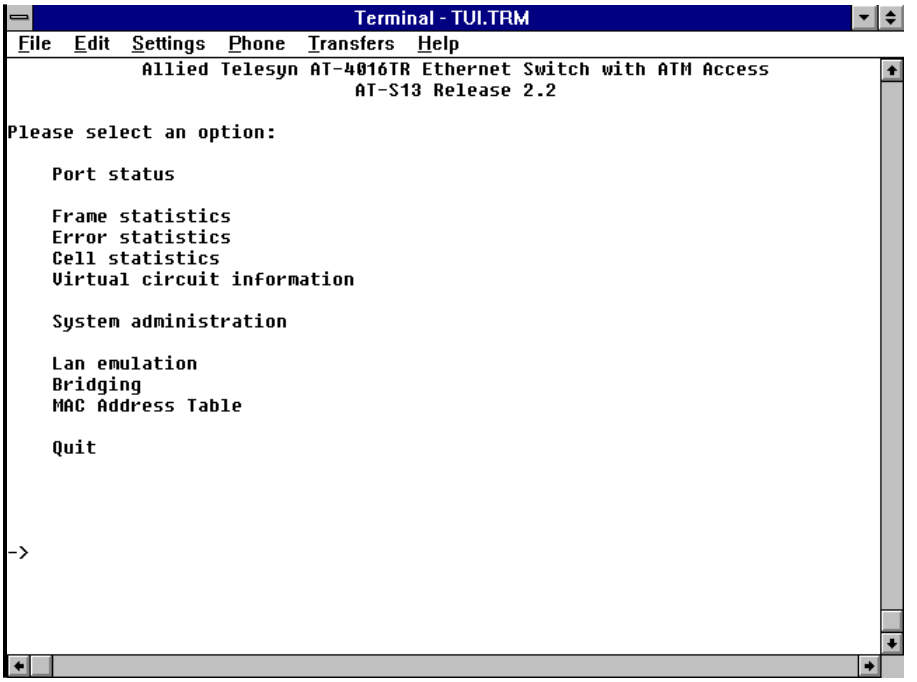
ATI's ATM software implements ATM Forum's LEC. LEC implementation, in turn, conforms to the Lan Emulation Specification 1.0. That is, your switch implements LEC functionality between a legacy Ethernet device and an ATM network. This is important since connection to the LAN Emulation Service (LES) is through LECs.

ATI's software Release v.2.2 means that the LEC, or port, does NOT determine ELAN membership — you do — through the LECS.

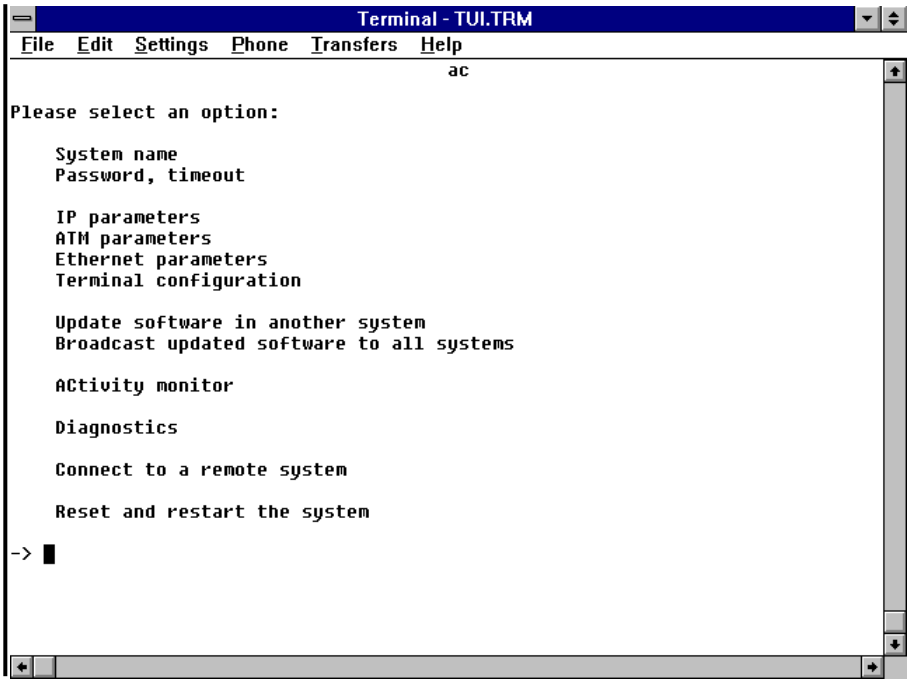
In short, with v.2.2, all LECs (switches) — as well as all devices (workstations, PCs, printers, scanners) attached to those LECs — can be automatically configured from the LECS.

ATM Parameters

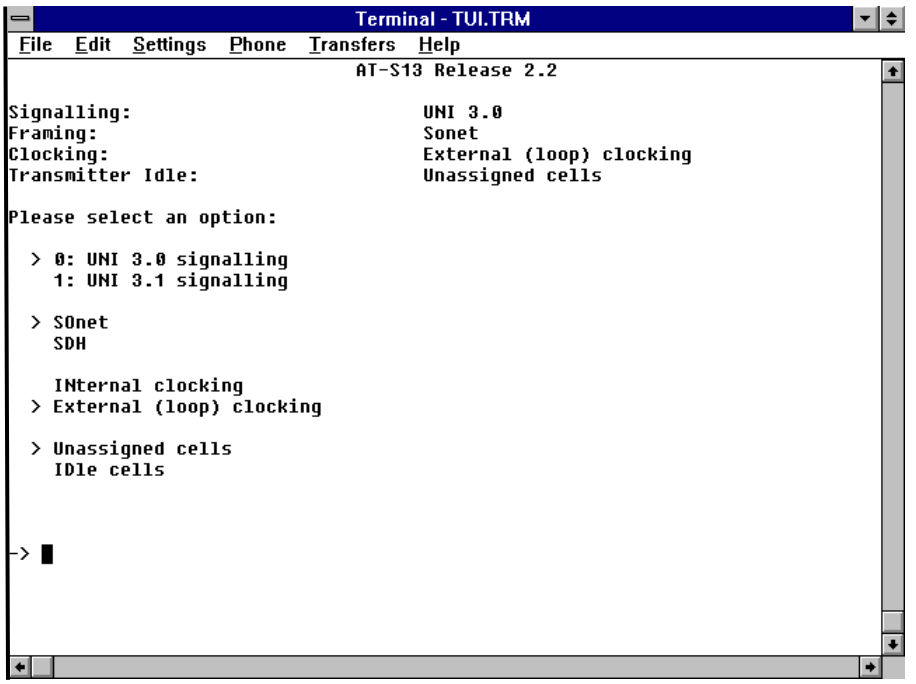
Access the **Main** menu from Omega management. As previously stated, Omega's **Main** menu enables you to access the submenus that are needed to configure both your Ethernet network *and* your ATM network.



Select the **System Administration** submenu by entering the letter **S** from the **Main Menu**.



From the **System Administration** submenu enter the letters **AT** to access the **ATM parameters** submenu:



This screen enables you to determine the values that regulate your ATM network. The top part of the display shows the current values.

The following variables can be configured:

UNI 3.0/3.1 signalling. UNI 3.1 represents a slight modification to the earlier UNI 3.0 specification. They vary primarily with differences in the data link Service Specific Convergence Protocol. You must determine which protocol is appropriate for your system by referencing your network requirements. The default is UNI 3.0.

Sonet/SDH. Two options are available for the Fiber Optic ATM interface: Synchronous Optical Network (SONET) STS-3c-type framing (which is more common in North America) and Synchronous Digital Hierarchy (SDH-1) framing (which is more common in other countries). Whichever option you choose should remain consistent throughout the entire network. The default is SONET.

Clocking. The options are either Internal or External. Since the clock signal is normally supplied by the ATM switch itself. Only one switch in the UNI connection should provide clocking. The default is External (loop).

Cells. The ATM specification requires the station to transmit null cells during periods without traffic. This parameter determines which cells contain Idle or Unassigned cells. The default is Unassigned cells and will be displayed within the **Frame statistics** submenu.

NOTE

Parameter changes require the system to be reset before they are recognized.

ATM addresses

As presented in the introduction to this chapter, the function of the ELAN protocol is to emulate (defined as: to imitate, to equal, or to approach equality with) a local area network to an ATM network. Specifically, the ELAN protocol defines the mechanisms that allow the emulation of an IEEE 802.3 Ethernet LAN. In other words, ELAN protocols for Ethernet make an ATM network look and behave like an Ethernet LAN.

The bottom line is that ELAN allows Ethernet repeaters, workstations and servers to transparently communicate across, and within, an ATM network.

Address Registration and Resolution

Address Registration is the mechanism by which LECs provide address information to the LES.

Address Resolution, on the other hand, is a procedure in which a LEC associates a LAN destination with the ATM address of another client or the Broadcast and Unknown Server (BUS). An intelligent LES may respond to address resolution requests if LECs register their LAN destinations (defined as MAC addresses) with the LES. Address resolution allows LECs to set up data direct Virtual Channel Connections (VCCs) to carry frames.

That is, when a LEC is presented with a frame for transmission whose LAN destination is unknown to that client, it must issue a LAN emulation address resolution protocol request frame to the LES over its control point-to-point VCC. The ATM protocol requires a destination ATM address to set up a connection across the network. Yet most people will only “know” the MAC address of the destination.

Address Determination

As noted in Chapter 1, Product Description, there is user-defined emulated LAN support for up to 64 ELANs using either port or MAC addresses. Normally, an ATM address consists of a network prefix, a MAC address and a selector byte.

[network prefix] [MAC address] [selector byte]

Network Prefix. The network prefix is determined through the Interim Local Management Interface (ILMI) protocol which automatically registers all 64 ATM addresses with the LECS.

[network prefix] [MAC address] [selector byte]

During the power on cycle, internal tests are automatically run to test the integrity of the CPU and memory. After the tests are successfully completed, a request is sent to the ATM switch for a network prefix assignment. When the network prefix is returned, the switch creates 64 ATM addresses.

MAC Address. Each port has its own MAC address. It does not have an ATM address. The MAC address can be determined as follows:

A base MAC address has been assigned to each switch by the manufacturer.

[network prefix] [**MAC address**] [selector byte]

If you are unsure of the base MAC address, it can be found either on a decal in the proximate location of the RS232 port and/or on the Omega Diagnostics submenu.

An ATM MAC address is created by adding the port number to the base MAC address. For example, since the AT-4016TR has 16 10Base-T ports, it would have 16 MAC addresses:

Port #1 — [basic MAC address + 01]

Port #2 — [basic MAC address + 02]

*
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***

Port #16 — [basic MAC address + 16]

Note that you do not have to assign a MAC address to every LEC if you use the default ELAN. You can simply assign each LEC to the default ELAN. Refer to the discussion “Default ELAN” on page 76.

Selector Byte. The selector byte is used to denote specific ELAN membership.

[network prefix] [MAC address] **[selector byte]**

Selector bytes consist of integers ranging from 00 to 64 and includes a “Super LEC.”

For example, a complete ATM address will resemble the following:

[network prefix] [MAC address] [00] — The “Super LEC”

[network prefix] [MAC address] [01] — LEC for ELAN #1

[network prefix] [MAC address] [02] — LEC for ELAN #2

*
**
***

[network prefix] [MAC address] [0x40] — LEC for ELAN #64

These ATM addresses are used to join ELANs 01 through 64 (hex 40). Specifically, the 64 ELANs have ATM addresses with selector bytes ranging from 01 through 64.

Super LEC

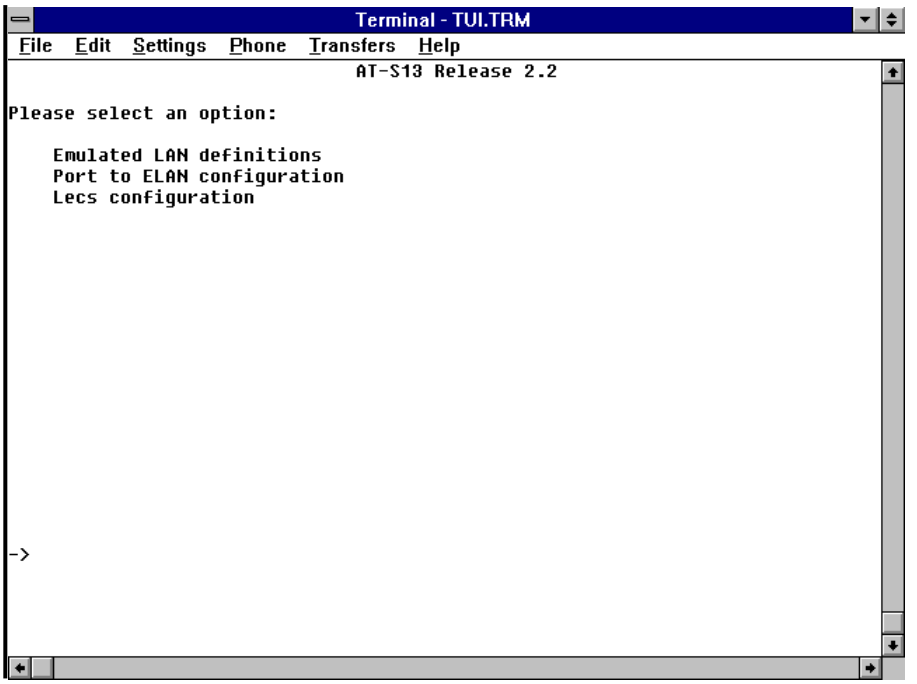
"Super LEC" ATM port address is not actually a LEC, nor can it join an ELAN. "Super LEC" is only used to facilitate configuration requests.

For example, if a device shows up that has not been heard from before, a configuration request will be sent from your switch to the LECS. This configuration request will, in turn, be acknowledged as valid. It will have the following ATM address as well as the MAC address of the device:

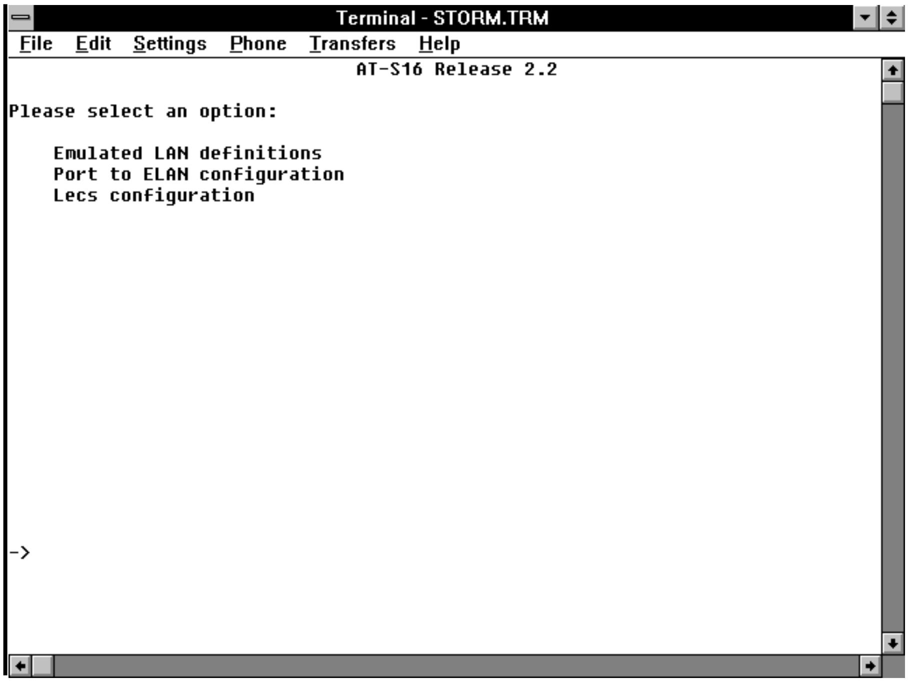
[network prefix] [MAC address] [00] — The "Super LEC"

LAN Emulation Menu

Return to the **Main** menu and enter **L** to access the **LAN emulation** submenu



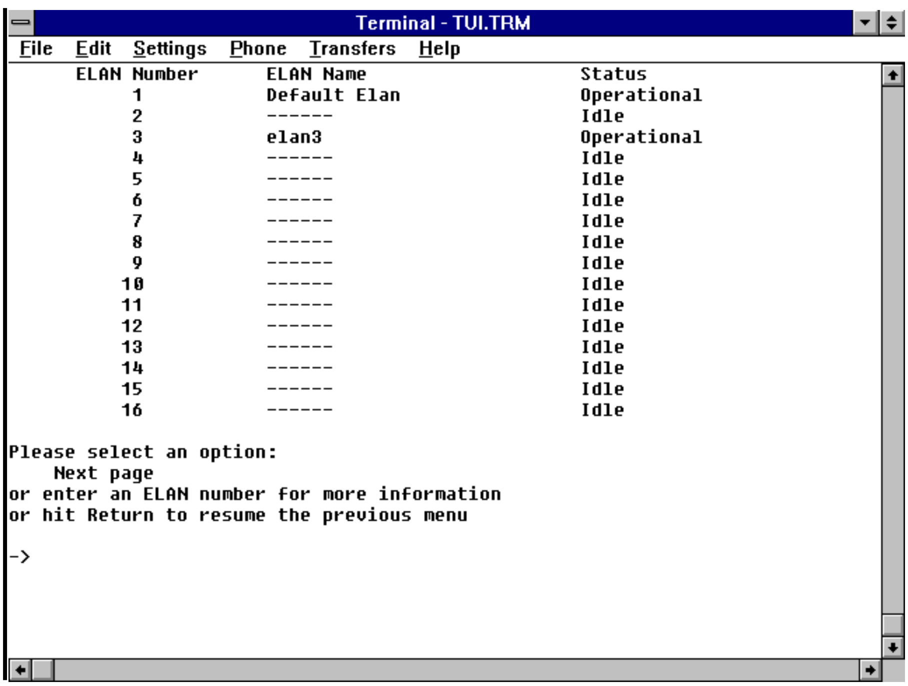
The **LAN emulation** submenu for the AT-S16 shows no difference.



Emulated LAN Definitions

This option provides a list of ELAN names associated with each port of your switch. Fields in this menu can only be configured through the LECS.

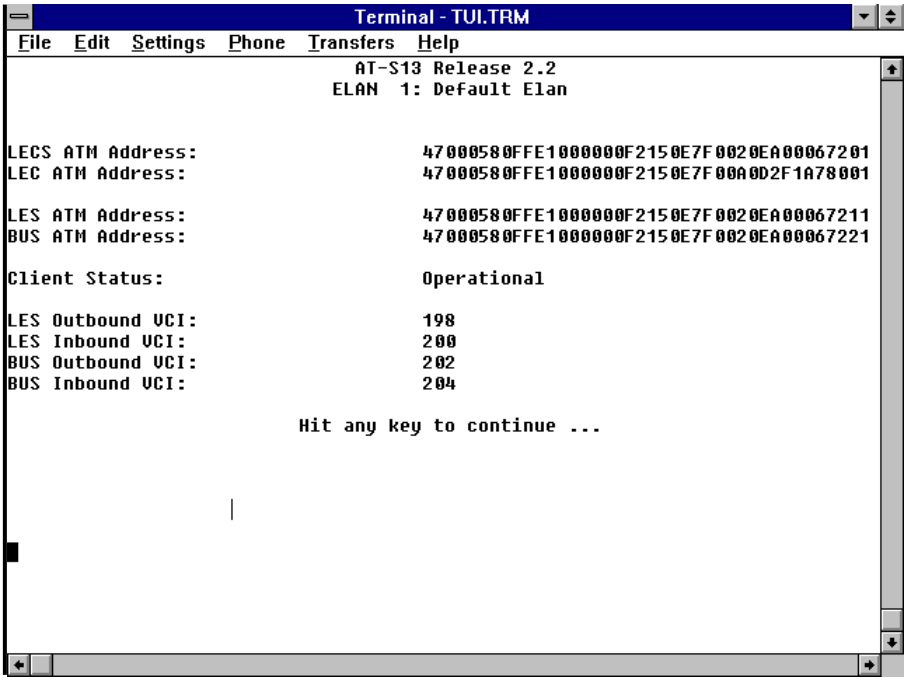
The Emulated LAN Definition option is shown below.



The Emulated LAN Definition menu provides the following information:

- ELAN number - There are 64 possible ELAN numbers per switch. Each ELAN number corresponds to the selector byte
- ELAN Name - This is the ELAN name associated with the ELAN. The ELAN name is requested and received from the LECS. The ELAN name field may contain up to 32 characters
- Status - Normally either Operational or Idle

The Emulated LAN Definition option about a particular ELAN is shown below. Fields in this menu cannot be configured.



