ForeRunnerLE ATM Workgroup Switch Installation Manual

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Software Version 6.1

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FCC CLASS A NOTICE

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void this user's authority to operate this equipment.

NOTE: The *ForeRunnerLE*™ 25 and *ForeRunnerLE* 155 have been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

DOC CLASS A NOTICE

This digital apparatus does not exceed Class A limits for radio noise emission for a digital device as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

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- EN 55022 - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."
- EN 50082-1 - "Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial, and light industry."
- IEC 1000-4-2 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 2: Electrostatic discharge requirements."
- IEC 1000-4-3 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 3: Radiate electromagnetic field requirements."
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This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

AUSTRALIA EMC COMPLIANCE

This product has been tested and found to comply with the Class A electromagnetic compatibility limits specified in AS/NZ 3548.

SAFETY CERTIFICATIONS

ETL certified to meet Information Technology Equipment safety standards UL 1950, CSA 22.2 No. 950, and EN 60950.

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Preface

This manual provides the technical information needed to install the *ForeRunnerLE*™ 25 and *ForeRunnerLE* 155 ATM Workgroup Switches, and the accompanying *ForeThought*™ software. This document was created for users with various levels of experience. If you have any questions or problems with the installation, please contact FORE Systems' Technical Assistance Center (TAC).

Chapter Summaries

Chapter 1 - Switch Hardware Overview: Provides a hardware overview of the *ForeRunnerLE* 25 and *ForeRunnerLE* 155 ATM Workgroup Switches.

Chapter 2 - Switch Hardware Setup: Provides information about the initial setup of a *ForeRunnerLE* ATM Workgroup Switch.

Chapter 3 - Switch Configuration: Provides information about basic configuration procedures that you must perform before using your switch.

Chapter 4 - Software Upgrade: Describes how to upgrade switch software, and how to boot over the serial port.

Appendix A - AMI Overview: Provides a brief overview of the ATM Management Interface (AMI) and contains descriptions of the root level AMI commands.

Appendix B - Hardware Specifications: Provides cabling, pinout, hardware, and general operating specifications for the *ForeRunnerLE* ATM Workgroup Switches, port interfaces, and Port Expansion Modules (PEMs).

Appendix C - Port Expansion Module Installation: Describes how to install the Port Expansion Module (PEM) into Interface D of your *ForeRunnerLE* 25 or *ForeRunnerLE* 155 switch. Procedures for replacing a PEM in a *ForeRunnerLE* 25 are also provided (PEMs in an LE155 cannot be removed and replaced once installed).

Related Manuals

References are made in this manual to the following:

- *AMI Configuration Command Reference Manual, Part 1* - Describes the root, connections, and hardware level AMI commands and menus.
- *AMI Configuration Command Reference Manual, Part 2* - Describes the interfaces, routing, ethernet, redundancy, and security level AMI commands and menus.
- *AMI Configuration Command Reference Manual, Part 3* - Describes the services, signalling, and system level AMI commands and menus.
- *ATM Switch Diagnostics and Troubleshooting Manual* - Describes the debug level AMI commands and menus. Also, describes error messages, loopbacks, SCP diagnostics, and ATM Forum PNNI debugging information.
- *ATM Switch Network Configuration Manual* - Discusses topics such as LAN Emulation, Classical IP, ATM Forum PNNI, and *ForeThought*® PNNI.

These manuals can be found on the CD and can be read and printed using Adobe's Acrobat® Reader which is also included on the CD. If Acrobat Reader is installed locally, run Acrobat and open the manual from the `/DOCS` directory of the CD. If Acrobat Reader is not installed locally, run the Acrobat installer to load Acrobat Reader on your machine. Then run the `ACROREAD.EXE` file in the `/DOCS` directory of the CD.

For the latest technical documentation and release notes for the *ForeRunnerLE* family of workgroup switches and other FORE products, visit the FORE technical manual website at:

`http://www.fore.com/support/manuals/index.htm`

The website provides manuals in Portable Document Format (PDF). They can be viewed or printed using Adobe Acrobat Version 3.0 Readers.

Contacting Technical Support

In the U.S.A., you can contact FORE Systems' Technical Assistance Center (TAC) by any one of the following four methods:

1. Select the "Support" link from FORE's World Wide Web page:

   http://www.fore.com/

2. Send questions, via e-mail, to:

   support@fore.com

3. Telephone questions to "support" at:

   800-671-FORE (3673) or **724-742-6999**

4. FAX questions to "support" at:

   724-742-7900

Technical support for customers outside the United States should be handled through the local distributor or via telephone at the following number:

+1 724-742-6999

No matter which method is used to reach FORE Support, customers should be ready to provide the following:

- A support contract ID number
- The serial number of each product in question
- All relevant information describing the problem or question

Typographical Styles

Throughout this manual, all specific commands meant to be entered by the user appear on a separate line in bold typeface. In addition, use of the `Enter` or `Return` key is represented as `<ENTER>`. The following example demonstrates this convention:

`cd /usr <ENTER>`

File names that appear within the text of this manual are represented in the following style: "...the `fore_install` program installs this distribution."

Command names that appear within the text of this manual are represented in the following style: "...using the **`flush-cache`** command clears the bridge cache."

Subsystem names that appear within the text of this manual are represented in the following style: "...to access the **`bridge`** subsystem..."

Parameter names that appear within the text of this manual are represented in the following style: "...using *`<seg-list>`* allows you to specify the segments for which you want to display the specified bridge statistics."

Any messages that appear on the screen during software installation and network interface administration are shown in `Courier` font to distinguish them from the rest of the text as follows:

```
.... Are all four conditions true?
```

Important Information Indicators

To call your attention to safety and otherwise important information that must be reviewed to insure correct and complete installation, as well as to avoid damage to the *ForeRunnerLE* Switch or your system, FORE Systems utilizes the following *WARNING/CAUTION/NOTE* indicators.

WARNING statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a ***WARNING*** statement until the indicated conditions are fully understood or met. This information could prevent serious injury to the operator, damage to the *ForeRunnerLE* Switch, the system, or currently loaded software, and will be indicated as follows:

WARNING!

Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

CAUTION statements contain information that is important for proper installation/operation. **CAUTION** statements can prevent possible equipment damage and/or loss of data and will be indicated as follows:

CAUTION

You risk damaging your equipment and/or software if you do not follow these instructions.

NOTE statements contain information that has been found important enough to be called to the special attention of the operator and will be set off from the text as follows:

If you have retrieved a software file with a .tar extension, do NOT untar it. The **`operation upgrade`** command in the ATM Management Interface (AMI) will expect the upgrade file to be in tarfile format.

Invisible Laser Warning Notice

Port Expansion Modules (PEMs) having a single mode fiber optic interface contains a Class 1 laser.

Class 1 Laser Product:
This product conforms to applicable requirements of 21 CFR 1040 at the date of manufacture.

Class 1 lasers are defined as products which do not permit human access to laser radiation in excess of the accessible limits of Class 1 for applicable wavelengths and durations. These lasers are safe under reasonably foreseeable conditions of operation.

WARNING!

Do not stare into the beam or view the beam with optical instruments.

This Laser Warning section only applies to products or components containing Class 1 lasers.

Safety Agency Compliance

This preface provides safety precautions to follow when installing a FORE Systems, Inc., product.

Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

CAUTION

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

ATTENTION

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du meme type ou d'un type equivalent recommande par le constructeur. Mettre au rebut les batteries usagees conformement aux instructions du fabricant.

Symbols

The following symbols appear in this book:

WARNING!

Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

CAUTION

You risk damaging your equipment and/or software if you do not follow these instructions.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. FORE Systems, Inc., is not responsible for regulatory compliance of a modified FORE product.

Placement of a FORE Systems Product

CAUTION

To ensure reliable operation of your FORE Systems product and to protect it from overheating, openings in the equipment must not be blocked or covered. A FORE Systems product should never be placed near a radiator or heat register.

Power Cord Connection

WARNING!

FORE Systems products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug FORE Systems products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.

WARNING!

To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

CHAPTER 1 Switch Hardware Overview

This chapter provides a hardware overview of the *ForeRunnerLE* 25 and the *ForeRunnerLE* 155 ATM Workgroup Switches.

For information about the technical and operating specifications, see Appendix B, "Hardware Specifications".

1.1 Introduction

The *ForeRunnerLE* 25 and *ForeRunnerLE* 155 Workgroup Switches deliver high-performance switching capacity and speed for ATM applications. A non-blocking switching capacity of 2.5 Gbps is continually available on both switches. The *ForeRunnerLE* 25 provides up to 24 ports of connectivity, each running at speeds of 25 Mbps. The *ForeRunnerLE* 155 provides up to 12 ports of connectivity, each running at speeds of 155 Mbps. The optional Port Expansion Module (PEM) on the LE25 and LE155 can provide up to an additional four ports of 155 Mbps or one 622 Mbps port.