This menu provides information for the requested ELAN from the ELAN Definition Menu. The following information is included in this menu:

- The specified ELAN number and associated name (ELAN #1, the default ELAN in this instance)
- The LECS ATM address used by the specified LEC client
- The LEC ATM address used by the specified LEC client
- The LES ATM address used by the specified ELAN
- The BUS ATM address used by the specified ELAN
- The active or inactive state of the client connected to the specified ELAN
- Inbound and outbound VCIs used by the LES and BUS

Port to ELAN Configuration Submenu — AT-S13/AT-S14

The Port to ELAN Configuration screen displays each UTP port as well as the logically defined management port.

By default, all devices on a port are in the same ELAN, but you can override membership assignments for individual devices on a port.

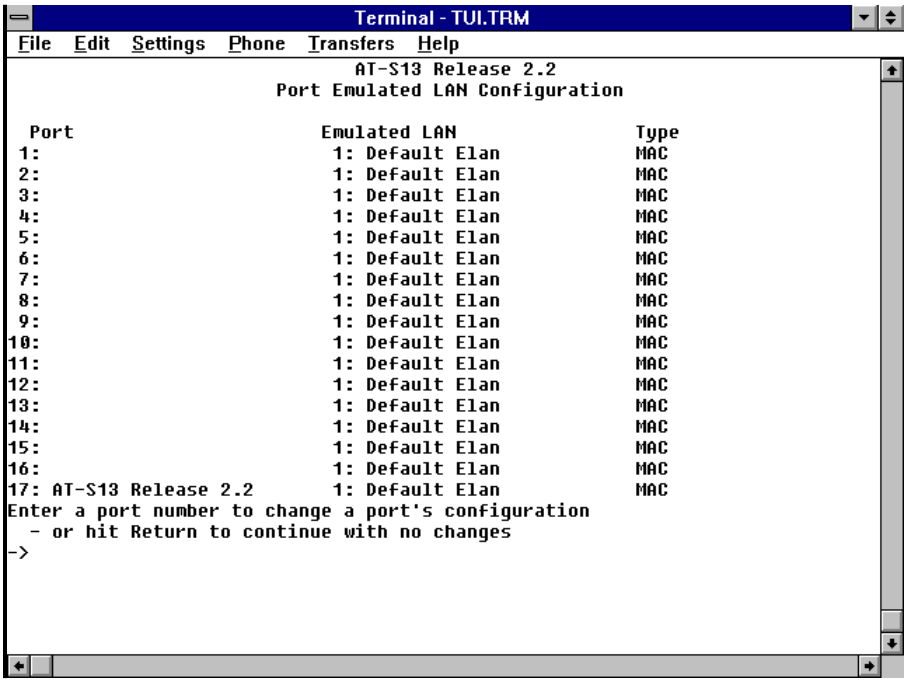
A configuration request will be sent to the LECS as new device is attached. A device that receives a positive response from the LECS will join an ELAN. A device that receives a negative response will join the "default" ELAN (if it has been configured).

NOTE

Ensure that the management workstation remains on the same ELAN as the management client port, Port 17. Otherwise you will lose contact with the switch via Telnet. If you lose contact, either Telnet in from a station on the management port's ELAN, or initiate an Omega local session and reassign the management station's port to be on the same ELAN as Port 17.

To make ELAN assignments by port:

Enter **p** to select the **`Port to ELAN Configuration`** submenu.

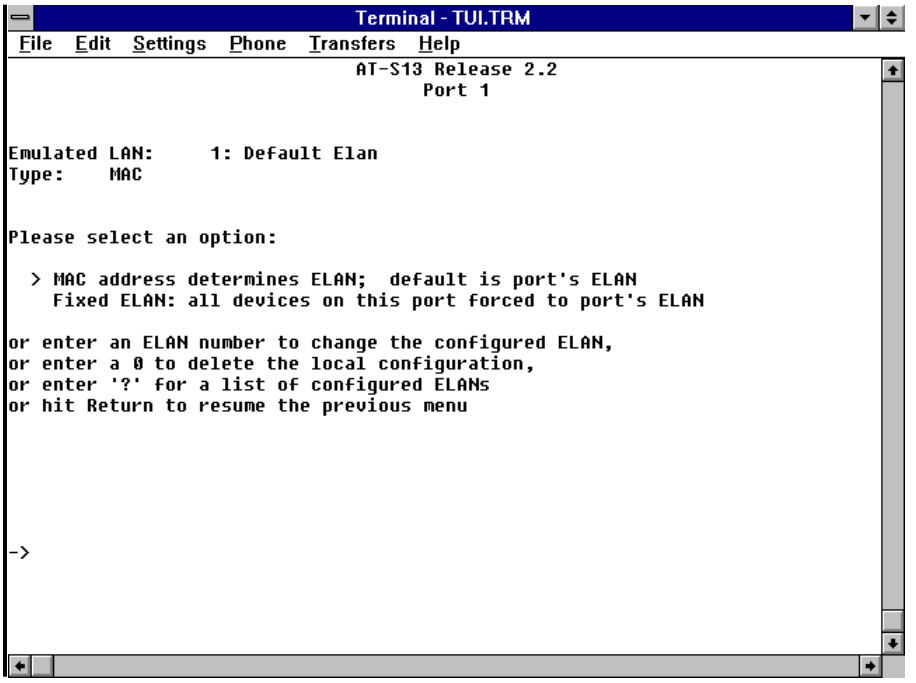


This screen displays each of the sixteen (16) actual AT-4016TR UTP or AT-4016F Fiber Optic ports as well as the logically defined management port (Port #17).

The Emulated LAN column lists the ELAN that is presently configured to each port. The Type column contains a user defined keyword used by the LECS to configure the port. There are two keywords used by the LECS:

- MAC - The LECS assigns an ELAN to a device using the device's MAC address. When the MAC address is received by the LECS, the MAC address is matched to an ELAN using previously defined information stored in the LECS.
- FIXED - The port is configured to the ELAN listed in the Emulated LAN column. The MAC address of the device is ignored.

Select a port by typing its number listed on the left of the screen. Port 1 was selected in this example.



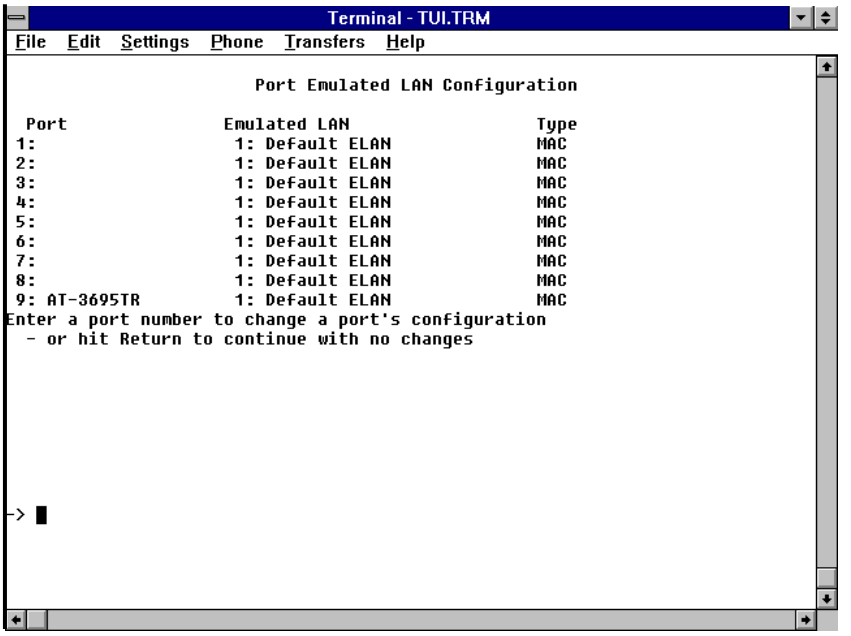
On the ELAN configuration screen for the selected port, you can change the method the switch uses to assign ELAN membership to network devices.

Choose either **M** for "MAC address determines ELAN; default is port's ELAN" or **F** for "Fixed ELAN: all devices on this port forced to port's ELAN."

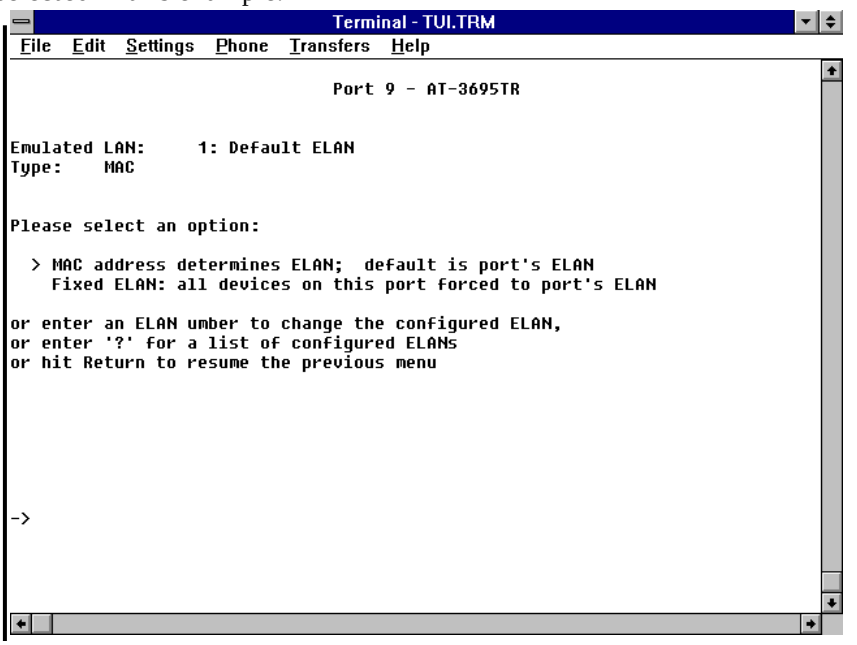
Port to ELAN Configuration Submenu — AT-S16

This screen displays each of the eight (8) actual AT-TS95TR UTP ports as well as the logically defined management port. As the functionality of this screen is essentially identical as that of the AT-4016 screen you are referred that information.

Enter **po** to select the **Port to ELAN Configuration** submenu.

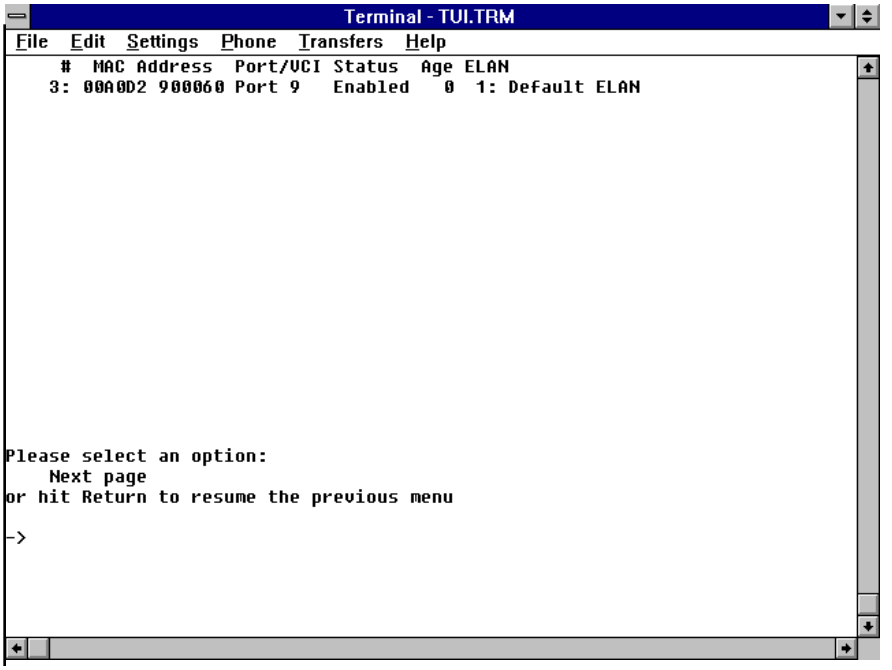


Select a port by typing its number listed on the left of the screen. Port 9 was selected in this example.



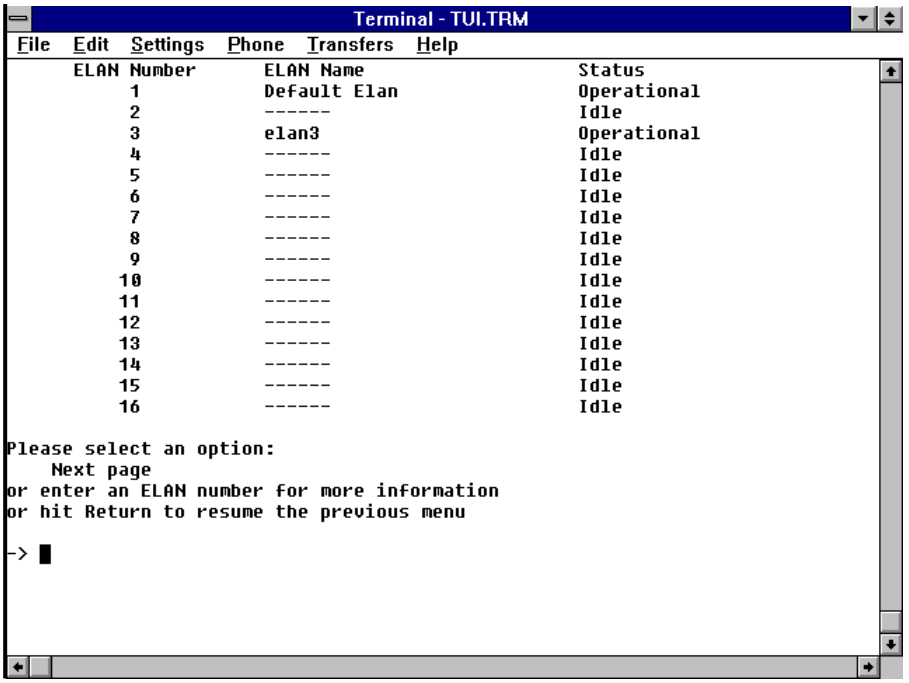
MAC Address Table. If you enter an ELAN number from the **`Port to ELAN Configuration`** submenu (ELAN #3 in this example) you will see the **`MAC Address Table`** option. This option displays all of the MAC addresses discovered by management software on the network.

From this screen you can determine all of the MAC addresses that are available, as well as the port or VCI, status, age, ELAN number and name for each MAC address.



ATM Addresses. The LECS uses LEC Media Access Control (MAC) addresses (also known as Ethernet addresses) to determine ELAN assignment. If you do not want to assign a MAC address to each and every device, a default ELAN can be created.

For example, the first screen from the **`Emulated LAN definitions`** submenu (via the **`Main`** and **`Lan Emulation`** menus) shows the first sixteen (of 64) ELANs.



ELAN Number corresponds to the LEC number. ELAN Name is the name of the ELAN itself which is retrieved from the LECS during a configuration request. ELAN #1 is Client #1 with the ATM address of: [NET Prefix] [Base MAC Address] [Selector #01].

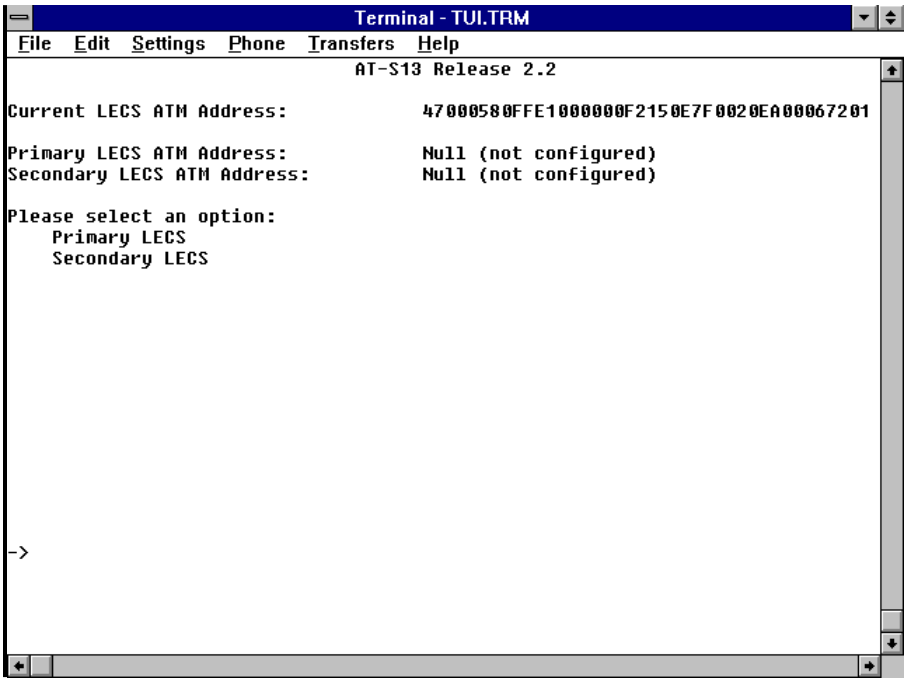
For instance, ELAN Number #1 is identified by “Default Elan” and is “Operational.”

The following pages provide specific information which directly correlates the Omega menus with LAN Emulation.

Note that a more complete discussion of Emulated LANs including such information as address configuration and resolution, components, and topography is contained in Appendix B — LANE.

LECS Configuration

From the **LAN emulation** menu, enter **L** to select the **LECS configuration** submenu.



The **LECS configuration** submenu shows the current LECS ATM address. If a connection has NOT been established, there will be no entry.

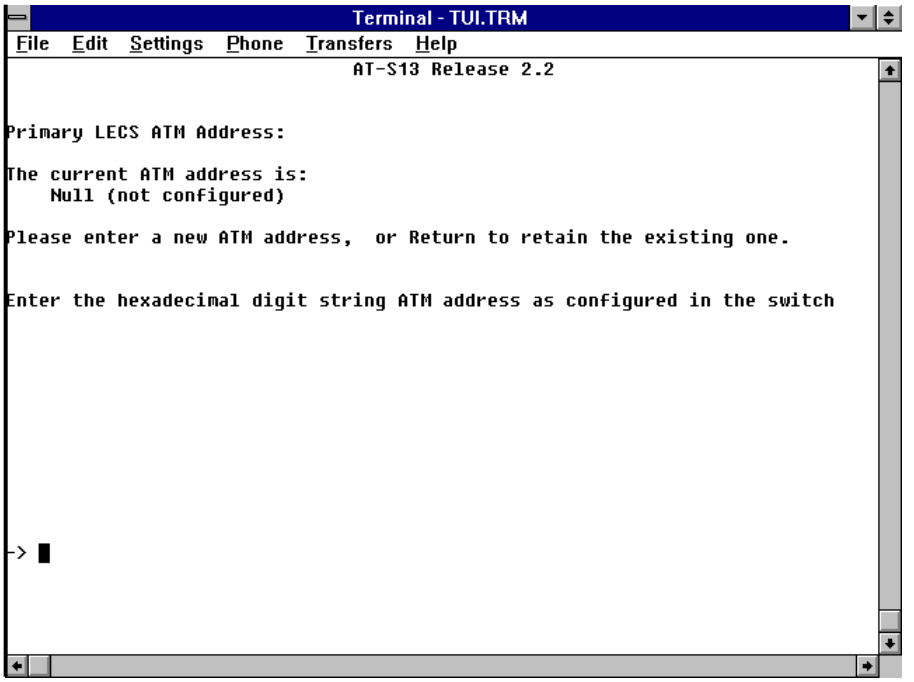
That is, after you have configured your switch, a connection request is sent to the Primary LECS. If the connection request is successful then the Primary LECS ATM Address becomes the Current LECS ATM Address.

If the Primary LECS is not available, a connection to the Secondary LECS is attempted. If this address is accepted then the Secondary LECS ATM Address becomes the Current LECS ATM Address.

If the Secondary LECS is NOT found, a search is made for the ILMI retrieved LECS address. If this is not found the “Well Known LECS” will, in turn, become the Current LECS ATM Address.