Interconnecting multiple *ForeRunnerLE* switches is simple. Once a new *ForeRunnerLE* switch is added to the network, all other switches recognize its presence and dynamically establish connections to ports on the new switch. Furthermore, scaling the network is accomplished without costly and time consuming address reconfiguration and LAN segmentation.

1.2 Switch Hardware Configuration

The *ForeRunnerLE* 25 and *ForeRunnerLE* 155, as shown in Figure 1.1 and Figure 1.2 respectively, are self-contained 2.5 Gbps ATM switches that provide serial connections for local console management access. The hardware for the *ForeRunnerLE* 25 consists of a single switch board with 24 integrated network ports running at 25 Mbps, a single slot to accept an optional Port Expansion Module (PEM), an integrated Intel i960CF processor, an internal power supply, and internal fans all housed in a horizontal enclosure. The *ForeRunnerLE* 155 also consists of a single slot to accept an optional Port Expansion Module (PEM), an integrated Intel i960CF processor, an internal power supply, and internal fans, but contains 12 integrated network ports running at 155 Mbps. All of these components work together to provide ATM switching capabilities, as well as distributed connection setup and management.

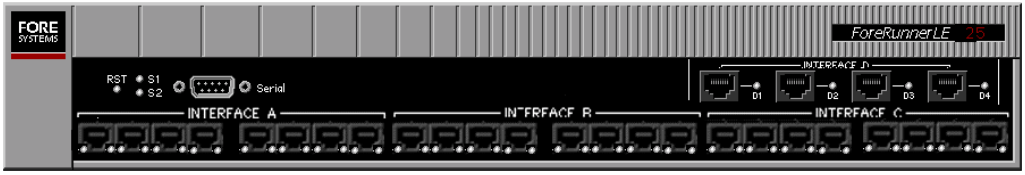


Figure 1.1 - *ForeRunnerLE* 25 ATM Workgroup Switch

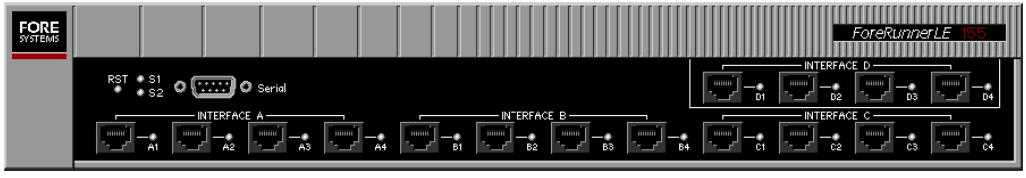


Figure 1.2 - *ForeRunnerLE* 155 ATM Workgroup Switch

1.2.1 Switch Board

The switch board (also referred to as the “switch fabric”) contains the VPI/VCI lookup tables and routing circuitry to ensure that a cell received from an input port is correctly switched to one or more output ports. The switch board includes the following features: four interface groups, a reset button, two status LEDS (S1 and S2), and an RS-232 serial port.

The switch board also has an interface, controlled by the integral switch control processor (SCP), that is functionally equivalent to an ATM host interface.

1.2.1.1 Interface Groups

The *ForeRunnerLE* 25 and *ForeRunnerLE* 155 include four interface groups. Interface groups A, B, and C contain the physical input/output network ports that are integrated into the switch board. Interface D may contain the optional Port Expansion Module. On an LE25, each integrated interface group (A, B, and C) consists of eight network ports. On an LE155, each integrated interface group (A, B, and C) consists of four network ports. The optional Port Expansion Module (PEM) in Interface D on the LE25 and LE155 can provide up to an additional four ports.

1.2.1.1.1 Port Expansion Module

The Port Expansion Module (PEM) provides additional ATM connections on the *ForeRunnerLE* switches. These ports offer the same features as the ports in interface groups A, B, and C, except that the ports in the PEM are the only ports that can export a clock source for distributed timing. For more information about configuring distributed timing, see the *ATM Switch Network Configuration Manual.*

Depending on your configuration, a PEM may or may not already be installed in Interface D. If a PEM is not installed, a blank face plate covers the slot. A PEM can be installed later if desired. For more information on the PEM installation, see Appendix C, ”Port Expansion Module Installation” or the *ForeRunnerLE ATM Workgroup Switch Port Expansion Module Installation Manual.*

1.2.1.1.2 Port Timing

The ports in interface groups A, B, C, and D (PEM) use the on-board crystal oscillator as their timing source by default. However, if the PEM is installed, you may use AMI to configure the timing source to be recovered from one of the PEM ports.

1.2.1.1.3 Port Numbering

The individual ports in an interface group are numbered by Board, Interface Group, and Port.

Board The number of the switch board that contains the port. `Board` is always `1` in a *ForeRunnerLE* switch, since it contains only one switch board.

Interface Group The interface group (A, B, C, or D) in the switch board that contains the port.

Port The physical port (1 - 4 or 1 - 8) on the interface group.

For example, according to this notation, the third port in interface group C would be 1C3.

1.2.1.1.4 Port LEDs

Each integrated port in Interface A, B, and C on the *ForeRunnerLE* 25 has a transmit LED (TX) at the bottom left of the port and a receive LED (RX) at the bottom right of the port. Table 1.1 and Table 1.2 describe the states of the LEDs and their indications.

Table 1.1 - LE25 Transmit LED Description

Color	Indication
Green (blinking)	The port is transmitting cell traffic.
Off	No traffic being sent.

Table 1.2 - LE25 Receive LED Description

Color	Indication
Green (blinking)	The port is receiving cell traffic.
Red (solid)	The port is experiencing a loss of carrier and is not receiving traffic.
Off	Carrier is present, but the port is not receiving traffic.

Each integrated port in the *ForeRunnerLE* 155 and each PEM port in an LE25 and LE155 have a single receive LED. The LED colors and the meanings of the colors are described in Table 1.3.

Table 1.3 - LE155 Port Receive and PEM Port Receive LED Description

Color	Meaning
Green (blinking)	The port is receiving cell traffic.
Red (solid)	The port is experiencing a loss of carrier.
Yellow (blinking)	The port is receiving SONET alarms.

1.2.1.2 Reset Button

The reset button labeled RST, allows you to reset the switch control software on the SCP. Using the reset button reboots the SCP and runs the initial power-on diagnostics. All open ATM Management Interface (AMI) sessions are ended by the SCP, and all ports lose any active sessions and initially go off-line after a reset. The ports then return to the configuration stored in the configuration database (CDB). Because the reset button is small (to avoid accidental resets), it is recommended that you use a straightened paper clip to push the reset button.

1.2.1.3 Status LEDs

There are two status LEDs on the front panel labeled S1 and S2. S1 is the software status LED and S2 is the power status LED. The LED colors and the meanings of the colors are described in Table 1.4 and Table 1.5.

Table 1.4 - S1 Software Status LED

Color	Meaning
Green (solid)	The switch software is functioning normally.
Red (blinking)	Once the switch software begins to boot, the LED blinks red briefly, then is extinguished. Once the switch finishes booting, the LED illuminates green.

Table 1.5 - S2 Power Status LED

Color	Meaning
Green (solid)	There is power to the switch.
Extinguished	There is no power to the switch.

If the S1 LED continuously blinks red and never turns green after a reboot, the non-volatile SRAM is corrupt. If this occurs, contact FORE Systems' Technical Assistance Center using one of the methods described in the Preface of this manual.

1.2.1.4 RS-232 Serial Port

The RS-232 serial port provides terminal access for any VT100 (or similar) terminal or terminal emulation package to the *ForeRunnerLE* switch. The serial port has a standard DB-9 male connector as shown in Figure 1.3. The pinout of the *ForeRunnerLE* switch's serial port is the same as that of a standard serial port (COM port) of a laptop or desktop PC.

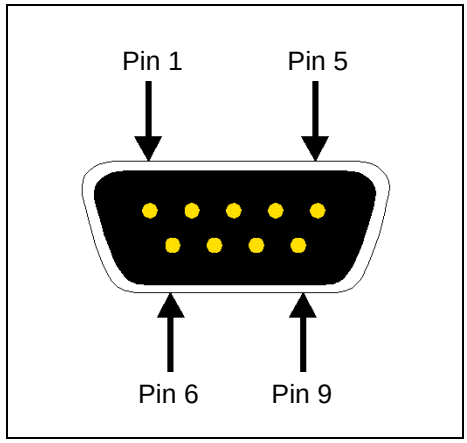


Figure 1.3 - RS-232 Serial Port Pinouts

The serial cable is a null modem, DB-9, female/female cable. The pinout for this cable is shown in Figure 1.4.