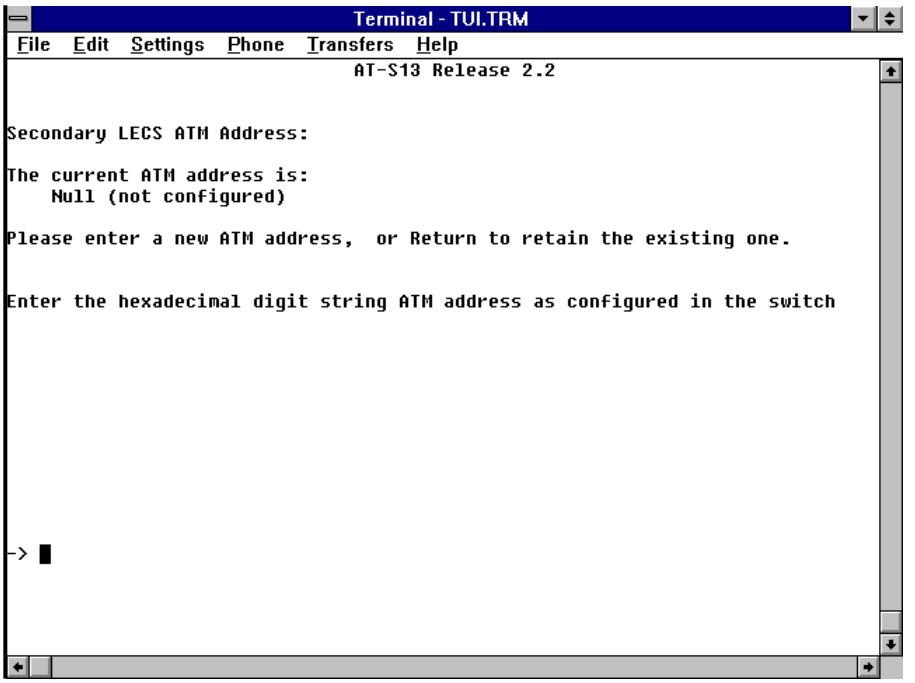
The “Well Known LECS” is 47007900000000000000000000A03E00000100.

Enter **P** to access the Primary LECS ATM Address submenu.



Enter a new ATM address if a current ATM address is not specified or if you simply want to change the existing address.

Return to the **LECS configuration** submenu and enter **S** to access the Secondary LECS ATM Address screen.



If the secondary LECS ATM address is not found, a search is made for the "Well Known " LECS Address.

This sequence will continue until a connection is made. Since all configuration information originates from the LECS, your switch will not know what ELAN's are available until the LECS acknowledges that connection.

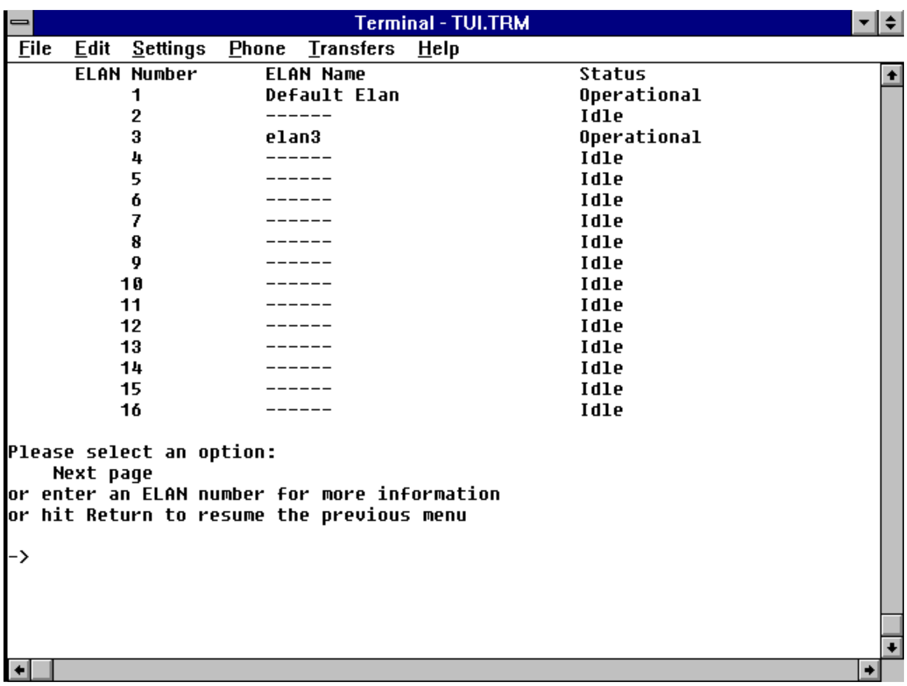
Default ELAN. You can also create a default ELAN on the LECS server with the "Super LEC." If, for instance, you want to assign all of the devices attached to an LEC to a default ELAN, then use the "Super LEC" ATM address.

All subsequent MAC requests sent by the LEC can then be assigned to the default ELAN by the LECS. This process allows you to configure all of the ports of your switch for one ELAN by only configuring a single ATM address.

Note that not all LEC servers will not function in exactly the same way. What is important to know is simply that configuration requests are sent to the LECS for every new device.

ELAN Requests. Once a connection to the LECS is completed, data can be forwarded. At this time your switch will send 64 configuration requests to the LECS in an attempt to identify the 64 ELANs that are available. All configured addresses will be acknowledged and the associated ELANs will be joined. Established ELANs will also be identified in the ELAN Name column on the **Emulated LAN definitions** submenu.

Select **Emulated LAN definitions** from the **LAN Emulation** menu. This screen displays ELAN Number, Name and Status. Note that only 16 ELANs can be shown on a screen. To view additional ELANs simply scroll forward by entering **"N"** for **Next Page** or enter a specific ELAN number.



This means that ELANs are established and that a device attached to your LEC will join a configured ELAN. It also means that a configured ELAN will remain joined until either it is reset or it is powered down.

Client Status. Client status can be found in the **Emulated LAN definitions** submenu.

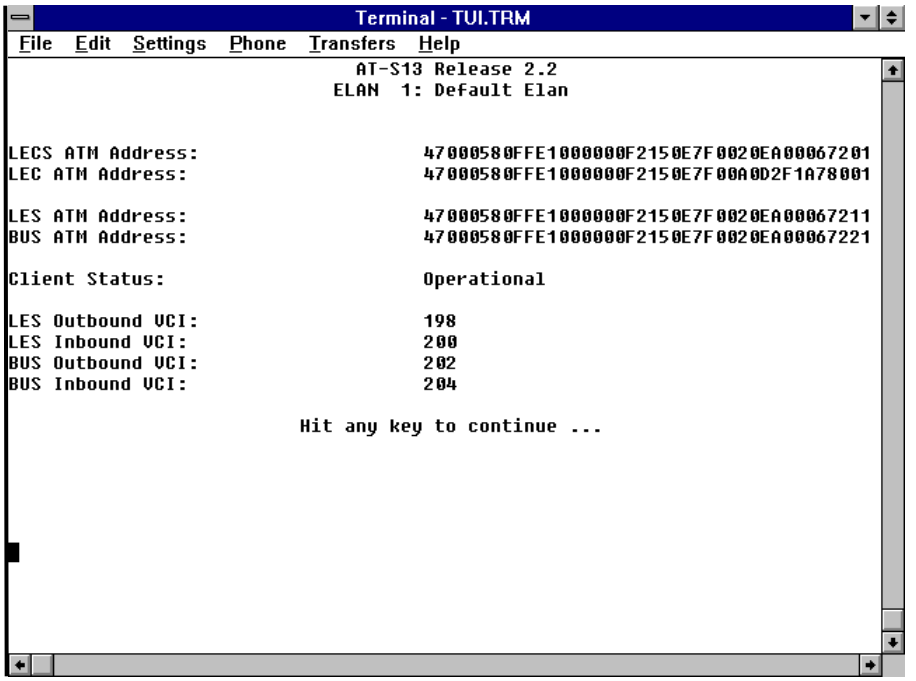
Operational means there is traffic for the ELAN across the ATM interface.

Idle means that the ELAN configuration is stored in the database but the associated client is not operational.

If the client is Operational, you can only return the client to Idle. You can change the client name only when the client is Idle. You can enter a new name, (up to 20 characters in length), or delete an existing name (by pressing the space bar), for any client.

Select a client by typing its ELAN number as shown on the left of the screen and press **<RETURN>**. There are 64 ELANs available. Press **N <RETURN> to see the next page. To see the previous menu, press <RETURN>**.

The status of ELAN #1 is shown below.



ELAN Membership

The following steps determine which ELAN a device can join during normal network operations.

There are **FOUR** ways to define ELAN membership:

1. When a new device is seen, your switch (LEC) requests configuration information from the LECS. If a MAC address has been preconfigured with the LECS, the LECS will send an acknowledgement message to your LEC and the desired ELAN will be assigned.

2. Your switch (LEC) requests configuration information from the LECS. If a MAC address has NOT been preconfigured with the LECS, the LECS will send a rejection message.

   Note that any or all ports can have “default” ELANs assigned by sending a Configuration Request to the LECS for each, or all, port(s) that you want assigned to the “default” ELAN. The LECS, in turn, will then assign that LEC to the default ELAN for the port — IF a default ELAN has been assigned.

   See *Default ELAN* on page 76.

   In short, there are two ways that a port can be assigned to the default ELAN. One way is through Omega. The second way is to not use Omega but through a configuration request at initialization using the port’s MAC address.

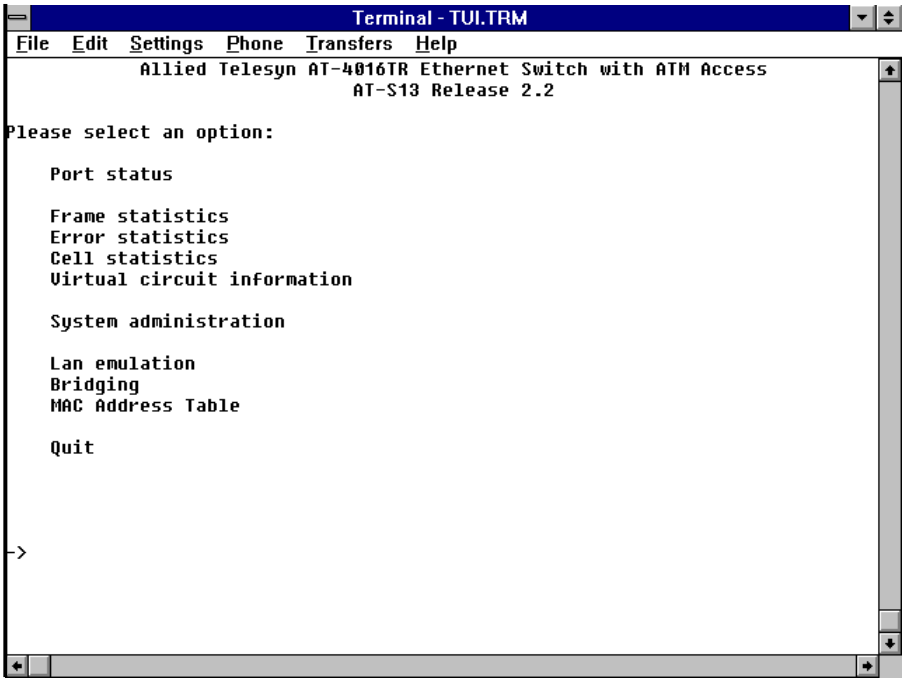
3. Your switch (LEC) requests configuration information from the LECS. If the MAC address has NOT been preconfigured with the LECS, the LECS will send a rejection message. The LECS will then assign that LEC to the default ELAN for the port.

   If a default ELAN has NOT been assigned to a port, the ELAN for all devices attached to that port MUST be configured by the LECS. This means that every device attached to that port will have the same ELAN.

4. Your LEC can also be assigned with a “FIXED ELAN” configuration. A “FIXED ELAN” simply means that all devices attached to a port will join the ELAN that has been predetermined by the LECS or is configured for the port.

ATM Status Menus

ATM status and configuration menus are accessible from the **Main** menu.



NOTE

The use of the Port, Frame, and Error statistics submenus were discussed in Chapter 3, Ethernet Administration. Since they are not used to actually configure an ELAN, they will not be presented here.

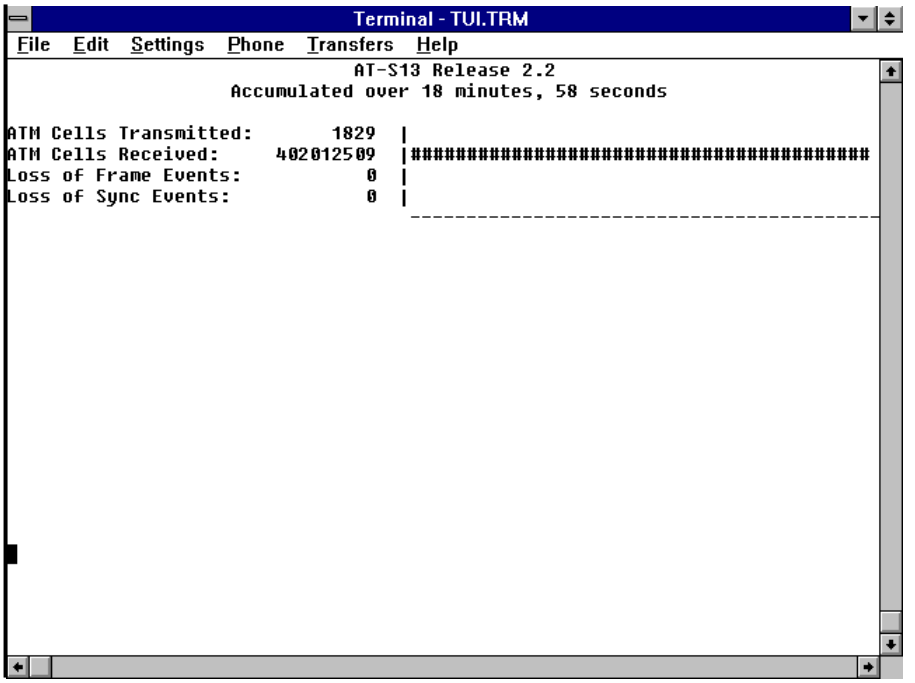
The following menus are used to either view ELAN information :

- Cell statistics - This menu enables you to view ATM cell transmit and receive statistics as well as Loss of Frame and Sync Events.
- Virtual Circuit Information - This menu enables you to view active VCI information and statistics. The VCI number, name, and type are listed in this menu. You can view specific VCI statistics in a submenu.

Cell Statistics Menu

The Cell Statistics menu enables you to view ATM cell transmit and receive statistics as well as Loss of Frame and Sync events. Fields in this menu cannot be configured.

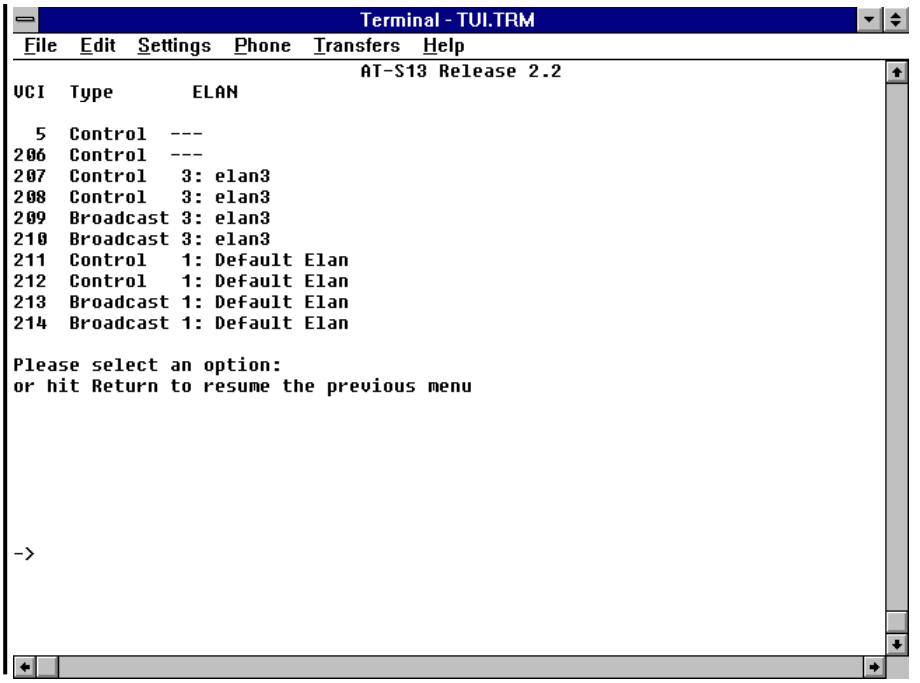
From the **Main** menu, access the **Cell statistics** submenu.



Virtual Circuit Information

The Virtual Circuit Information (VCI) submenu enables you to view VCI statistics for each active VCI. VCI is the 16-bit number in an ATM cell header which identifies the specific virtual channel on which the cell is traversing on the current physical circuit.

From the **Main** menu, access the **Virtual Circuit Information** submenu. This submenu will allow you view all active VCIs on the network as well as data information on each. Fields in this menu cannot be configured.



This menu provides the following information:

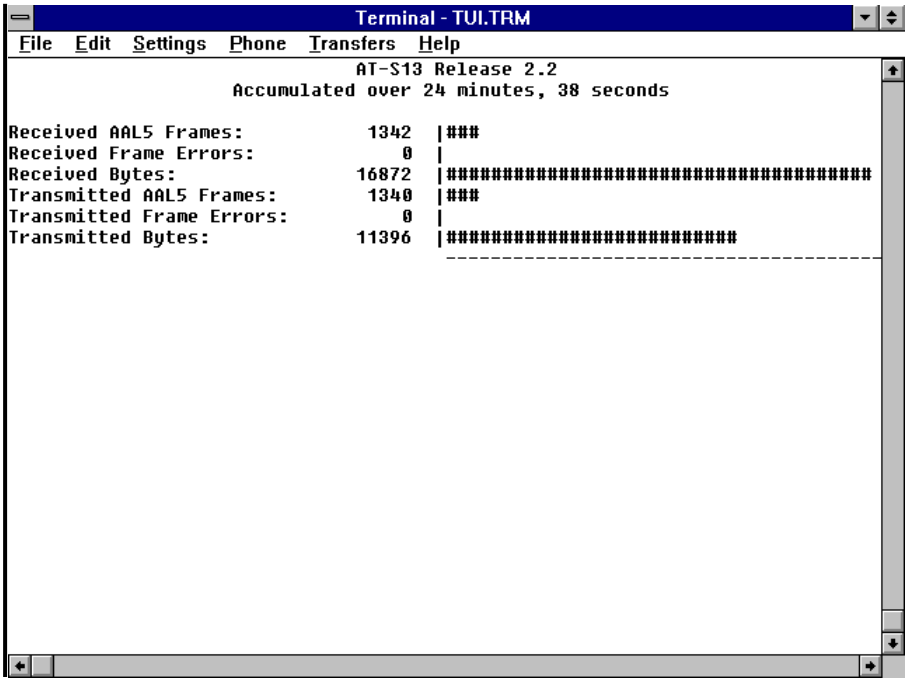
- VCI - All active Virtual Channel Identifier connections associated with this switch are listed in this column.
- Type - The type of VCI connection is listed in this column. This column defines one of three (3) VCI connections:
  - — Control - A bi-directional connection to the LES which may include Signalling (indicates that this connection complies with the Q.2931 standard) and LECS Control (is the control circuit, either direct or distributed, used to connect the LECS to your AT-4016TR?).
  - — Broadcast - A bi-directional connection to the BUS
  - — Data Direct - A bi-directional connection to your AT-4016TR
- ELAN - The name of the ELAN associated with this VCI is listed in this column.

NOTE

VCI number 65 does not have an associated ELAN name but is used as a connection to your LECS.

To view additional VCI information in the VCI Statistics Menu, enter an active VCI number and press return.

This menu displays statistics for the VCI you specified. Again, Fields in this menu cannot be configured.



This VCI Statistics menu provides the following information:

- Received AAL5 Frames - The total number of AAL5 frames received by this switch from the specified VCI
- Received Frame Errors - The total number of frame errors received by this switch from the specified VCI
- Received Bytes - The total number of bytes received by this switch from the specified VCI
- Transmitted AAL5 Frames - The total number of AAL5 frames transmitted from this switch to the specified VCI
- Transmitted Frame Errors - The total number of frame errors transmitted from this switch to the specified VCI
- Transmitted Bytes - The total number of bytes transmitted from this switch to the specified VCI

NOTE

All switch statistics are reset by either selecting the *Zero all statistics counters on the entire system* option from any statistics menu or by disrupting power to the switch.

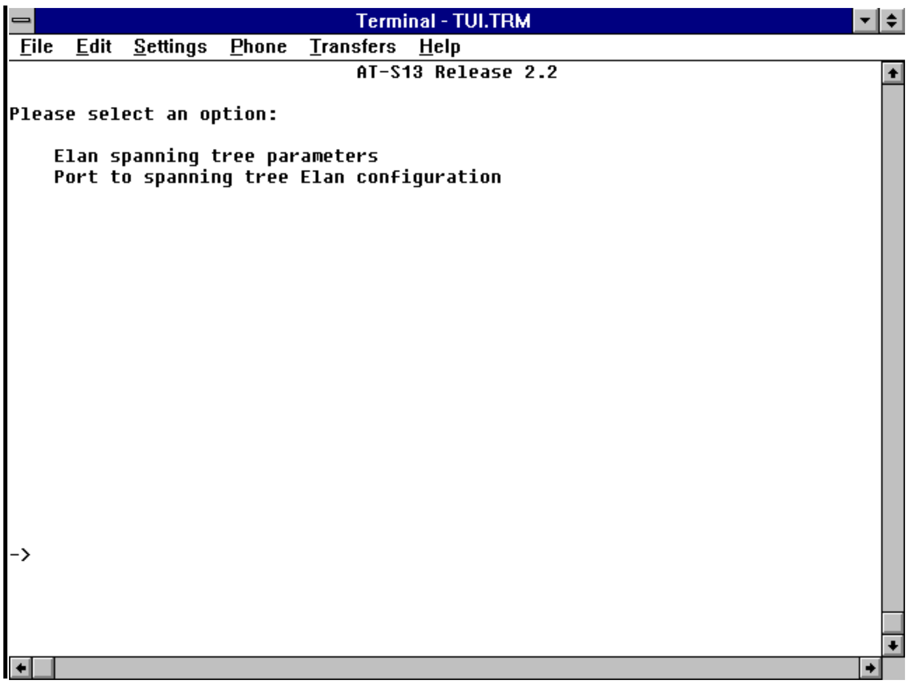
Chapter 5

Spanning Tree Protocol

Spanning Tree

The IEEE 802.1d Spanning Tree Protocol (STP) is both a configuration algorithm and a protocol. When STP is applied to a bridged LAN of arbitrary topology, it will reduce the topology to a single Spanning Tree. This ensures that there is only one data route between two end stations and that there are no data loops.

When you select **`Bridging`** from the **`Main menu`**, the following screen appears:



ELAN Spanning Tree Parameters

Your switch, along with other Spanning Tree compliant bridges in the network, dynamically configures 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.

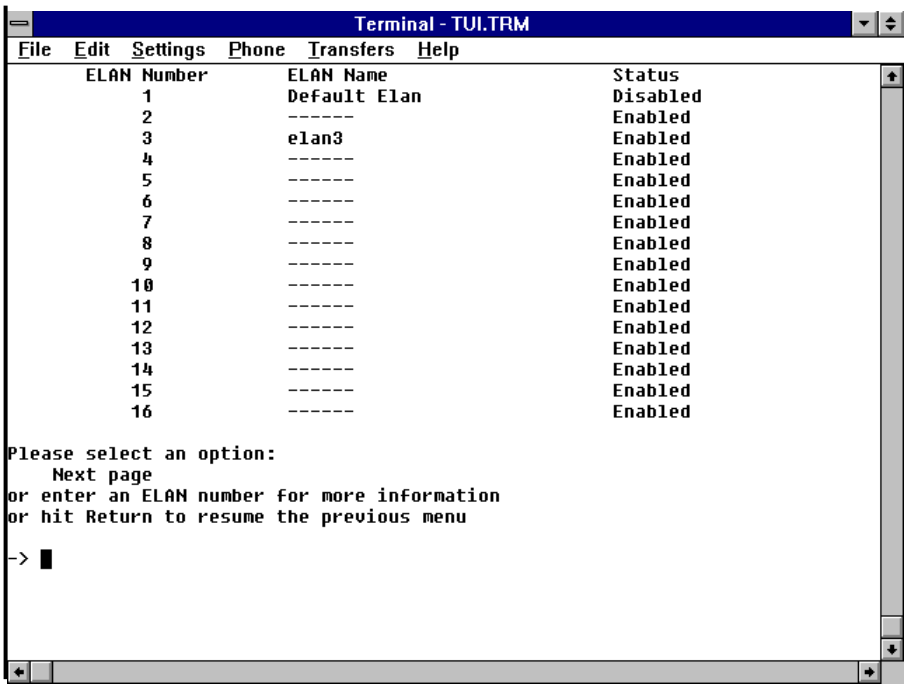
When there are multiple ports connecting LANs in a loop, the Spanning Tree algorithm determines which port should forward packets to the LAN. If there is a cable break or a port failure, the network topology is automatically reconfigured by STP to create an alternate path to the LAN.

When you select the Elan spanning tree parameters option the following menu, with three informational columns, will appear:

ELAN Number: 1 through 64

ELAN Name: Either the default or a name assigned by you.

Status: Enabled (Blocking, Listening, Learning, Forwarding) and Disabled



Status

The Status column shows the current state of the LECs ports as defined by the application of the Spanning Tree Protocol. Status controls the action an ELAN takes, if any, when a frame is received and applied to the ATM port for that ELAN.

Enabled. Enabled indicates a port that is currently forwarding frames — a ready (but not necessarily currently active) — port.

A port enters the blocking state because it has received information that another bridge is the designated bridge for the LAN to which the port is attached.

- **Blocking** indicates a port that is NOT PARTICIPATING in forwarding frames thusly preventing the creation of multiple topology paths. Received frames are discarded and frames are not submitted for transmission. Station locations are not added to the database.
- **Listening** A port in this state is PREPARING TO PARTICIPATE in frame relay but is temporarily disabled to prevent temporary loops. Learning is *disabled* since changes in the active topology may lead to incorrect information when the active topology becomes stable.

  Received frames are discarded and frames are not submitted for transmission. Station location information *is not* added to the database
- **Learning** indicates a port is PREPARING TO PARTICIPATE in frame relay but it is temporarily disabled in order to prevent temporary loops. Learning is *enabled* to allow information to be acquired prior to frame relay in order to reduce the number of frames unnecessarily relayed.

  Received frames are discarded and frames are not submitted for transmission. Station location information *is* added to the database
- **Forwarding** indicates a port that is PARTICIPATING in frame relay. It is both forwarding and submitting frames. The learning process incorporates station location information into the filtering database.

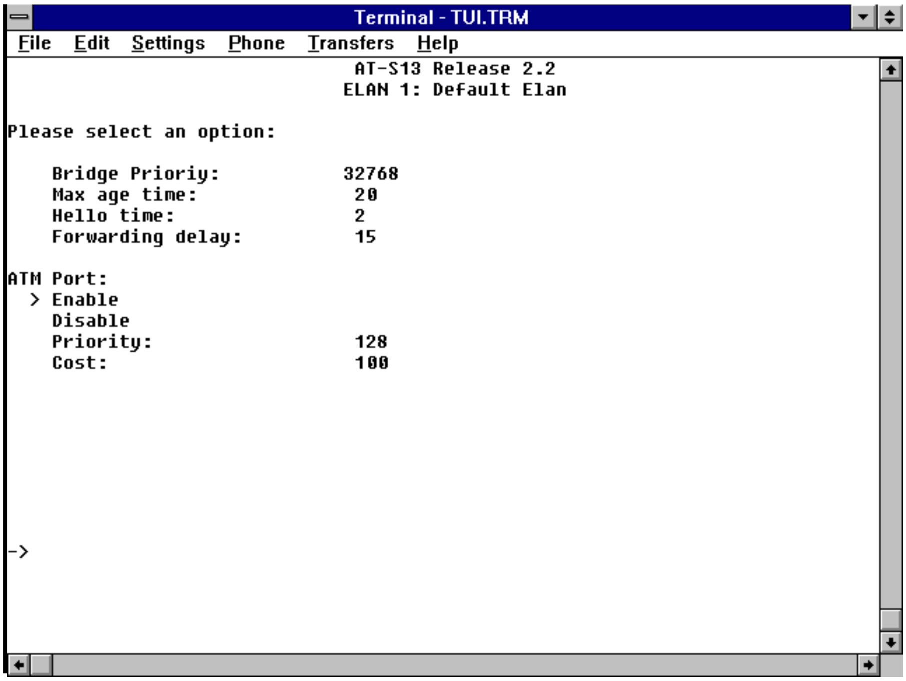
  Received BPDUs will be submitted for transmission. They will also be processed as required by the STP algorithm.

Disabled. Disabled indicates a port that is NOT PARTICIPATING in frame relay. Nor is it participating in the operation of the STP algorithm and protocol.

Received frames *are* discarded. Submitted frames *are not* forwarded for transmission.

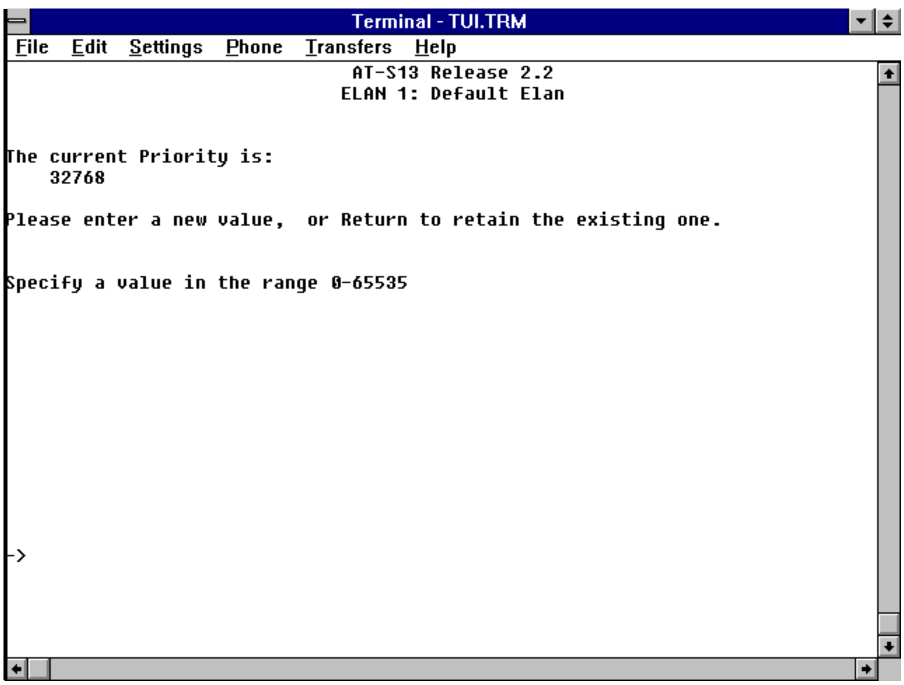
Disabled is left when the port is enabled by management action and the blocking state is entered.

If, for example, you select ELAN 1, the following screen appears:



Bridge Priority

When you select “Bridge Priority”, the following screen appears:

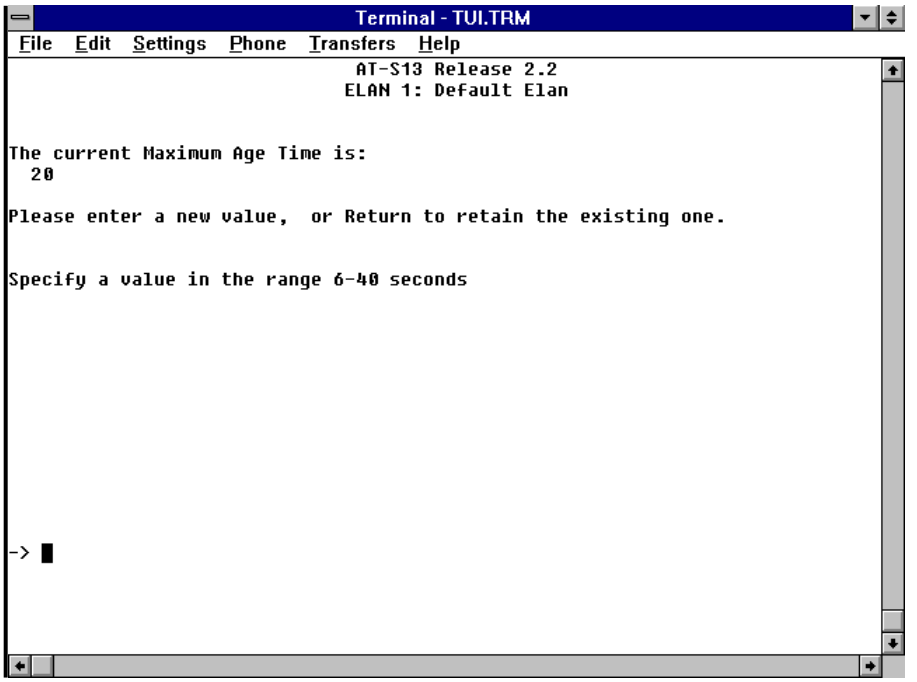


Bridge priority is used by the Spanning Tree algorithm to determine the root bridge. It consists of a two-byte bridge priority concatenated with a 6-byte MAC address.

You can set the bridge priority by entering a decimal number from 0 to 65,535. Zero being the highest priority.

Max Age Time

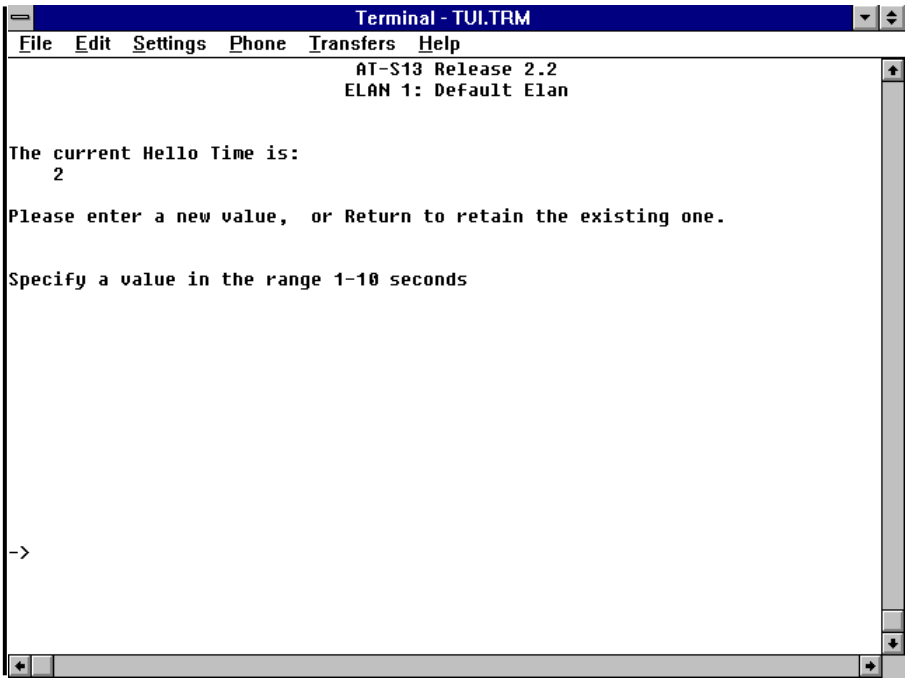
When you select “Max age time,” the following screen appears:



The maximum age time is the received bridge protocol information before it is discarded, in seconds.

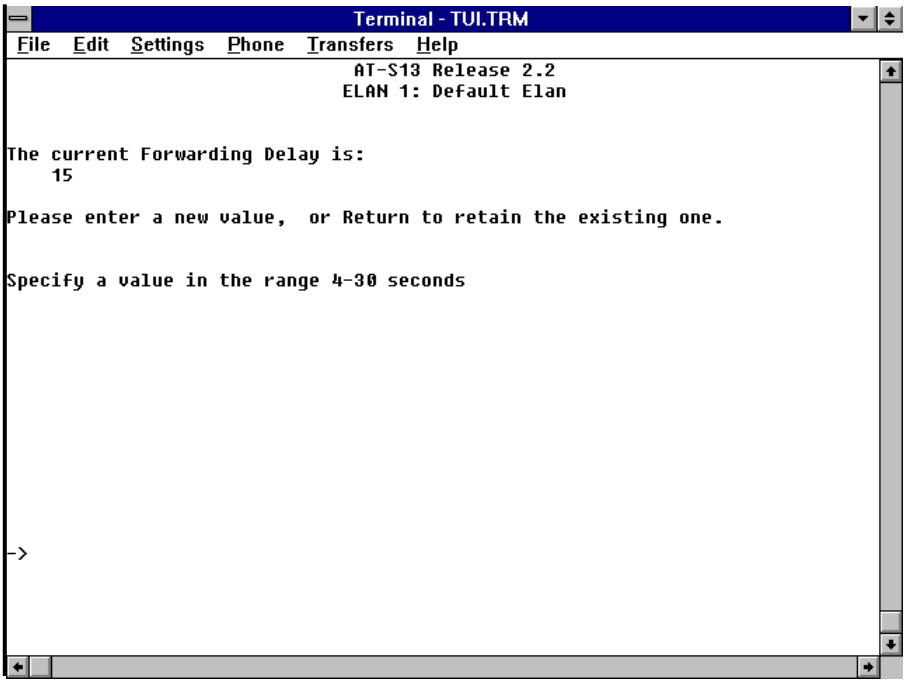
Hello Time

When you select “Hello time,” the following screen appears:



Forwarding Delay

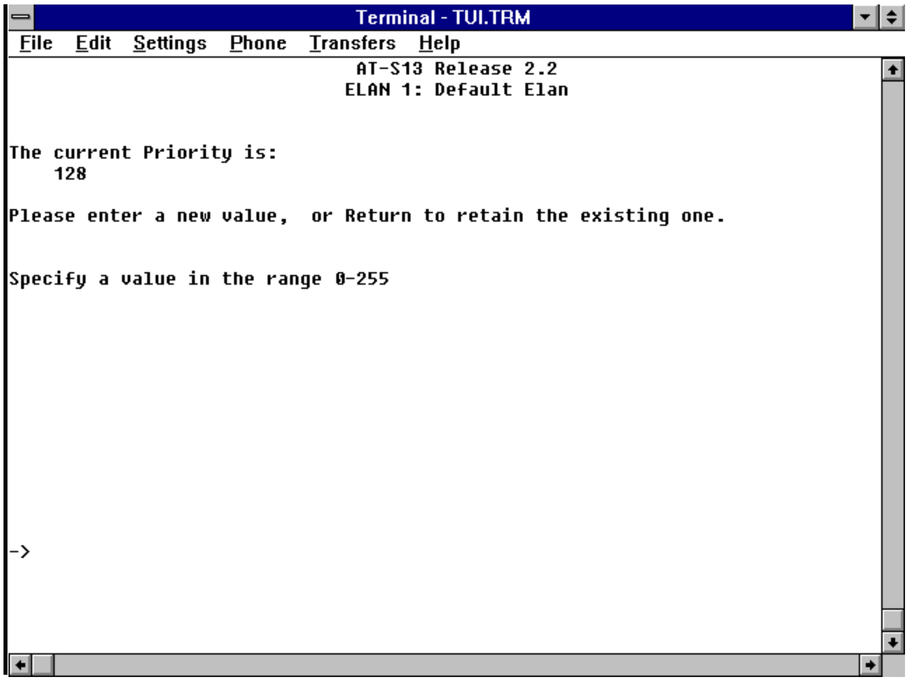
When you select “Forwarding delay,” the following screen appears:



Forwarding delay is the amount of time that controls how fast a port stays in each of the Listening and Learning states. This value is also used to age out all dynamic entries in the database when a topology change has been detected and is underway.

ATM Port - Enable/ Disable/Priority

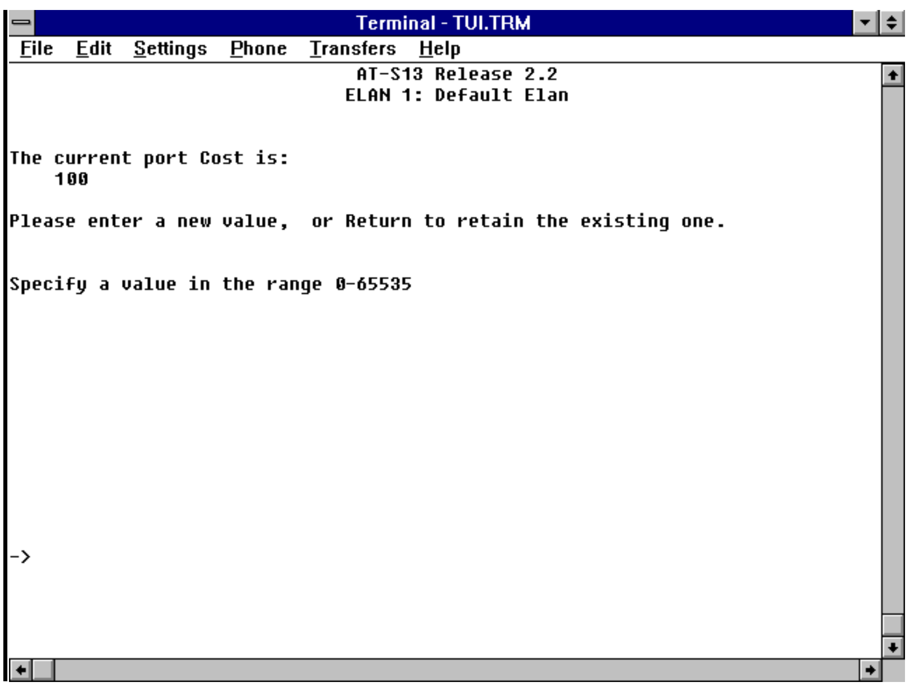
ATM Port Enable/Disable either enables or disables the Spanning Tree for the ATM port. When you select “ATM Port - Priority,” the following screen appears:



You can set the port priority by entering a decimal number from 0 to 255. Zero is the highest priority.