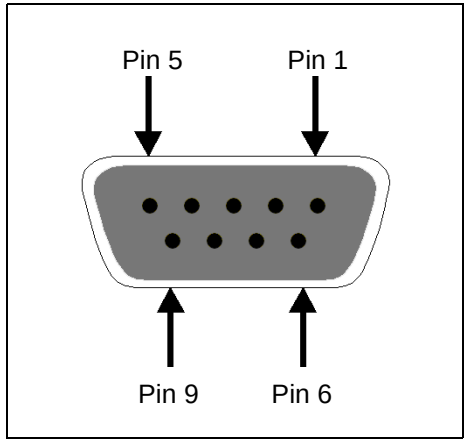
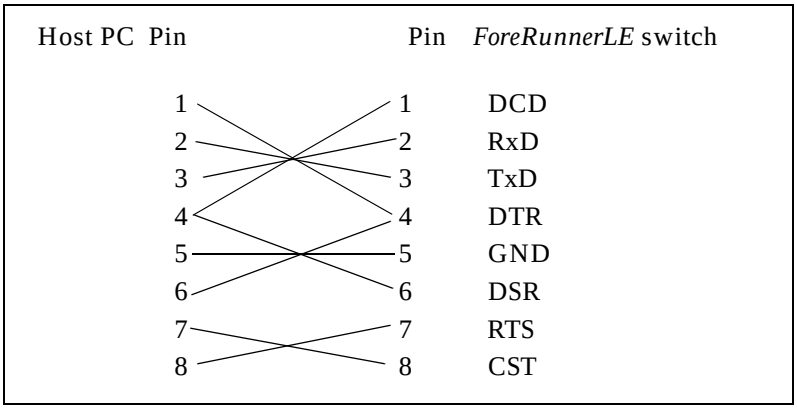


Figure 1.4 - Null Modem Serial Cable Pinouts

The null modem cable makes the following pin connections between the host PC or terminal and the *ForeRunnerLE* switch:

- Pin 1 and pin 6 to pin 4 from the PC to the *ForeRunnerLE* switch.
- Pin 4 to pin 1 and pin 6 from the PC to the *ForeRunnerLE* switch.
- Pin 2 to pin 3 in both directions.
- Pin 5 to pin 5.
- Pin 7 to pin 8 in both directions.
- Pin 9 is not used.



CHAPTER 2 Switch Hardware Setup

This chapter contains information about unpacking and setting up a *ForeRunnerLE* 25 or *ForeRunnerLE* 155 ATM Workgroup Switch.

Before installing a *ForeRunnerLE* switch, there are several important factors that must be taken into consideration, depending on the type of installation site. The following sections discuss in detail how to install a *ForeRunnerLE* switch and any prerequisites to the installation.

It is important to read through the ENTIRE installation procedure before attempting to supply power to the unit.

2.1 Unpacking and Checking the Contents

Upon receipt of, and before unpacking your order, inspect the package for any damage that may have occurred during shipping. If the package shows any signs of external damage or rough handling, notify your carrier's representative.

When unpacking your *ForeRunnerLE* switch, be sure to keep all original packing materials. They may be needed for storing, transporting, or returning the product.

CAUTION

All products returned to FORE Systems, under warranty, must be packed in their original packing materials.

A complete inventory of the *ForeRunnerLE* switch package should be performed before any power is supplied to the unit. Check the contents of the package against the packing slip and verify that all listed equipment has been received.

If any of the items are missing or damaged, please contact FORE Systems' Technical Assistance Center immediately using one of the methods described in the Preface of this manual.

2.2 *ForeRunnerLE* Installation

Before you install the switch and plug it in, FORE Systems strongly recommends that you let the unit adjust to room temperature after unpacking the unit from its shipping container.

2.2.1 Electrical Considerations

The following items should be considered when setting up the switch:

CAUTION

Consideration should be given to the connection of the equipment to the supply circuit and the effect that the overloading of circuits could have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

CAUTION

Reliable grounding of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch (i.e., use of power strips).