ATM Port - Cost

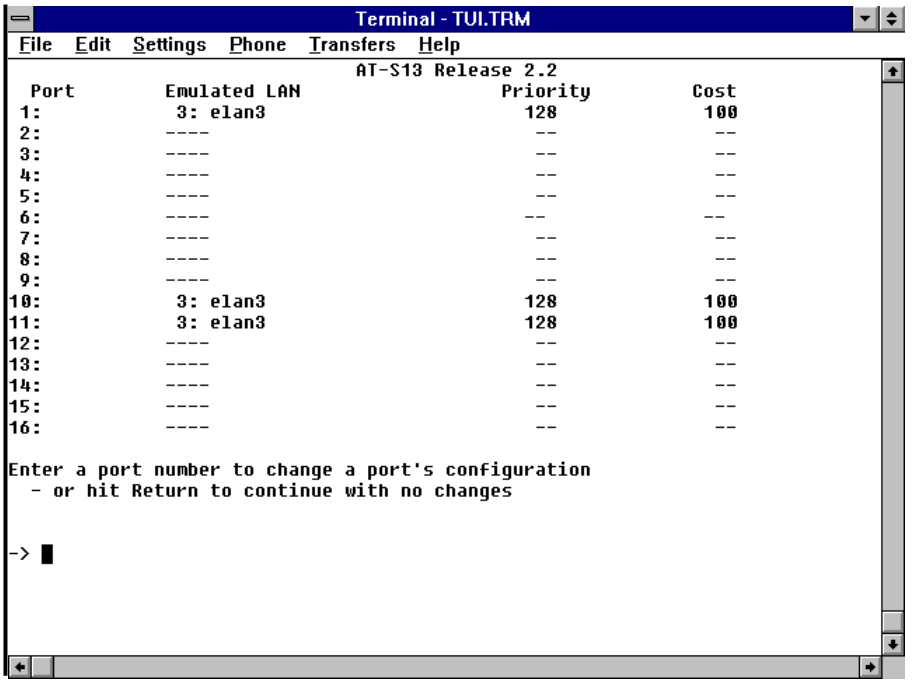
When you select “ATM Port - Cost,” the following screen appears:



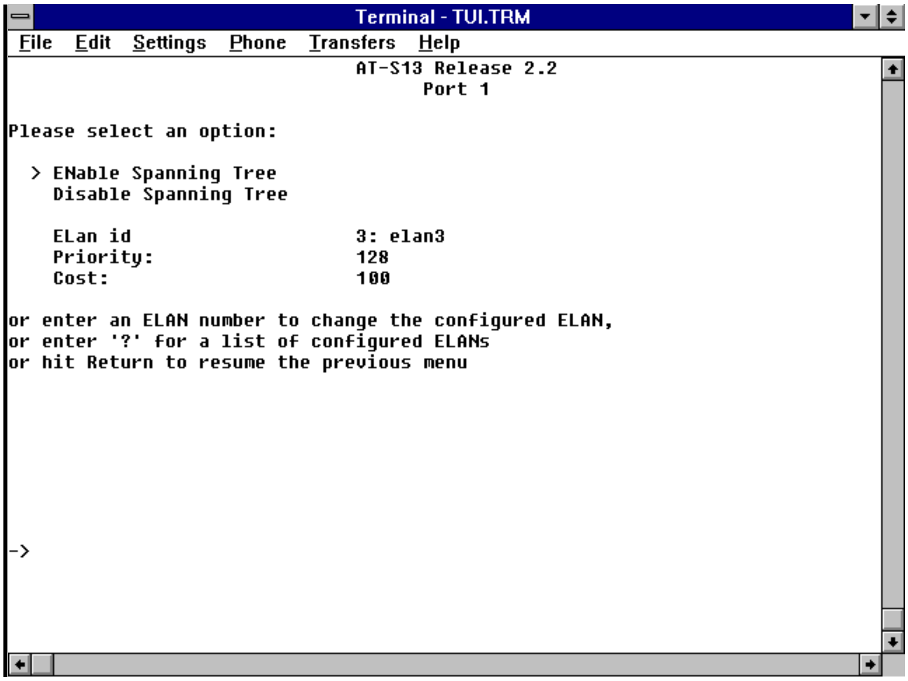
ATM Port Cost is the cost of the path to the root as seen from the port. This 2-Byte port cost is concatenated with a 6-byte MAC address and can be specified by entering a decimal number between 0 and 65,535.

Port To Spanning Tree ELAN Configuration

Returning to the **Bridging** menu, select “Port to spanning tree Elan configuration.”



If you select a particular port (Port #1 in this instance), the following screen appears:



This menu allows you to either enable or disable the Spanning Tree Protocol for the port. It also allows you to view the ELAN identification (name) as well as the priority and cost for that ELAN.

Chapter 6
Software

To Obtain New or Upgraded Software

There are several ways to obtain new or upgraded software:

- PCMCIA — through Allied Telesyn's *optional* AT-S13/AT-S14 PCMCIA card
- EPROM Cassette — through Allied Telesyn's *optional* AT-S16 Firmware Cassette
- FTP Server
- TFTP — using Allied Telesyn's Omega Manager which is an on-line TCP/IP family TFTP file transfer procedure
- 24-hour On-line BBS
- Internet
- CompuServe

The procedures and telephone numbers for ATI's BBS, Internet and CompuServe were presented in the Preface.

NOTE

During the downloading process to the switch, the system will not function. While the download is taking place, the user interface becomes inoperable, SNMP requests will not be honored, and packet traffic to or from the Ethernet ports is suspended. Normal system operation will resume after the download is completed.

PCMCIA

Allied Telesyn offers Omega management software for the AT-4016TR and the AT-4016F on a firmware PCMCIA card, the AT-S13 and the AT-S14 respectively.

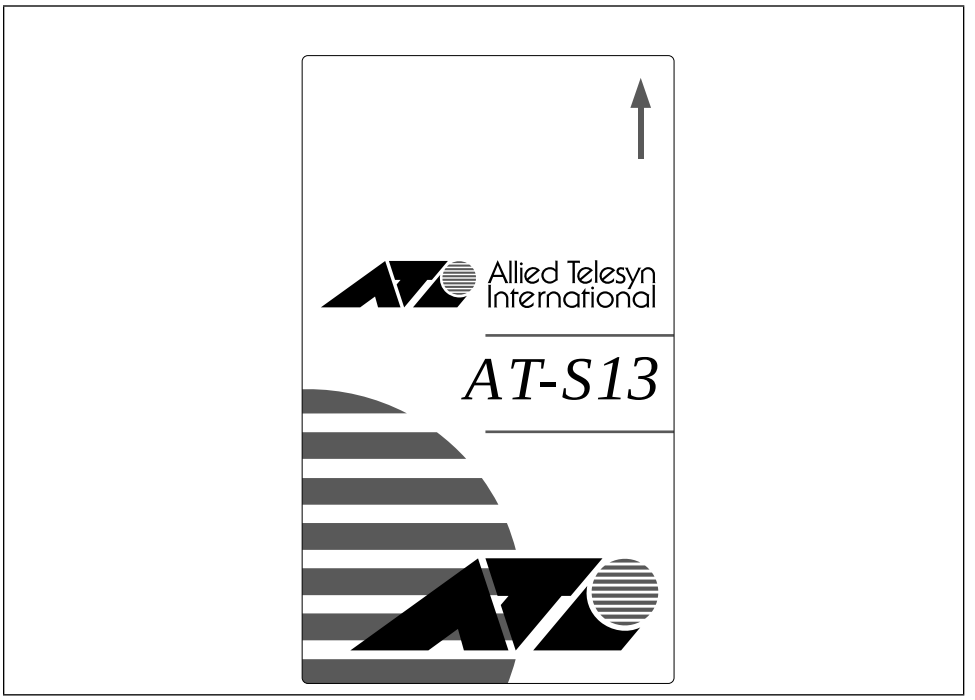


Figure 6: AT-S13 PCMCIA Card

PCMCIA Port. The PCMCIA card is a read-only interface used for restoring or updating software. If a PCMCIA card is installed before a reset or power-up sequence, the switch boots from the PCMCIA card. Otherwise, it boots from internal Flash RAM.

To update software through the PCMCIA port:

1. Insert the PCMCIA card into the PCMCIA port. This port is located on the front panel of the AT-4016TR and the AT-4016F and identified as such.
2. Reset the unit with either the reset button located on the front panel or the reset option in Omega management software.
3. During this process the red Alarm LED will display while the LEDs will cycle through the Network Load LED. When the LEDs return to normal operation, the update is complete.
4. Remove the PCMCIA card.
5. Reset the unit again. This will allow the system to boot from flash memory.

The new firmware will be copied to the switching system's onboard nonvolatile flash memory.

NOTE

Your system must be reset before any software modifications will be recognized. This can be accomplished by physically disrupting power to the switch or by using the software reset.

Firmware Cassette

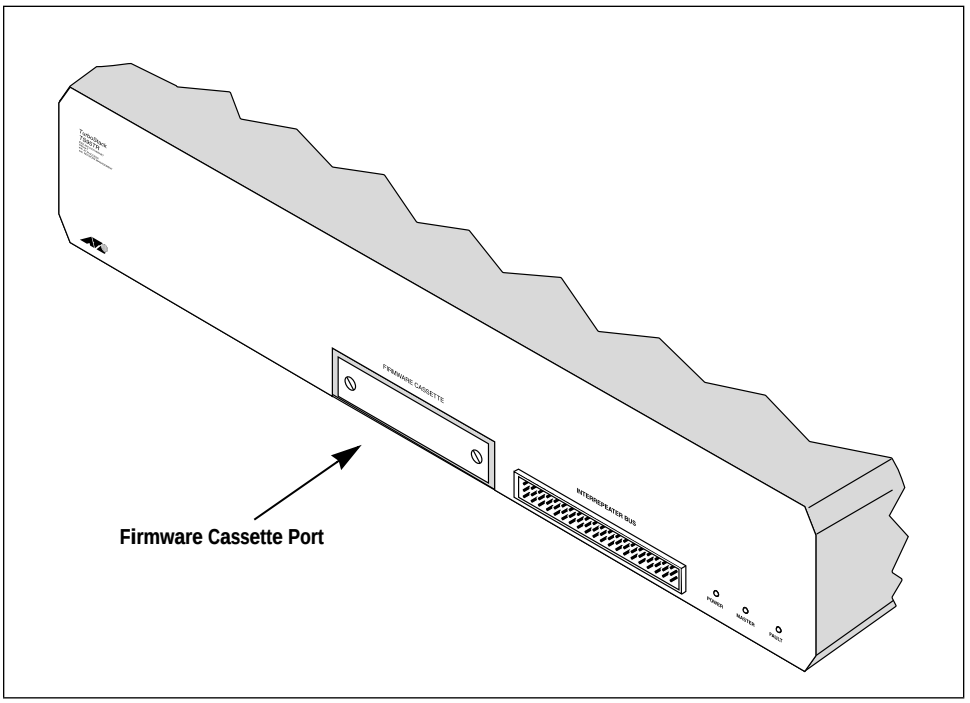


Figure 7: AT-S16 Firmware Cassette Port

Firmware Cassette Port. AT-TS95TR agent software is easy to upgrade through the Firmware Cassette port (see Figure 7).

The Firmware Cassette is a read-only interface used for restoring or updating software. If a Firmware Cassette is installed before a reset or power-up sequence, the AT-TS95TR boots from the Firmware Cassette. Otherwise, it boots from internal Flash RAM.

To update software through the Firmware Cassette:

1. Remove power from the switch.
2. Insert the Firmware Cassette into the Firmware Cassette port. This port is located on the rear panel of the AT-TS95TR and identified as such.
3. Restore power to the switch.
4. Reset the unit with either the reset button located on the front panel or the reset option in Omega management software.
5. When the LEDs return to normal operation, the update is complete. During this process the red Alarm LED will display while the LEDs will cycle through the Network Load LED.
6. Remove power from the switch.
7. Remove the Firmware Cassette.
8. Restore power to the switch.
9. Reset the unit again using software reset. This will allow the system to boot from flash memory.

The new firmware will be copied to the switching system's onboard nonvolatile flash memory.

FTP Server

Allied Telesyn has Internet access to an FTP Server for driver and Readme files on our adapter cards and managed products. The server can be accessed through your Internet connection as follows (note — use lower case letters):

Address	gateway.centre.com [lowercase letters]
Login	anonymous [lowercase letters]
Password	your e-mail address [requested by the server when you login]

The first thing you should do once you access the server is to read the CONTENTS.TXT file. This is a directory of what files are available and where they are located. All files are compressed and self-extracting; you can open them by simply typing the file name (most self-extracting files include multiple drivers, README and support files for specific operating systems). A file called TECHSUPP.ORT lists the Technical Support telephone numbers.

For example, the files as shown below are typical:

- ATHUB.MIB 154,469 07/14/94 | 3100 HUB MIB; RFC1368 & MIB II
- DwnLds:33 Last DL: 07/14/94 | software.
- Omega.ZIP 165,427 08/24/92 | A stand-alone demo of the Omega management DwnLds: 42 Last DL: 07/14/94 | software.

Once you obtain a new version of software from the Internet Server or BBS, use TFTP (discussed next) to load the software.

TFTP

Software can also be downloaded using the Trivial File Transfer Protocol (TFTP) and ATI's image file. A complete discussion of TFTP procedures is contained in Appendix A and you are referred to that information.

Appendix A
TFTP

Background

Software can be downloaded using the Trivial File Transfer Protocol (TFTP) and ATI's image file. ATI's switches support the use of TFTP in ASCII mode to both upload configuration parameters to a host and/or download configuration parameters to a switch.

What this means is straightforward: you can save configuration data from many switches to a single host. TFTP also allows you to change the configuration parameters of all switches easily through the use of an editor and a batch file. Switches can even be reset to the factory default configuration, if needed. Finally, using defined keywords, any configured parameter can be changed once the switch has a configured IP address.

To use TFTP, you will need the following:

- A TCP/IP stack and a copy of the TFTP utility on your workstation
- The download password
- The name of the file on the remote host
- The IP address of the remote host (the switch)
- The local filename (or image filename)

While TFTP utilities vary from vendor to vendor as does the TFTP syntax, the general form of the command line is as follows:

tftp <direction> <localfile> <hostIP> <downloaded password> <mode>

where:

tftp	invokes the utility
direction	specifies which way the file is being transferred: get or put
localfile	specifies name of file on your workstation
hostIP	specifies source or destination address
hostfile	specifies name of file on the remote host (download password)
mode	specifies the file transfer mode: ascii or octet

TFTP Configuration Data Requirements

The following information lists the configuration field and the required character string that precedes the user configuration value that has been chosen. Each configuration field data text string entry must be separated from the previous and the following by new line character sequence, i.e., carriage return (0x0D hex) or carriage return/linefeed (0x0D 0x0A hex) character combination. Without this delineation, the configuration of the fields will not occur. The general format of these configuration field strings is:

FIELD IDENTIFIER = VALUE

Where FIELD IDENTIFIER is specified to the left of the = (or: which is also allowed) followed by the VALUE.

For example, if you wanted to change the baud rate to 9600:

BAUD = 9600

Text strings must be surrounded by double quotes!

For example if you want port 7 to be designated 'computer room' then:

PORT NAME = 7 "COMPUTER ROOM"

BAUD = 9600

If the FIELD is multi-dimensional such as PORT_NAME (which has up to 16 ports), use the designating number followed by "=" and then the value.

For example:

PORT NAME [1] = "Port Number 1"

or

ELAN NAME [2] = "Elan Two"

One, or all, configuration fields can be used in a TFTP configuration file for downloading purposes. When a given configuration file is not to be downloaded, the default or previously entered configuration data for that field will remain active.

Text strings require the double quote ("") character. When a character string is to be removed, enter a NULL STRING. A NULL STRING is defined as two consecutive double quotes ("") which will be interpreted as a string length of zero.

In the configuration field examples that follow, there are numerous fields that do not have double quotes around the value that is to be entered. These are "defined" as constant fields. The allowable constant values are listed for each field. The use of quotes around the constant value will cause this field setting to be ignored.

An image file uses a binary format. Configuration data uses an ASCII format. The switch, however, has the ability to differentiate between the two formats and, once differentiated, accepts and places this data in the correct place.

NOTE

Not all configuration fields apply to all products. This file includes configuration data for the AT-S6 (AT-3690), AT-S7 (AT-4016 with PVC's), AT-S9 (AT-TS95TR) with PVC's and AT-S13/AT-S14 (AT-4016TR and AT-4016F with SVC's) and the AT-S16 (AT-TS95TR with SVC's). Exceptions are noted.

Get

To obtain a current image for an AT-4016TR, AT-4016F, or AT-TS95TR respectively, enter either:

tftp get image.s13 (MAC address) AT4016 octet (or)

tftp get image.s14 (MAC address) AT4016 octet

tftp get image.s16 (MAC address) ATTS95 octet

The switch will respond to a TFTP "get" request by transferring an image file of the software currently executing in that unit to the requesting host. This enables you to download the software onto another host system.

The host computer should then save the uploaded binary program image into a file without otherwise modifying it in any way.

When you receive a "get" file from a device that has had its default configuration values changed, you receive only those parameters, not the entire configuration.

Put

A TFTP configuration field "put" file involves the use of any, or all, configuration parameters.

To download the image file for an AT-4016TR, AT-4016F, or AT-TS95TR respectively:

tftp put image.s13 (MAC address) AT4016 octet (or)

tftp put image.s14 (MAC address) AT4016 octet

tftp put image.s16 (MAC address) ATTS95 octet

Once the file is placed on the switch, downloading procedures are initiated.

The switch responds to a TFTP 'put' request by accepting program data from the sending host. The system will write the new program image into its non-volatile memory. When the TFTP session is complete, the system will reboot itself and begin executing the new program.

NOTE

The switch will not accept a TFTP "put" request if a PCMCIA card or Firmware Cassette is installed.

When you use TFTP, the file name for the switch must be the same as the downloaded password. For example, if you had changed the default download password to ALLIED, and the configuration file on your PC was NEWCONF, your TFTP command line might look like the following:

TFTP PUT NEWCONF 135.24.35.122 ALLIED ASCII

General System Configuration

Description	FIELD IDENTIFIER and VALUEs
Terminal Baud Rate:	BAUD = 19200
Allowable configuration data:	AUTO, 192000, 9600, 4800, 2400, 1200, 600, 300, 150, 75
Default Value:	AUTO
Terminal Parity:	PARITY = NONE
Allowable configuration data:	NONE, ODD, EVEN, MARK, SPACE
Default Value:	NONE
Terminal Type:	TERM TYPE = VT100
Allowable configuration data:	DUMB, VT100, USER
Default Value:	DUMB
Terminal Character Echo:	CHAR ECHO = ECHO
Allowable configuration data:	ECHO, NO_ECHO
Default Value:	ECHO
Terminal Cursor Home Position	
Control Character Sequence:	HOME CURSOR = “XXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	NULL
Terminal Clear Screen Control	
Character Sequence:	CLR SCREEN SEQ = “XXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	NULL STRING

Terminal Clear Line Control

Character Sequence:	CLR LINE SEQ = “XXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	NULL STRING

IP Address:	IP ADDR = XXX.XXX.XXX.XXX
Allowable configuration data:	Four numeric values separated by (.) ranging from 0 - 255.
Default Value:	00.00.00.00

Subnet Mask:	SUBNET MASK = XXX.XXX.XXX.XXX
Allowable configuration data:	Four numeric values separated by (.) ranging from 0 - 255.
Default Value:	00.00.00.00

Router Address:	DEFAULT GW = XXX.XXX.XXX.XXX
Allowable configuration data:	Four numeric values separated by (.) ranging from 0 - 255.
Default Value:	00.00.00.00

Manager Address:	MNGR ADDR = 1 XXX.XXX.XXX.XXX MNGR ADDR = 2 XXX.XXX.XXX.XXX MNGR ADDR = 3 XXX.XXX.XXX.XXX MNGR ADDR = 4 XXX.XXX.XXX.XXX
Allowable configuration data:	Four numeric values separated by (.) ranging from 0 - 255.
Default Value:	00.00.00.00
SNMP Get String:	GET STRING = “XXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	“public”

SNMP Set String:	SET STRING = “XXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	“private”

SNMP Trap String:	TRAP STRING = “XXXXXXXXXXXXXXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	“public”
System Location:	SYS LOCATION = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of sixty-four (64) ASCII characters
Default Value:	NULL STRING
System Contact:	SYS CONTACT = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of sixty-four (64) ASCII characters
Default Value:	NULL STRING
Omega Time-out:	SYS TIMEOUT = XXXX
Allowable configuration data:	A numeric value ranging from 0 - 16384
Default Value:	0
System Password:	SYS PASSWORD = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	NULL STRING
Download Password:	DOWNLOAD PASSWORD = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
System Name:	SYSTEM NAME = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII characters
Default Value:	NULL STRING
Port Name:	PORT NAME = 1 “XXXXXXXX.....XXXXXXXX”
	PORT NAME = 2 “XXXXXXXX.....XXXXXXXX”
	:
	:
	:

	PORT NAME = 16 “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of twenty (20) ASCII character name NOT INCLUDING the port number
Default Value:	NULL STRING
System Configuration Reset:	RESET TO SYSTEM DEFAULTS
Allowable configuration data:	NONE. When this field identifier is received, the systems configuration data will be set to its default value.

ATM Configuration

Description	FIELD IDENTIFIER and VALUEs
System ATM Address:	SYSTEM ATM ADDRESS = “XXXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of forty (40) ASCII digits
Default Value:	NULL STRING
Exceptions:	For PVC systems only
System VPI	SYSTEM VPI = XXXX
Allowable configuration data:	A numeric value ranging from 0 - 255
Default Value:	0
Exceptions:	For PVC systems only
System ATM Framing	ATM FRAMING = SONET
Allowable configuration data:	SONET, SDH
Default Value:	SONET
Exceptions:	For ATM systems only
System ATM Clocking	ATM CLOCKING = INTERNAL
Allowable configuration data:	INTERNAL, EXTERNAL
Default Value:	INTERNAL
Exceptions:	For ATM systems only

System ATM UNI Signaling	ATM SIGNALING = UNI
Allowable configuration data:	3.0, 3.1
Default Value:	UNI 3.0
Exceptions:	For ATM systems only
System ATM Transmitter Idle	ATM TRANSMITTER IDLE = IDLE CELLS
Allowable configuration data:	IDLE CELLS, UNASIGNED CELLS
Default Value:	IDLE CELLS
Exceptions:	For ATM systems only

Ethernet Configuration

Description	FIELD IDENTIFIER and VALUEs
System Ethernet Forwarding Mode	FORWARDING = STORE AND FORWARD
Allowable configuration data:	STORE AND FORWARD, CUT THROUGH
Default Value:	STORE AND FORWARD
System Ethernet LED Mode Indication	LED MODE = TRANSMIT
Allowable configuration data:	TRANSMIT, COLLISION
Default Value:	COLLISION

Spanning Tree Configuration

Description	FIELD IDENTIFIER and VALUEs
Spanning Tree Bridge Priority:	ST BRIDGE_PRIORITY [1] = 65535 ([Bridge number] = value) ST BRIDGE_PRIORITY [2] = 65535 : : ST_BRIDGE PRIORITY [64] = 65535
Allowable configuration data:	A numeric value ranging from 0 - 65535
Default Value:	65535

Bridge Age Time:	ST AGE_TIME [1] = 20 ([Bridge number] = value) ST AGE_TIME [2] = 20 : : ST AGE TIME [64] = 20
Allowable configuration data:	A numeric value ranging from 6 - 40
Default Value:	20
Bridge Hello Time:	ST HELLO TIME [1] = 2 ([Bridge number] = value) ST HELLO TIME [2] = 2 : : ST HELLO TIME [64] = 2 Allowable configuration data: A numeric value ranging from 0 - 10
Default Value:	2
Bridge Forwarding Delay:	ST FWD DELAY [1] = 15 ([Bridge number] = value) ST FWD DELAY [2] = 15 : : ST FWD DELAY [64] = 15
Allowable configuration data:	A numeric value ranging from 4 - 30
Default Value:	15
Bridge ATM State:	ST ATM STATE [1] = DISABLED ([Bridge number] = value) ST ATM STATE [2] = DISABLED : : ST ATM ADMIN STATE [64] = DISABLED
Allowable configuration data:	DISABLED, ENABLED
Default Value:	DISABLED

ATM Port Priority:	ST ATM PORT-PRIORITY [1] = 128 ([Bridge number] = value)
	ST TM PORT-PRIORITY [2] = 128
	:
	:
	ST ATM PORT-PRIORITY [64] = 128
Allowable configuration data:	A numeric value ranging from 0 - 255
Default Value:	128
ATM Port Cost:	ST ATM PORT COST [1] = 6 ([Bridge number] = value)
	ST ATM PORT COST [2] = 6
	:
	:
	ST ATM PORT COST [64] = 6
Allowable configuration data:	A numeric value ranging from 0 - 65535
Default Value:	6
Spanning Tree Port to Elan:	ST PORT ELAN [1] = 1 ([Port number] = then Bridge #)
	ST PORT ELAN [2] = 1
	:
	:
	ST PORT ELAN [16] = 1
Allowable configuration data:	A numeric value ranging from 1 - 64
Default Value:	0
Spanning Tree Port Cost:	ST PORT COST [1] = 100 ([Port number] = Value)
	ST PORT COST [2] = 100
	:
	:
	:
	ST PORT COST [15] = 100
	ST PORT COST [16] = 100
Allowable configuration data:	A numeric value ranging from 1 - 65535

Default Value:	100
Spanning Tree Port Priority:	ST PORT PRIORITY [1] = 255 ([Port number] = Value) ST PORT PRIORITY [2] = 255 : : ST PORT PRIORITY [16] = 255
Allowable configuration data:	A numeric value ranging from 0 - 255
Default Value:	128
Spanning Tree Port Enabled:	ST PORT ENABLED [1] = DISABLED ([Port number] = Value) ST PORT ENABLED [2] = DISABLED : : ST PORT ENABLED [16] = DISABLED
Allowable configuration data:	DISABLED, ENABLED
Default Value:	DISABLED

ELAN/VLAN Definition

Description	FIELD IDENTIFIER and VALUEs
Elan Name:	ELAN NAME [1] = “XXXXXXX.....XXXXXXXX” ELAN NAME [2] = “XXXXXXX.....XXXXXXXX” : : ELAN NAME [64] = “XXXXXXX.....XXXXXXXX”
Allowable configuration data:	A maximum of thirty-two (32) ASCII characters
Exceptions:	For PVC systems

Port to ELAN Configuration:	PORT ELAN ID [1] = 1 ([Port number] = Elan number)
	PORT ELAN ID [2] = 2
	:
	:
	PORT ELAN ID [16] = 1
Allowable configuration data:	A port number 1 - 16 followed by an ELAN/VLAN number 1 - 64
Default Value:	Elan 1
Exceptions:	For AT-S6 and PVC systems only (AT-S7, AT-S9)
Port to ELAN Configuration Type:	PORT ELAN TYPE [1] = MAC ([VLAN number] = Config Type)
	PORT ELAN TYPE [2] = MAC
	:
	:
	PORT ELAN TYPE [64] = MAC
Allowable configuration data:	MAC, FIXED
Default Value:	MAC
PVC Administration State:	PVC ADMIN STATE [1] = DISABLED
	PVC ADMIN STATE [2] = DISABLED
	:
	:
	PVC ADMIN STATE [128] = DISABLED
Allowable configuration data:	DISABLED, ENABLED
Default Value:	DISABLED
Exceptions:	For PVC systems only
PVC VCI:	PVC VCI [1] = 100 ([PVC Number] = Value)
	PVC VCI [2] = 101
	:
	:
	PVC VCI [128] = 101

Allowable configuration data:	A number from 1 - 1023
Default Value:	0
Exceptions:	For PVC systems only
PVC ATM Address:	PVC ATM ADDRESS [1] = “XX.....XXX” ([PVC Number] = Value)
	PVC ATM ADDRESS [2] = “XX.....XXX”
	:
	:
	PVC ATM ADDRESS [128] = “XX.....XXX”
Allowable configuration data:	A maximum of forty (40) ASCII digits
Default Value:	NULL STRING
Exceptions:	For PVC Systems Only
PVC VLAN Number:	PVC VLAN [1] = 1 ([PVC Number] = Value)
	PVC VLAN [2] = 1
	:
	:
	PVC VLAN [128] = 1
Allowable configuration data:	A number from 1 - 64
Default Value:	0
Exceptions:	For PVC systems only

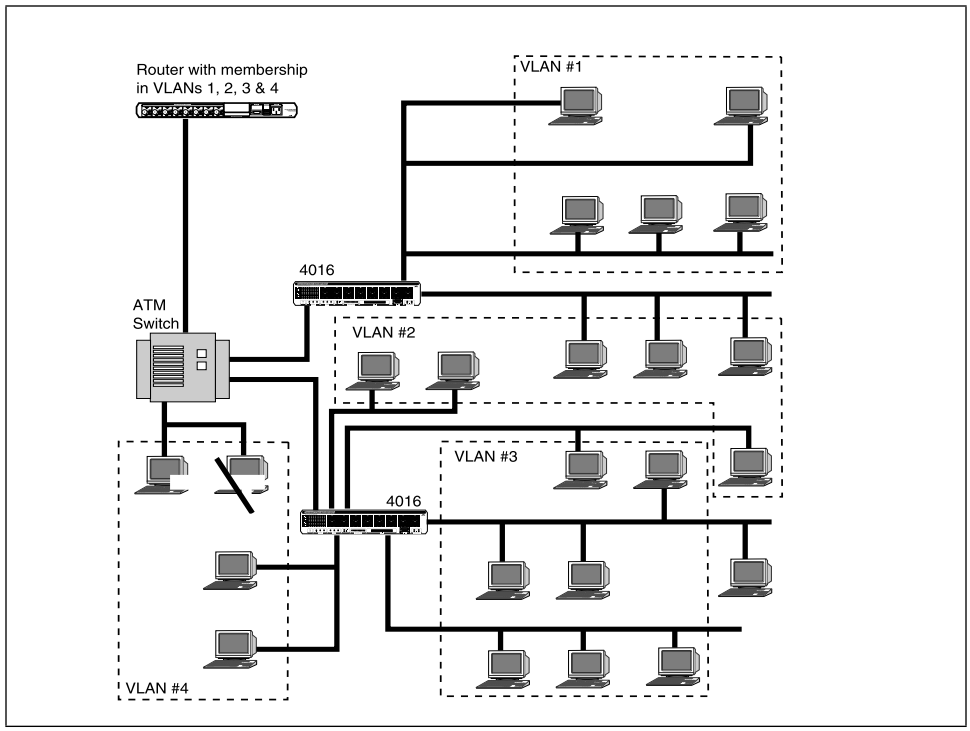
Appendix B

LAN Emulation

ATI's ATM software implements ATM Forum's Lan Emulation Client (LEC). LEC implementation, in turn, conforms to the Lan Emulation Specification 1.0. That is, your switch implements LEC functionality between a legacy Ethernet device and an ATM network. This is important since connection to the LAN Emulation Service (LES) is through LECs.

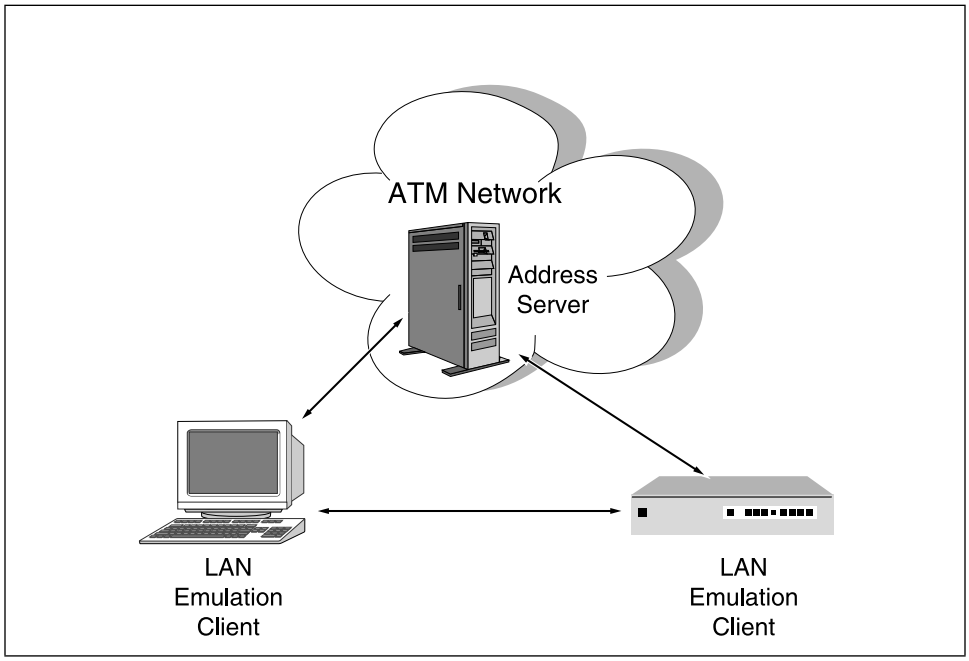
LECs are typically implemented at ATM End Stations, either as part of the software driver (between the Operating System and ATM hardware) or as part of the ATM Adapter (ATM specific hardware). This means that, essentially, your switch is an LEC.

The following illustration depicts a typical configuration that involves LAN Emulation.



That is, when a LEC is presented with a frame for transmission whose LAN destination is unknown to that client, it must issue a LAN emulation address resolution protocol request frame to the LES over its control point-to-point VCC. The ATM protocol requires a destination ATM address to set up a connection across the network. Yet most people will only “know” the MAC address of the destination.

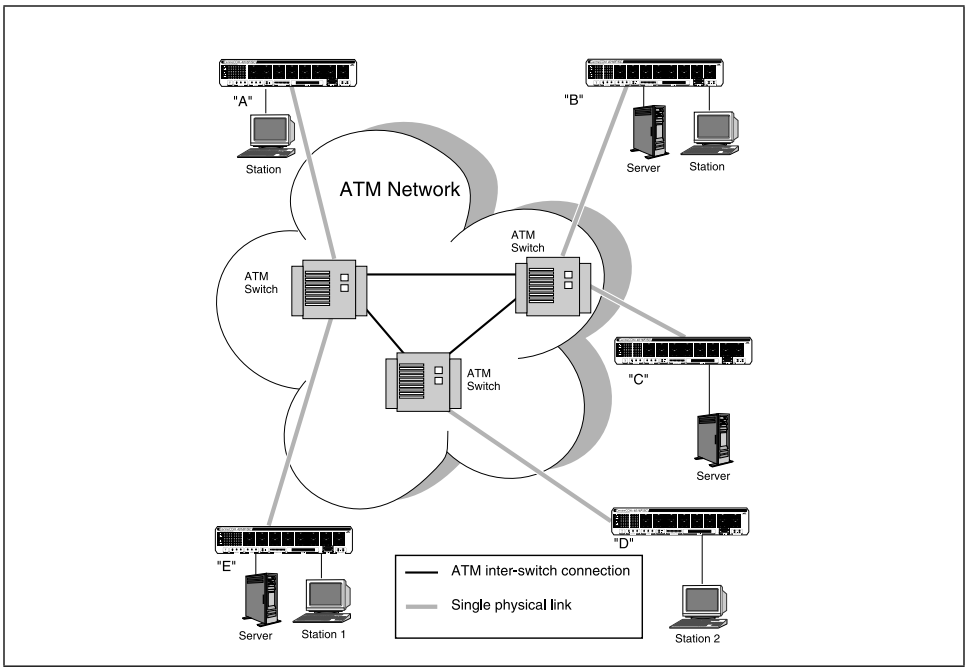
As shown in the following figure, the ATM approach used within the LAN Emulation protocol uses a LES which acts as an Address Resolution Server to help LAN Emulation clients map the MAC address into an ATM address.



LANE

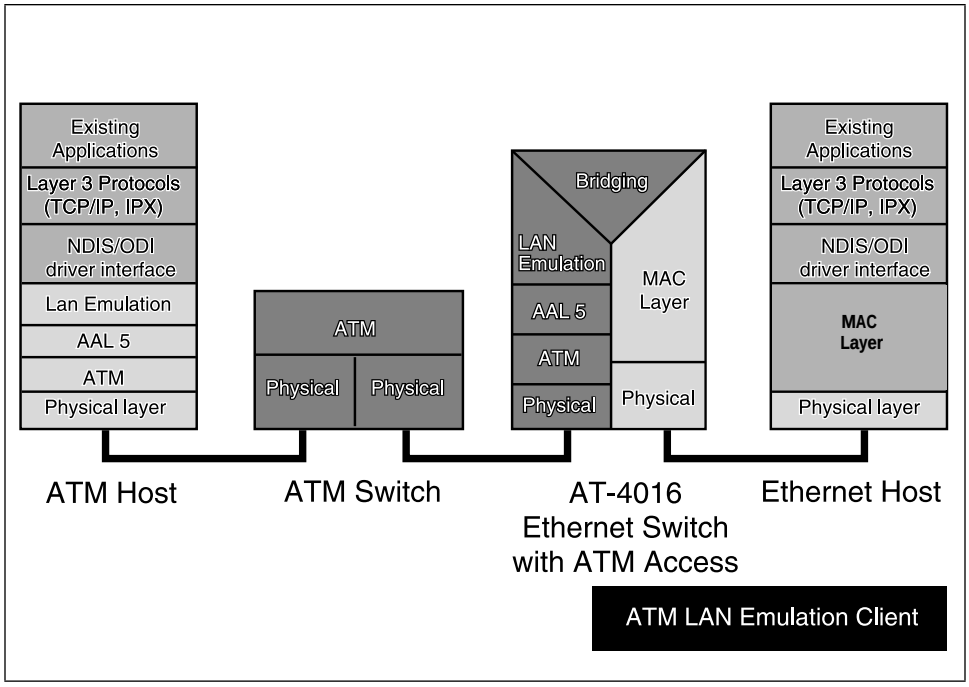
LANE allows you to create multiple different ELANs within the network.

The following diagram shows how one LAN host communicates to another LAN Host.



LANE allows existing LANs to use ATM as a transit path between similar LAN types. ATM then becomes a backbone path which, in turn, allows ATM workstations to communicate with attached LANE stations.

The following diagram shows how an Ethernet host communicates to an ATM host using LANE.



Note that, in switched virtual connection (SVC) environments, LANE entities (e.g., LEC, LES and BUS) set up connections between each other using UNI signaling and a best effort quality of service.

Components of LANE

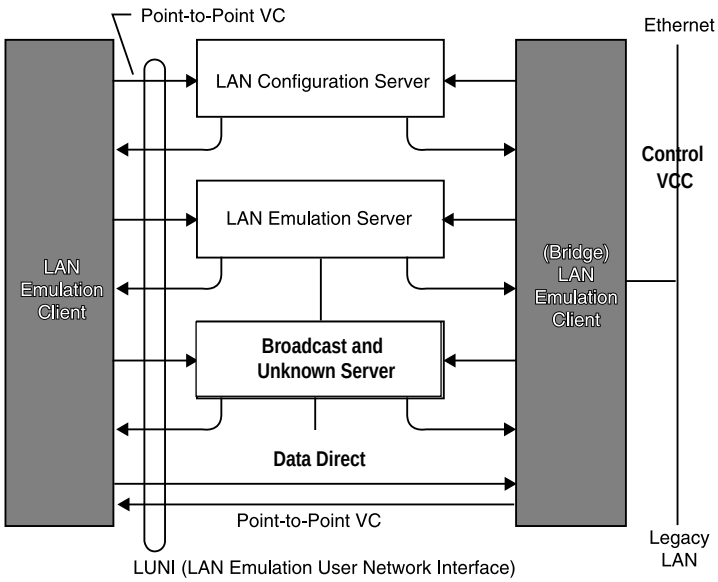
LANE has been subdivided into four major components, each of which will be discussed:

1. LAN Emulation Client (LEC)
2. LAN Emulation Services
    - — Lan Emulation Server (LES)
    - — Broadcast and Unknown Server (BUS)
    - — Lan Emulation Configuration Server (LECS)

The components of an Emulated LAN network include Clients (e.g., ATM workstations and ATM bridges) and the components of the LAN Emulation Services. Since your switch is a Lan Emulation Client, it interacts with the three components of the LAN Emulation Services (which physically reside elsewhere in the network — either in an ATM End System workstation or at the ATM switch).

LAN Emulation Client (LEC)

LEC performs address resolution, data forwarding and other control functions. It does this by providing a MAC level emulated 802.3 or 802.5 interface to higher level software such as bridging functions. LEC implements the LANE User-Network Interface (LUNI) with other entities within the Emulated LAN.



LAN Emulation Components

In short, LEC software runs on ATM End Stations and makes them appear to be Ethernet stations on the network.

Note that each ATM end-system can simultaneously be members of several Emulated LANs. In these situations the End System would contain several LECs, one for each Emulated LAN using a unique MAC address to join different ELANs.

LEC software bridges data frames between Ethernet ports on the same ELAN. In addition, bridge software will work with the LEC software to allow a LEC to respond to LANE Address Resolution Protocol (ARP) requests for end-stations behind the Ethernet interfaces and to detect changes in the topology of any bridged network that the LEC is a member.

Packets destined to cross VLANs are filtered or discarded by the bridge. A router should, therefore, be used to communicate between VLANs.

Lan Emulation Services

The LES, BUS and LECS are collectively referred to as LAN Emulation Services.