CAUTION

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

2.2.2 Placement of a *ForeRunnerLE*

The *ForeRunnerLE* 25 or *ForeRunnerLE* 155 can be installed as a stand-alone unit placed on the desktop, as a rack-mounted unit, or as a stacked unit. Depending on your configuration, the rack-mounting and stacking hardware may be included in the optional mounting kit.

2.2.2.1 Using the Switch as a Stand-Alone Unit

If you wish to use your *ForeRunnerLE* as a stand-alone unit placed on the desktop, you should affix the four rubber feet to the bottom of the unit using the following procedure:

1. Carefully place the *ForeRunnerLE* unit upside down on a clean, flat, sturdy work surface.
2. Peel the backing off the rubber feet and secure one to each of the four corners on the bottom of the unit.
3. Once the feet are secure, place the unit right side up.
4. Connect the serial cable from the serial port to any tty-type device (such as a terminal, or the serial port of a workstation or PC running a terminal emulation program).
5. Connect the power cord into an approved electrical outlet (110 volt).

At this point, the switch will begin sending traffic. However, there are a few basic configurations you need to make before you can begin to fully utilize the switch. For information about configuring the switch, you may skip the rest of this chapter and go to Chapter 2, ”Switch Hardware Setup.”

2.2.2.2 Rack-mounting the Switch

A set of rack-mount brackets and 6 flat-head screws are supplied with the mounting kit. You will need to supply a screwdriver.

The following items should be addressed when installing your switch in a 19-inch rack:

WARNING!

When rack-mounting equipment, make sure that a hazardous condition is not created due to uneven weight distribution.

CAUTION

To prevent damage to your equipment, FORE Systems recommends that the maximum operating temperature not exceed 40°C @ 10,000 ft. Consideration must be made if the switch is to be installed in a closed or multi-unit rack assembly, because the ambient temperature of the rack environment may be greater than the room ambient temperature.

CAUTION

Take care not to block the air vents of the switch, as this would compromise the amount of air flow required for proper cooling.

To install the rack-mount brackets, use the following procedure:

1. Carefully place the unit on a clean, flat, sturdy work surface with the front of the unit facing forward.
2. Insert and tighten three of the provided screws to secure the bracket marked HWSH2061-1 to the left side of the unit and insert and tighten the other three screws to secure the bracket marked HWSH2061-2 to the right side of the unit as shown in Figure 2.1.

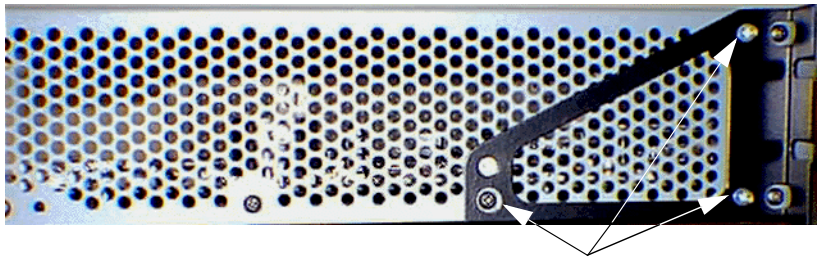


Figure 2.1 - Attaching a Rack-mount Bracket

CAUTION

When attaching the rack-mount brackets, the use of screws other than those provided could damage the unit.

3. Once the brackets are secure, choose a rack position for the *ForeRunnerLE* and secure the switch to the rack. It should be placed right side up in the rack with the front of the unit facing forward.

CAUTION

When the switch is mounted in the equipment rack, do not use the *ForeRunnerLE* chassis to support other equipment. This could overload the mounting brackets and cause damage to the unit.

4. Connect the serial cable from the serial port to any tty-type device (such as a terminal, or the serial port of a workstation or PC running a terminal emulation program).
5. Connect the power cord into an approved electrical outlet (110 volt).

At this point, you are ready to configure the switch. For information about configuring the switch, you may skip the rest of this chapter and go to Chapter 2, ”Switch Hardware Setup.”

2.2.2.3 Stacking the Switch

A set of stacking brackets and 4 pan-head screws are supplied with the stacking kit. You will need to supply a screwdriver.

The following items should be addressed when stacking the switch:

CAUTION

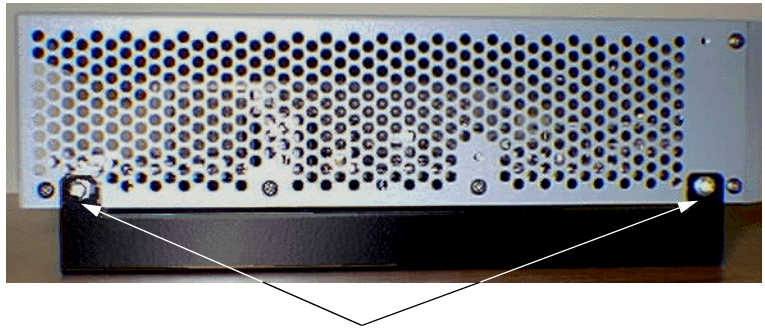
Take care not to block the air vents of the switch, as this would compromise the amount of air flow required for proper cooling.

CAUTION

When stacking the *ForeRunnerLE* switches, do not stack more than four units high. Before stacking the switches, ensure that the surface will hold the combined weight of the stacked units.

To install the stacking brackets, use the following procedure:

1. Carefully place the unit on a clean, flat, sturdy work surface with the front of the unit facing forward.
2. Slide one of the brackets under the right end of the enclosure so that the holes on the bracket line up with the holes on the side of the enclosure. The stacking brackets are interchangeable (either bracket may be used on either side) and are marked HWSH0110.
3. Insert and tighten two of the provided screws to secure the bracket to the right side of the unit as shown in Figure 2.2.
4. Slide the other bracket under the left end of the enclosure so that the holes on the bracket line up with the holes on side the enclosure.
5. Insert and tighten the other two provided screws to secure the bracket to the left side of the unit.



Insert the screws in these holes and tighten to secure the bracket.

Figure 2.2 - Attaching a Stacking Bracket

CAUTION

When attaching the stacking brackets, the use of screws other than those provided could damage the unit.

6. Once the brackets are secure, peel the backing off the rubber feet and secure two feet to the bottom of each of the stacking brackets in the locations designated on the brackets.
7. Carefully place the unit on top of another LE switch with the front of the unit facing forward.
8. Connect the serial cable from the serial port to any tty-type device (such as a terminal, or the serial port of a workstation or PC running a terminal emulation program).
9. Connect the power cord into an approved electrical outlet (110 volt).

At this point, you are ready to configure the switch. For information about configuring the switch, proceed to Chapter 2, "Switch Hardware Setup."

CHAPTER 3 Switch Configuration

After installing your *ForeRunnerLE* switch, it will begin sending traffic. However, there are a few basic configurations you need to make before you can begin to fully utilize the switch. Before performing the configurations in this chapter, read through Appendix A, "AMI Overview" to learn how to open an AMI session on the switch and how to use AMI in general.

The following list provides a brief overview of basic switch configuration, with more detail of each provided in the following sections:

- **Section 3.1 -** Overview of IP Addressing
- **Section 3.2 -** Configuring FORE IP
- **Section 3.3 -** Configuring Classical IP
- **Section 3.4 -** Configuring LAN Emulation

Although this chapter describes FORE IP first, then Classical IP, and then LANE, it does not matter in which order or in which combination you choose to configure your switch.

3.1 Overview of IP Addressing

If you wish to use SNMP functions, the minimum configuration for a *ForeRunnerLE* switch is to assign an IP address to its network interfaces. This allows you to communicate with the switch from any workstation connected to your ATM LAN. IP addresses must be assigned to the network interfaces in order to perform any SNMP functions. By setting the IP address of the FORE IP (`asx0`) interface or one of the Classical IP (`qaa0`, `qaa1`, `qaa2`, or `qaa3`) interfaces, in-band (over ATM) access to the switch control processor (SCP) is enabled.

3.1.1 Logical IP Subnets

An important concept in IP ATM networks is that of a Logical IP Subnet (LIS). An LIS is a group of hosts configured to be members of the same IP subnet (that is, they have the same IP network and subnetwork numbers). It is possible to maintain several overlaid LISes on the same physical ATM network. Therefore, placing a host on a specific subnet is a logical choice rather than a physical one.

The number of LISes, and the division of hosts into each LIS, is purely an administrative issue. Limitations of IP addressing, IP packet filtering, and administrative boundaries may guide a manager into establishing several LISes onto a single ATM network. Keep in mind that communication between LISes must occur through IP routing.

The IP subnet mask is a pattern of 32 bits that is combined with an IP address to determine which bits of an IP address denote the network number and which denote the host number on that particular network.

3.1.2 Network Classes

There are three classes of networks in the Internet, based on the number of hosts on a given network.