LAN Emulation Server (LES). Each LES provides Address Resolution Request (ARP) services for one ELAN. When a client joins an ELAN, the client broadcasts a 48-byte MAC address to the LES. The LES maps the MAC address to a 20-byte OSI NSAP address to create an ATM address. The new ATM address is then returned to the client. When a client requests an ATM address for a specific MAC address, it send an ATM ARP request to the LES.

Conversely, in an Ethernet LAN based network, ARP and RARP protocols are used to map a 32-bit IP address to a 48-bit Ethernet address. The ARP protocol is necessary when there is no pre-established relationship (or table) correlating an IP and Ethernet address. When a new network client is attached to a network, the client can issue a RARP broadcast ('who am I?') to a RARP server to find out its IP address. The RARP server responds to the client broadcast by returning an IP address, if known, that corresponds to the client MAC address.

The LAN Emulation Server (not a part of the switch) can be summarized as a facility that provides the registration and resolution of MAC addresses to ATM addresses. When a client wishes to join an emulated LAN, it does so through protocol processing with the LES. The LES has a bi-directional point-to-point VC coming from the LEC and unidirectional point-top-multipoint VC going to the LEC.

Initially, the LEC sets up the control VCC to the LES. After the VCC is successfully set up, it sends a join request to the LES to participate in the ELAN. That is, the LEC sets up a bi-directional point-to-point VCC to the LES for sending traffic. Next, the LES sets up a unidirectional point-to-multipoint VCC to distribute the control traffic to the LECs.

When an LEC needs to locate the ATM address for a particular MAC address it does so by sending an ATM ARP request to the Server. The LES will either respond directly to the client or forward the query to other clients for a response.

Broadcast and Unknown Server (BUS). The BUS handles data sent by an LEC to the broadcast MAC address, all multicast traffic, and initial unknown unicast frames (those that are sent by a LEC before an ATM address has been resolved or before a VCC has been established).

A BUS must always exist in the Emulated LAN and all LECs must join its distribution group.

In an SVC environment, the BUS needs to participate in the LE Address Resolution Protocol (LE_ARP) to enable a LEC to locate the BUS. The BUS also handles ATM connections and manages its distribution group.

Once a LEC has successfully joined an ELAN, it will request the LES with the BUS address to set up a connection to the BUS. If it loses this connection, it has to rejoin the ELAN. If it receives a packet with a multicast or broadcast MAC (group) address, the LEC sends the packet to the BUS which forwards it to all the other LECs in the ELAN.

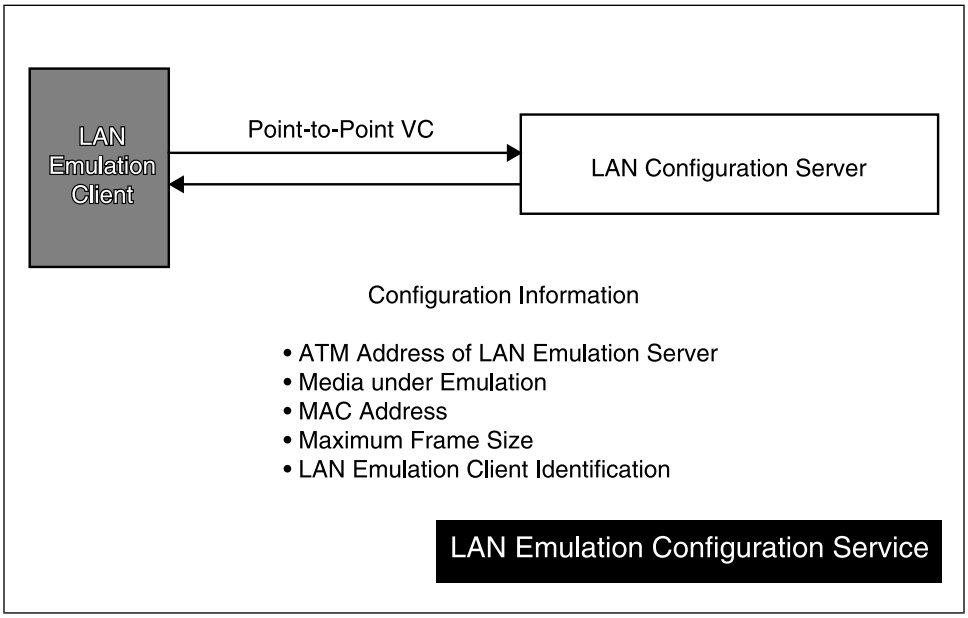
A BUS is the multicast server for an ELAN. It handles all broadcast, multicast and unknown unicast traffic. Packets to be broadcast from the LEC are sent to the BUS. The BUS then sends the packets back to all the LECs using the point-to-multipoint connection.

LECs also send packets with unknown destinations to the BUS. The BUS forwards these packets to every LEC on the ELAN, including the source LEC where the packet originated.

In the meantime, the LEC also sends an ARP request to the LES for address resolution. After the associated ATM address is resolved, the LEC sets up a data direct VCC to carry the traffic. After the data VCC is set up the following data to the destination address will be forwarded via the data VCC instead of the BUS.

LAN Emulation Configuration Server (LECS). The primary function of the LECS is to provide LES addresses to the LECs.

The LECS implements the assignment of individual LE clients to different emulated LANs. A LEC can either obtain the information from the LECS using the configuration protocol, or from its own database. It assigns any client which requests configuration information to a particular emulated LAN service by giving the client the LES's ATM address. This method supports the ability to assign a client to an emulated LAN based on the client's location (ATM address).



It is optional for the LEC to obtain information from the LECS using the configuration protocol. The LECS allows the LEC to configure automatically.

The LECS is also used to keep track of all the emulated LANs and the LECs which belong to them. When a LEC is initialized, one of its first actions is to set up a connection to the LECS. It then sends a request for its configuration, including the ATM address of the LES it should contact to join an ELAN. The database in the LECS would typically be initialized by the network administrator and managed through SNMP management applications.

SNMP is defined by RFC-1157 and published by the Internet Engineering Task Force. Full details of the ATM UNI MIB and of generic SNMP are beyond the scope of this publication. The essential parameters are, however, as follows:

- Physical layer type (SONET), medium (UTP, fiber, coaxial cable and more), unique index number, status (normal or looped) and relevant specifications.
- Number of ATM virtual paths and connections allowed. Numbers active. How much of each address field is being used.
- ATM statistics: cells received, sent or dropped. Traffic descriptors and the values that define the Sustainable Cell Rate, burst tolerance, quality of service and more.
- MIB-II system group values that are required. This includes the length of time since the last reset.

Note that while a unique LES and BUS pair must exist for each ELAN/VLAN, only one LECS is required in the network itself.

Connections

Each LEC has separate VCCs to control address resolution requests and data traffic. While each VCC carries traffic for only one ELAN, the VCCs form a mesh of connections between the LECs and the other LANE entities including the LECS, LES and the BUS.

Control Connections

LEC ↔ LECS. A Configuration Direct VCC is a bi-directional VCC set up by the LEC to be used to obtain configuration information such as the address of the LES.

LEC ↔ LES/LEC ← LES. A Control Distribute VCC means VCCs will be set up between a LEC and a LES. First, the LEC sets up a bi-directional point-to-point VCC to the LES for sending control frames. In turn, the LES may optionally set up a unidirectional point-to-point or point-to-multipoint VCC for distributing control traffic from LES to LEC.

Data Connections

Data VCCs are used to carry data frames between LECs or between an LEC and the BUS. These carry data frames as well as flush messages. Apart from flush messages, data VCCs never carry control traffic.

LEC ↔ LEC. A Data Direct VCC is set up to carry the unicast frames between two LECs. When there are data packets to send, but the ATM address of the destination MAC address is unknown, the LEC will forward the packets to the BUS to broadcast them to all devices in the ELAN and, in the meantime, query the LES of the ATM address for the destination address.

If the LES does not have the ATM address of the MAC address, it will run an address resolution protocol to resolve it. After receiving a reply with the ATM address from the LES, the LEC sets up a point-to-point VCC to that destination ATM address. After the data VCC is set up, all subsequent data will be sent over the VCC to the LAN destination.

LEC ↔ BUS. After obtaining the BUS's ATM address from the LES, a VCC LEC sets up a bi-directional Multicast Send VCC to the BUS.

Appendix C
MIBs

Management Information Base (MIB) documents are defined by the IEEE in “Requests For Comments” (RFCs). The core of the industry-standard SNMP MIB, MIB II (RFC 1213), contains general variables relating to IP, TCP, and UDP statistics for network devices such as repeaters, routers, and gateways. The MIB II client is implemented as part of Omega. Each MIB variable (managed object) has a value, either numeric or string (text). These values are stored in registers or accumulators in the switch. Many of these variables are counters that track network performance, e.g., errors or number of packets. Other variables regulate switch configuration, e.g., “turn port X Off Line” or “Enable Link Test function.”

Your switch implements other related MIB extensions as well. For more information on MIB definitions and documentation of each MIB object, refer to IEEE MIB documentation. RFCs. Other RFCs that apply to the switch include:

- RFC 792—Internet Control Message Protocol (ICMP or PING)
- RFC 783—Trivial File Transfer Protocol (TFTP)
- RFC 854—Telnet Protocol Specifications
- RFC 906—Bootstrap loading using TFTP
- RFC 951—Bootstrap Protocol (BootP)
- RFC 1157—Simple Network Management Protocol (SNMP)
- RFC 1212—Concise MIB Definition (describes ASN.1 mapping)
- RFC 1213—SNMP MIB2
- RFC 1215—SNMP Traps
- RFC 1493—Partial Bridge
- RFC 1573—SNMP MIB2
- RFC 1643—Ethernet MIB

- RFC 1695—ATM MIB
- ATM Forum—UNI (User-to-Network Interface) MIB
- ATM Forum—Interim Layer Management Interface (ILMI MIB)
- ATM Forum 94-0737R2—LAN Emulation Client

Many parameters are described by existing MIB documents. The meanings of those parameters are not always implemented exactly; instead, the parameters are treated as best as can be correlated. In addition to SNMP and TFTP, the switch employs the following protocols, as part of its software interface with an NMS:

- UDP - User Datagram Protocol, RFC 768
- IP - Internet Protocol, RFC 791
- ARP - Ethernet Address Resolution Protocol, RFC 826
- RARP - Reverse Address Resolution Protocol, RFC 903. RARP is only used when IP addresses have not been assigned

SNMP Primitives

The major software interface consists of one simple mechanism – the exchange of SNMP (Simple Network Management Protocol, RFC 1157) datagrams over any available physical media. The following restrictions apply:

1. All datagrams must obey SNMP format.
2. All datagrams must be sent via UDP and IP. Thus, all datagrams will have UDP and IP headers.
3. Datagrams may be sent over the following physical media: Ethernet/ 802.3 LAN - the datagram must have an Ethernet MAC header, with an Ethernet frame type of IP; or, the datagram must be in 802.3 format with IP-encapsulation as defined by RFC 1042.
4. The NMS must rely on IP, rather than MAC addressing for all datagrams.
5. All datagrams from the switch are addressed to either an NMS or the broadcast IP address.

MIB Types

The MIB definitions in this document may reference the primitive types that are described in the Structure and Identification of Management Information for TCP/IP-based Internets, RFC 1155. RFC 1155 is based on the Specification of Abstract Syntax Notation One, ASN.1.

The primitive types are described in the following Table.

Primitive	Size	Description
Boolean	1 byte	Enumerated Integer with possible true (1) or false (2) values; note that the ASN.1 BOOLEAN primitive type is not used
BridgeID	8 bytes	Priority and MAC address used to identify a spanning tree bridge
Counter	4 bytes max	Unsigned value
DisplayString	n X1 byte	Array of printable ascii characters
Gauge	4 bytes	Non-negative integer
Integer	4 bytes max	Signed value
IpAddress	4 bytes	Internet address
MacAddress	6 bytes	Ethernet address
OctetString	n X1 byte	Array of bytes
PhysAddress	n X1 byte	Array of bytes, using the same as a MAC Address
PortID	2 bytes	Priority and port number used to identify a spanning tree port
TimeTicks	4 bytes	Max time counter with a granularity of 1/100th of a second (also known as centiseconds)

User Functions

SNMP primitives may be used to accomplish the following functions:

1. Obtain the current value of certain parameters - the NMS uses the GetRequest or GetNextRequest PDU and the switch responds with a GetResponse PDU. If the NMS issues a GetRequest for an unsupported parameter, the switch sends a GetResponse with a noSuchName ErrorStatus. If the NMS issues a GetNextRequest for an unsupported parameter, the switch skips to the next object.

2. Change the value of certain parameters - the NMS uses the SetRequest PDU, and the switch responds with a GetResponse PDU. The switch will change both its current value and its local default to be used when the switch reboots, unless noted otherwise.

3. Obtain the current value of certain parameters and simultaneously change the value of other parameters - the NMS uses the SetRequest PDU, and the switch responds with a GetResponse PDU. For the parameters which are being obtained rather than changed, the NMS must use the ASN.1 NULL value with the SetRequest PDU.

4. Provide notification of significant events - the switch uses the Trap PDU and/or the Get Response PDU. The NMS uses the Set Request PDU to control the frequency that the switch may send Trap PDUs.

TCP/IP MIB-II

Your switch supports TCP/IP MIB-II, as defined by *Management Information Base for network management of TCP/IP-based internets MIB-II*, RFC 1213 (K. McCloghrie, editor), dated March 1991. The MIB is divided into groups of parameters. The individual groups are described in the subsections below. You may want to refer to the actual TCP/IP MIB, since this document paraphrases the standard MIB in order to provide switch-related descriptions.

Address Translation Group

TCP/IP Address Translation Group parameters are minimally supported (i.e., for any parameter in this group, the switch returns a GetResponse with a noSuchName ErrorStatus). It is anticipated that the Address Translation Group will be deleted from TCP/IP MIB III, since there will be separate address translation tables for every type of network protocol (indeed, TCP/IP MIB II already defines the IP Address Translation Table).

IP Routing Table

The TCP/IP IP routing table contains the routing information for each route currently known. When adding a row, the entire row must be specified, except for the following defaults:

- ipRouteDest is obtained from the row's instance identifier
- ipRouteMetric1 defaults to 0
- ipRouteMetric2 defaults to sxadminStaticPreference
- ipRouteMetric3 through ipRouteMetric5 default to -1
- ipRouteNextHop is obtained from the row's instance identifier
- ipRouteType defaults to “direct” if ipRouteNextHop is not specified, or if ipRouteNextHop is specified and it, combined with ipRouteMask, equals the same network as that defined by ipRouteDest
- ipRouteProto defaults to “netmgmt”
- ipRouteMask defaults to the standard network class mask based on the row's instance identifier (except 255.255.255.255 is used if the row's instance identifier contains a non-zero host portion)

IP Address Translation Table

The TCP/IP IP address translation table contains mappings of Internet addresses to MAC addresses, except for the Internet addresses itself.

The parameters are Read/Write, according to TCP/IP MIB-II; however, the switch has the restriction that a dynamic entry should not be modified, except to be made “invalid” (any other modifications will cause a static entry to be created).

When adding a row, the following defaults are used:

- ipNetToMediaIfIndex is obtained from the row's instance identifier
- ipNetToMediaPhysAddress defaults to 0
- ipNetToMediaNetAddress is obtained from the row's instance identifier
- ipNetToMediaType defaults to “static”

TCP Group

The AT-4016TR supports the TCP Group.

SNMP Group

snmp	{mib-2 11} The TCP/IP SNMP Group parameters are described below.	
snmpInPkts	{snmp 1} The number of SNMP PDUs received by the AT-4016TR.	Counter Read-Only
snmpOutPkts	{snmp 2} The number of SNMP PDUs created by the AT-4016TR.	Counter Read-Only
snmpInBadVersions	{snmp 3} The number of SNMP PDUs received by the AT-4016TR which had an unsupported SNMP version.	Counter Read-Only
snmpInBadCommunityNames	{snmp 4} The number of SNMP PDUs received by the AT-4016TR which had an unrecognized SNMP community name.	Counter Read-Only

snmpInBadCommunityUses	{snmp 5}	Counter Read-Only
	The number of SNMP PDUs received by the AT-4016TR which had an authentication failure.	
snmpInASNParseErrs	{snmp 6}	Counter Read-Only
	The number of SNMP PDUs received by the AT-4016TR which had an ASN.1 parsing error while being decoded by the AT-4016TR.	
snmpInBadTypes	{snmp 7}	Counter Read-Only
	All GetResponse PDUs indicate a noSuchName ErrorStatus, since this variable is no longer used.	
snmpInTooBigs	{snmp 8}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInNoSuchNames	{snmp 9}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInBadValues	{snmp 10}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInReadOnlys	{snmp 11}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInGenErrs	{snmp 12}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInTotalReqVars	{snmp 13}	Counter Read-Only
	The total number of MIB objects which have been successfully retrieved by the AT-4016TR as a result of SNMP GetRequest or GetNext PDUs.	
snmpInTotalSetVars	{snmp 14}	Counter Read-Only
	The total number of MIB objects which have been successfully altered by the AT-4016TR as a result of SNMP SetRequest PDUs.	
snmpInGetRequests	{snmp 15}	Counter Read-Only
	The total number of SNMP GetRequest PDUs received by the AT-4016TR, which have been processed with no errors.	
snmpInGetNexts	{snmp 16}	Counter Read-Only
	The total number of SNMP GetNext PDUs received by the AT-4016TR, which have been processed with no errors.	

snmpInSetRequests	{snmp 17}	Counter Read-Only
	The total number of SNMP SetRequest PDUs received by the AT-4016TR, which have been processed with no errors.	
snmpInGetResponses	{snmp 18}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP response PDUs.	
snmpInTraps	{snmp 19}	Counter Read-Only
	Always zero, since the AT-4016TR ignores all SNMP Trap PDUs.	
snmpOutTooBigs	{snmp 20}	Counter Read-Only
	The total number of SNMP PDUs created by the AT-4016TR, with a value of “tooBig” in the PDU's “ErrorStatus”.	
snmpOutNoSuchNames	{snmp 21}	Counter Read-Only
	The total number of SNMP PDUs created by the AT-4016TR, with a value of “noSuchName” in the PDU's “ErrorStatus”.	
snmpOutBadValues	{snmp 22}	Counter Read-Only
	The total number of SNMP PDUs created by the AT-4016TR, with a value of “badValue” in the PDU's “ErrorStatus”.	
snmpOutReadOnlys	{snmp 23}	Counter Read-Only
	All GetResponse PDUs indicate a noSuchName Error	
	Status, since this variable is no longer used.	
snmpOutGenErrs	{snmp 24}	Counter Read-Only
	The total number of SNMP PDUs created by the AT-4016TR, with a value of “genErr” in the PDU's “ErrorStatus”.	
snmpOutGetRequests	{snmp 25}	Counter Read-Only
	Always zero, since the AT-4016TR never creates any SNMP request PDUs.	
snmpOutGetNexts	{snmp 26}	Counter Read-Only
	Always zero, since the AT-4016TR never creates any SNMP request PDUs.	
snmpOutSetRequests	{snmp 27}	Counter Read-Only
	Always zero, since the AT-4016TR never creates any SNMP request PDUs.	
snmpOutGetResponses	{snmp 28}	Counter Read-Only
	The total number of SNMP GetResponse PDUs created by the AT-4016TR.	

snmpOutTraps	{snmp 29}	Counter Read-Only
	The total number of SNMP Trap PDUs created by the AT-4016TR.	
snmpEnableAuthenTraps	{snmp 30}	Integer Read-Write
	Whether authentication failures should cause the AT-4016TR to generate authentication-failure Trap PDUs.	
	Values include:	
	enabled (1)	generate traps
	disabled (2)	do not generate traps

Ethernet MIB

Your switch supports the Ethernet MIB as defined in *Definitions of Managed Objects for the Ethernet-like Interface Types*, RFC 1284 (J. Cook, editor), dated December 1991.

Bridge MIB

Your switch supports the Bridge MIB as defined in Definitions of Managed Objects for Bridges, RFC 1286 (Decker, Langille, Rijsinghani, and McCloghrie, editors).

Traps

The unit sends Trap PDUs to the NMS, using the pre-configured NMS IP address (see sxadminNMSIPAddr). If no address has been pre-configured, then the unit sends the Traps to the source IP address of the last SNMP datagram received from an NMS. If no address has been pre-configured, and if no datagrams have been received since the unit was booted, then the unit uses the broadcast IP address.

The Trap PDUs are sent from a source UDP port, to a destination UDP port, which are the SNMP standard numbers reserved for Trap PDUs. The unit may be configured to send an additional copy of each Trap PDU to a user specified destination UDP port number (see sysTrapPort).

Generic Traps

SNMP defines the generic traps described below. At this time, only generic traps are sent.

coldStart (0)	The switch has restarted.
warmStart (1)	Not used.

linkDown (2)	A port has failed, and the local management agent has disabled usage of the port. The “variable-bindings” portion of the trap contains the ifIndex of the port.
linkUp (3)	A port has come back to life, and the local management agent has re-enabled usage of the port. The “variable-bindings” portion of the trap contains the ifIndex of the port.

Appendix D
Glossary

10BASE-T—IEEE 802.3 UTP Ethernet. Low-cost Level 3 or better UTP wiring affords 100 meters (328 ft.) of point-to-point link segments. UTP uses RJ45 connectors and sometimes 50-pin AMP connectors to a patch panel and runs at 10 MHz.

ADDRESS RESOLUTION PROTOCOL (ARP)—The procedures and messages in any communications protocol which resolve local addresses to those of the network. In TCP/IP, the protocols for translating between IP addresses and physical addresses.

ASYNCHRONOUS TRANSFER MODE (ATM)—A technology for LAN data transport that packages the data in short fixed length cells for high-speed transport.

ATM FORUM—An international voluntary organization composed of ATM vendors, manufacturers, service providers, research organizations and users. Purpose is to "accelerate the use of ATM products and services through the rapid convergence of interoperability specifications, promotion of industry cooperation and other activities."

BIT RATE (BR)—The rate of data throughput on the medium in bits per second. Ethernet specifies 10 million bits per second.

BIT TIME—The duration of one bit symbol (1/BR). Ethernet specifies a bit time of 100 ns.

BROADCAST AND UNKNOWN SERVER (BUS)—BUS defines that set of functions implemented in an ATM network that provide LAN-to-LAN transmission support while a LAN connection is being established, It also supports LAN broadcast services.

CARRIER SENSE—In a LAN, an ongoing activity of a data station to detect whether another station is transmitting.

CARRIER SENSE MULTIPLE ACCESS with COLLISION DETECT (CSMA/CD)—This is the access method employed by IEEE 802.3 LAN transceivers, by which multiple stations compete for use of the transmission medium (coax cable) for data packet transmission. It provides for a level of error detection should that transmission be corrupted or impeded by contention for the transmission medium.

COLLISION—An unwanted condition that results from concurrent transmissions on the physical medium.

COLLISION PRESENCE—Provides the ability to detect simultaneous occurrence of Manchester-encoded data on the DI and DO and to report such an occurrence as a collision.

CROSSOVER—Wiring used when connecting a 10BASE-T MAU to another 10BASE-T MAU or a 10BASE-T hub to another 10BASE-T hub. For example, one 10BASE-T MAU has the TD pair on the same pins as another 10BASE-T MAU. If pins were wired straight,

there would be two transmitters on one pair and no receiver. As a solution, the crossover cable crosses the TD pair with the RD pair, to connect the TD pins on one end to the RD pins at the other end.

CYCLIC REDUNDANCY CODE (CRC)—An algorithm used to check for and correct bit errors in data transmission.

DATA COMMUNICATION EQUIPMENT (DCE)—In RS232 specification a module, such as a modem, for connecting a DTE to other equipment. A repeater connected to a terminal or workstation for OMEGA management use is wired as a DCE.

DATA TERMINAL EQUIPMENT (DTE)—In RS232 specification a module typically at the end of a segment. The DTE could be an Ethernet workstation, repeater or bridge.

EMULATED LOCAL AREA NETWORK (ELAN)—See LAN Emulation.

FOIRL — A fiber optic standard that allows up to 1,000 meters (3,280 ft.) of multimode duplex fiber optic cable in a point-to-point link.

HOT SWAPPING— The process of replacing a module without interrupting the network. This process occurs by sliding an active module into a fully powered up unit, replacing a failed module.

HOUSE WIRING—House wiring is the existing wiring inside a building. This wiring generally originates from one or more wiring closets, such as a telephone room. Some older buildings may have wiring unsuitable for 10 megabit data rates. In these circumstances, it is recommended that the wiring be tested with a 10BASE-T signal/wire tester.

HUB/REPEATER—A hub is a central signal distributor. It is used in a wiring topology consisting of several point-to-point segments originating from a central point. The term hub is often used interchangeably with the term repeater. Multiport 10BASE-T, 10BASE2 and fiber optic (10BASE-FL, FOIRL) repeaters are considered hubs. See Repeater.

HUB-to-HUB WIRING—See MAU-to-MAU Wiring

HUB-to-MAU WIRING—UTP cables for 10BASE-T hub-to-MAU or NIC cards are wired straight-through. An RJ45 receptacle at the hub would wire pin-to-pin to the RJ45 receptacle at the MAU.

IMPEDANCE—An electrical characteristic of a circuit dealing with the combination of the AC and DC resistance and the appearance of that resistance to attached circuits.

INTERIM LAYER MANAGEMENT INTERFACE (ILMI)—Protocol defined by the ATM Forum UNI standards for managing the UNI.

JABBER LOCK-UP—The MAU's ability to automatically inhibit the transmit data from reaching the medium if the transmit data time exceeds a specified duration. This duration is in the range of 20 ms to 150 ms. Jabber lock-up protects the medium from being overrun with data packets from a possibly defective device.

JAM—This is a term used to describe the collision reinforcement signal output by the repeater to all ports. The jam signal consists of 96 bits of alternating 1s and 0s. The purpose is to extend a collision sufficiently so that all devices cease transmitting.

JITTER—The fluctuation of the data packet in respect to a standard clock cycle. Jitter is undesirable and must be minimized.

LAN—See Local Area Network

LAN EMULATION—Methodology for mimicking the appearance of a LAN by rendering the ATM switching fabric invisible to the user; enables user interface software to treat a virtual LAN as if it were a physical LAN.

LAN EMULATION CLIENT (LEC)—ATM Forum-defined specifications in support of LAN-to-LAN connectivity, called LAN Emulation. LEC defines that set of functions implemented in a LAN DTE to interface with an ATM network in support of LAN Emulation.

LAN EMULATION SERVER (LES)—LES defines that set of functions implemented in an ATM network in support of LAN-to-LAN connection establishment.

LAN EMULATION CONFIGURATION SERVER (LECS)—LECS defines that set of functions implemented in an ATM network that provide LAN DTEs with information regarding the location of the other LAN Emulation services.

LINK SEGMENT—The link segment of coaxial cable is a segment that has no MAU devices, but links together two LAN devices such as repeaters.

LINK TEST—In 10BASE-T Ethernet there is a link test function that validates the UTP link. This consists of a pulse transmitted from point A on one pair that is validated at point B. Point B also transmits a pulse on the second pair to be validated by point A. These pulses occur during media idle states (in between packets).

LOCAL AREA NETWORK (LAN)—A type of limited-area broadcast network in which devices attached to a common transmission medium.

MEDIA ACCESS CONTROL (MAC)—IEEE specifications for the lower half of the data link layer (layer 2) that defines topology-dependent access control protocols for IEEE LAN specifications.

MANAGEMENT AGENT—Software that is used to view system activity and set system variables.

MAU—See Medium Attachment Unit

MAU-to-MAU, HUB-to-HUB WIRING—10BASE-T MAU-to-MAU or hub-to-hub wiring generally requires a crossover cable located somewhere along the UTP cable run. This may commonly occur at the punch-down block or between the RJ45 wall receptacle and the workstation.

MAU/TRANSCEIVER—An Ethernet transceiver is a MAU. A 10BASE-T MAU interfaces the UTP media to an AUI port on a workstation, repeater, bridge or other Ethernet device.

MDI/MDI-X—See Medium Dependent Interface

MEDIUM ATTACHMENT UNIT (MAU)—In a LAN, a device used in a data station to couple the DTE to the transmission medium.

MEDIUM DEPENDENT INTERFACE (MDI)—The mechanical and electrical interface between the trunk cable medium and the MAU. MDI-X is another version of the interface that enables like devices to connect using different pin-outs, thereby avoiding conflicts that occur when receiving and transmitting packets use the same pin-out.

MANAGEMENT INFORMATION BASE (MIB)—A data base of network configuration and performance information. The formal definition of a MIB includes the names of the objects it contains and the type of information retained. Management protocols such as SNMP and CMIP contain procedures for acquiring and exchanging MIB information.

MULTIMODE FIBER—Type of fiber optic cable used for transmitting data over relatively short distances (maximum 2 km). The fiber contains two materials with different refractive indices and uses reflection to propagate a relatively low-intensity signal (Class 3 or equivalent).

NETWORK SERVICES ACCESS POINT (NSAP)—OSI generic standard for a network address consisting of 20 octets. ATM has specified E.164 for public network addressing and the NSAP address structure for private network addresses.

NETWORK SERVICES ACCESS POINT (NSAP)—OSI generic standard for a network address consisting of 20 octets. ATM has specified E.164 for public network addressing and the NSAP address structure for private network addresses.

PATCH PANEL—A 10BASE-T patch panel may be used between a punch-down block and UTP workstation. The patch panel generally has a female RJ45 connector on the front for each workstation and a Telco (RJ21) connector on the back, which is wired to a punch-down block. This provides a convenient way for the installer or network manager to connect the hub 10BASE-T ports into the desired building locations.

PERMANENT VIRTUAL CIRCUIT (PVC)—A virtual circuit (x.25), virtual connection (Frame Relay) or virtual channel connection (ATM) that has been established by manual or semi-automated methods in advance of its need. Analogous to a leased/dedicated/ provisioned real circuit.

PHYSICAL MEDIUM ATTACHMENT (PMA)—The portion of the MAU that contains the functional circuitry.

PHYSICAL SIGNALING (PLS)—That portion of the physical layer contained within the DTE that provides the logical and functional coupling between MAU and data link layers.

POLARITY CORRECTION—Many 10BASE-T UTP ports have a polarity correction function. If the UTP wiring has RD- and RD+ inadvertently crossed, the polarity correction function will sample the signal and electrically swap the wires. If the TD- and TD+ wires are crossed, the correction would occur at the MAU on the other end of the UTP link. This occurs within a single pair and should not be confused with the crossover cable.

PROPAGATION DELAY—The time it takes a signal to travel from the input of a system component to the output. Usually measured in nanoseconds. IEEE 802.3 has specific propagation delay maxima for computing propagation budgets when designing a LAN. Cable length plays a major role in propagation delay; for example, a 50-meter (164-foot) AUI cable has a maximum allowable propagation delay of 257 ns. The propagation delay of cable depends on the length and velocity factor of the cable type. There are also propagation delays associated with electronics attached to the system.

PUNCH-DOWN BLOCK—The punch-down block is the wiring panel where the house wiring from the building's offices terminates. This is where many 10BASE-T hubs would be located. Wiring installers use a special punch-down tool to insert the UTP wire for data and voice applications.

REPEATER—A device used to extend the length, topology, or interconnectivity of the physical medium beyond that imposed by a single segment, up to the maximum allowable end-to-end trunk transmission line length. Repeaters perform the basic actions of restoring signal amplitude, waveform and timing applied to normal data and collision signals.

RJ45—This connector is a 10BASE-T standard for connecting UTP cabling. It is inexpensive and easy to install onto UTP cable.

SDH—See Synchronous Optical Network.

SIGNAL QUALITY ERROR (SQE) TEST—Signal indicates SQE function is active. The SQE message is sent by the MAU to the DTE in the presence of a collision.

SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP)— SNMP is a TCP/IP protocol that generally uses the User Datagram Protocol (UDP) to exchange messages between a management information base and a management client residing on a network. Since SNMP does not rely on the underlying communication protocols, it can be made available over other protocols, such as XNS or DECnet.

SINGLE MODE FIBER—Type of fiber optic cable that uses wave propagation within a homogenous medium to transmit signal over long-range distances (5 to 10 km). Requires high-intensity laser light source (Class 1 emission).

SONET—See Synchronous Optical Network.

STANDALONE—Repeater operating as a hub on its own; i.e., not a module among other modules in a department concentrator chassis.

STRAIGHT-THROUGH—A type of wiring connection where the pins of one connector connect to the same pins of another connector. For example, pin 1 of one connector connects to pin 1 of another connector.

STRAIGHT TIP (ST) CONNECTOR—A type of port connection where the pins connect through a bayonet-style interface.

SUBSCRIBER CHANNEL (SC) CONNECTOR—A type of port connection where the pins connect through a push-pull mating interface.

SUB MINIATURE ASSEMBLY (SMA) CONNECTOR —A type of port connection where the pins connect through a threaded attachment interface. Also referred to as an SM Connector.

SWITCH, ETHERNET—A type of Ethernet hub that filters traffic based on low-level address. As over against a repeater, a switch does not necessarily broadcast, retime or retransmit packets, depending on its configuration. A switch cuts down on traffic by placing packets only on the receiver's segment when known.

SWITCHED VIRTUAL CIRCUIT (SVC)—A virtual circuit (X.25), virtual connection (Frame Relay) or virtual channel connection (ATM) that has been established dynamically in response to a signaling request message.

SWITCHED LAN—Emerging technology that replaces the shared bus backplane of Ethernet hubs and the shared ring backplane of token Ring hubs with a switching backplane. Connectivity is provided by switching sender traffic directly to the port of the addressed destination device. Provides potentially higher throughput, scalable capacity, and simpler configuration support. Does not require any changes to access wiring or adapter cards.

SYNCHRONOUS OPTICAL NETWORK (SONET)—A set of physical layer definitions for data transmission across fiber-based high-speed links. Two options are available for the Fiber Optic ATM interface: Synchronous Optical Network (SONET) STS-3c-type framing (which is more common in North America) and Synchronous Digital Hierarchy (SDH-1) framing (which is more common in other countries). Whichever option you choose should remain consistent throughout the entire network.

TCP/IP PROTOCOLS—A set of protocols for intercomputer communication, including network level (Internet Protocol), transport level (Transmission Control Protocol or TCP) and application level protocols (for example, Telnet terminal emulation). TCP/IP has been used for many years in two country-wide networks, the ARPANET and MILNET. Recently, TCP/IP has become very popular with users of a variety of multi-user computer systems and engineering workstations. Most UNIX computers use TCP/IP over Ethernet as the main intercomputer networking technology. TCP/IP is also popular among PC users, particularly as a means of communication with large multi-user computers.

TIME DIVISION MULTIPLEXING (TDM) — This is a technique that combines several channels onto one high-speed circuit by providing each channel a specific, regularly recurring time slot sufficsient to carry the full transmission rate of that channel. The transmixsion rate of the the high-speed circuit must be equal to, or greater than, the aggregate speed of all of the channels.

TELCO CONNECTOR— A 50-pin receptacle that plugs into the front of the hub, enabling cables from external devices to connect to the hub.

TRUNK CABLE—Coaxial cable used for distribution of signals over long distances throughout a cable system.

UNSHIELDED TWISTED PAIR (UTP)—A cable used in 10BASE-T wiring that consists of at least two twisted pairs of 22 to 26 AWG wire. The pairs should have at least 3 twists per foot and have an impedance of 100 W. Level 3, Level 4 and Level 5 UTP cables fit these criteria.

USER-TO-NETWORK INTERFACE (UNI)—The interface between an end device and a public or private ATM switch.

VIRTUAL CIRCUIT (VC)—A connection between end users that has defined end points and route but does not have bandwidth dedicated to it. Bandwidth is allocated on demand by the network as users have traffic to transmit.

VIRTUAL CHANNEL CONNECTION (VCC)—Virtual channels in two or more sequential physical circuits can be concatenated to create an end-to-end connection called a VCC. A VCC is a specific instance of a SVC or PVC. A VCC may traverse one end-to-end VPC or several sequential VPCs.

VIRTUAL CIRCUIT IDENTIFIER (VCI)—Field in an ATM cell that maps the cell's route through the ATM network.

VIRTUAL LAN (VLAN)—A user-configured logical workgroup or collection of Ethernet addresses, as opposed to a physical LAN defined entirely by wiring.

VIRTUAL PATH IDENTIFIER (VPI)—Field in an ATM cell that maps the cell's route through the ATM network.

Appendix E

Technical Support Fax Order

Name _____

Company _____

Address _____

City _____ **State/Province** _____ **Zip/PostalCode** _____

Country _____ **Phone** _____ **Fax** _____

Incident Summary

Model number of Allied Telesyn product I am using _____

Firmware release number of Allied Telesyn product _____

Other network software products I am using (e.g., network managers)

_____

Brief summary of problem _____

_____

Conditions (List the steps that led up to the problem.) _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Detailed description (Please use separate sheet)

Please also fax printouts of relevant files such as batch files and configuration files. When completed, fax this sheet to the appropriate ATI office. Fax numbers can be found on page 139.

Appendix F

Where To Find Us

For Technical Support or Service		
Location	**Phone**	**Fax**
North America United States, Canada, Mexico, Central America, South America, Australia, New Zealand	1 (800) 428-4835	1 (206) 481-3790
France France, Belgium, Luxembourg, The Netherlands, Middle East, Africa	(+33) 1-69-28-16-17	(+33) 1-69-28-37-49
Germany Germany, Switzerland, Austria, Eastern Europe	(+01) 30-83-56-66	(+49) 30-435-70-650
Italy Italy, Spain, Portugal, Greece, Turkey, Israel	(+39) 2-38093-444	(+39) 2-38093-448
United Kingdom United Kingdom, Denmark, Norway, Sweden, Finland, Iceland	(+0) 800-20-40-40	(+44) 1-865-390-002
Japan	(+81) 3-3443-5640	(+81) 3-3443-2443
Asia Singapore, Taiwan, Thailand, Malaysia, Indonesia, Korea, Philippines, China, India	(+65) 383-2050	(+65) 383-2079
Hong Kong	(+852) 2-529-4111	(+852) 2 529-7661
Technical Bulletin Board Service	1 (206) 483-7979	
CompuServe	Go ALLIED	
World Wide Web	http://www.alliedtelesyn.com	

For Information Regarding Allied Telesyn International Corp.	
Allied Telesyn International Corp. 19015 North Creek Parkway Suite 200 Bothell, WA 98011 TEL: 1 (206) 487-8880 FAX: 1 (206) 489-9191	**Allied Telesyn International Corp.** 950 Kifer Road Sunnyvale, CA 94086 Tel: 1 (800) 424-4284 (USA and Canada) Fax: 1 (408) 736-0100

For Sales Information

United States

Lilburn, GA
Tel: (404) 717-0290, Fax: (404) 717-0806
Salt Lake City, UT
Tel: (801) 350-9130, Fax: (801) 350-9051
Vienna, VA
Tel: (703) 506-0196, Fax: (703) 506-1986
Chicago, IL
Tel: (708) 406-8431, Fax: (708) 406-8462
Austin, TX
Tel: (512) 502-3087, Fax: (512) 794-9326
Dallas, TX
Tel: (214) 446-9873, Fax: (214) 446-8555
Reading, MA
Tel & Fax: (617) 944-3492
Los Angeles, CA
Tel: (310) 412-8684, Fax: (310) 412-8685
Costa Mesa, CA
Tel: (714) 432-6424, Fax: (714) 432-6546
San Diego, CA
Tel: (619) 279-3896, Fax: (619) 279-3897
Clearwater, FL
Tel: (813) 726-0022, Fax: (813) 726-0234
Turnersville, NJ
Tel: (609) 438-1070, Fax: (609) 468--1201

Canada

Mississauga, Ontario
Tel: (905) 803-8626, Fax: (905) 279-0050
Richmond, British Columbia
Tel: (604) 244-0678, Fax: (604) 270-3644

Germany

Berlin
Tel: (+49) 30-435-9000, Fax: (+49) 30-435-70650
Freising
Tel: (+49) 8161-62-002, Fax: (+49) 8161-68-374
Lothar Bahn

The Netherlands

Schiphol
Tel: (+31) 20-654-0111, Fax: (+31) 20-654-0270

Italy

Milano
Tel: (+39) 2-38093-444, Fax: (+39) 2-38093-448

England

Abingdon, Oxon
Tel: (+1) 44-865-390001, Fax: (+1) 44-865-390002

France

Les Ulis
Tel: (+33) 1-69-28-16-17, Fax: (+33) 1-69-28-37-49

Hong Kong

Kowloon
Tel: (+852) 2-393-0101, Fax: (+852) 2-397-7979
Wanchai
Tel: (+852) 2-529-4111, Fax: (+852) 2-529-7661

Singapore
Tel: (+65) 383-3832, Fax: (+65) 383-3830

Japan

Shinagawa-ku, Tokyo
Tel: (+81) 3-3443-5640, Fax: (+81) 3-3443-2443
Yodogawa-ku, Osaka
Tel: (+81) 6-391-6310, Fax: (+81) 6-391-6325
Fujisawa-shi, Kanagawa
Tel: (+81) 466-88-8510, Fax: (+81) 466-88-8515
Machida-shi, Tokyo
Tel: (+81) 427-21-8141, Fax: (+81) 427-21-8848
Nagoya-shi, Aichi
Tel: (+81) 52-223-3791, Fax: (+81) 52-223-3736

Appendix G

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