- Class A - These are large networks with addresses in the range 1-126 and with a maximum of 16,387,064 hosts.
- Class B - These are medium networks with addresses in the range 128-191 and with a maximum of 64,516 hosts.
- Class C - These are small networks with addresses in the range 192-254 with a maximum of 254 hosts.

Addresses are given as dotted decimal numbers in the following format:

nnn . nnn . nnn . nnn

In a Class A network, the first of the numbers is the network number, the last three numbers are the local host address. The default subnet mask is 255.0.0.0.

In a Class B network, the first two numbers are the network, the last two are the local host address. The default subnet mask is 255.255.0.0.

In a Class C network, the first three numbers are the network address, the last number is the local host address. The default subnet mask is 255.255.255.0.

3.2 Configuring FORE IP

To configure FORE IP on a *ForeRunnerLE* switch, use the following AMI command on the switch:

```
myswitch:interfaces ip-> modify
Usage:
   [-ifname] <interface>      Interface
  [[-ipaddr] <IP Address>]    Address
  [[-mask] <IP Address>]      Network Mask
  [[-state] (up|down)]        Interface State
  [[-bcast] (0|1)]            Broadcast Setting
  [[-mtu] <integer>]          MTU
```

To use FORE IP on the switch, you must use `asx0` as the *<interface>*. The *<IP Address>* would be one that is appropriate for your network. The subnet *<IP Address>* must be entered in dotted decimal notation. For example, you would enter something similar to the following:

```
interfaces ip modify asx0 -ipaddr 198.25.22.46 -mask 255.255.255.0
                          -state up
```

By default, the only interface on a switch which is `up`, or active, is the switch's local interface, `lo0`. This interface is always `up` to allow AMI to run on the switch. All of the other interfaces are `down`, or not active. You must change the state of the FORE IP interface to be `up`, or active.

At this point, FORE IP is running on the switch. To configure Classical IP, follow the examples shown in the next section.

3.3 Configuring Classical IP

To configure Classical IP on a *ForeRunnerLE* ATM switch, perform the following steps:

1. Configure the IP address of one of the Classical IP interfaces (qaa0, qaa1, qaa2, qaa3) by entering the following AMI command:

   interfaces ip modify <interface> **-ipaddr** <IP Address>

   where <interface> must be one of the qaa interfaces. If you are configuring one Classical IP interface, you should use qaa0. <IP Address> would be one that is appropriate to your network. For example, you would enter something similar to the following:

   interfaces ip modify qaa0 -ipaddr 198.25.22.48

2. Change the state of the Classical IP interface by entering the following AMI command:

   interfaces ip modify <*interface*> **-state** (**up**|**down**)

   where <*interface*> must be the qaa interface to which you assigned the address in step 1. For example, you would enter the following:

   interfaces ip modify qaa0 -state up

For more information about Classical IP, see Chapter 2 in the *ATM Switch Network Configuration Manual.*

Be sure that the adapter interface to the switch has been configured. For information about configuring this interface, refer to the User's Manual that came with your particular adapter.

3.3.1 Configuring the ARP Server

If you wish to use a workstation or a switch other than this switch as the ARP server, then you must configure the ARP server for your switch. To configure the address of the ARP server, use the following AMI command:

```
myswitch:services atmarp arpserver-> modify
Usage:
   [-ifname] <interface>      Interface
  [[-addr] <NSAP Address>]    Arp Server Addr
```

Use the command **services atmarp getnsap** to display the NSAP address for this interface and cut and paste the *<NSAP address>* from the display.

Again, since you are configuring Classical IP, the *<interface>* must be one of the qaa interfaces. If you are using qaa0, you do not need to enter it since it is the default interface. If you are using a different qaa interface, you must enter a value for *<interface>*. For example, you would enter the following:

```
services atmarp arpserver modify qaa -addr
 47000580ffe1000000f12400de0020481900de00
```

At this point, Classical IP is running on the switch. To configure LAN Emulation, follow the examples shown in the next section.

3.4 Configuring LAN Emulation

LAN emulation (LANE) is an ATM software solution that imitates LAN services across ATM using emulated LANs (ELANs). An ELAN provides communication of user data frames among all members of the ELAN, similar to a physical LAN.

If a Port Expansion Module is not already installed, the *ForeRunnerLE* 25 and *ForeRunnerLE* 155 are preconfigured with LAN Emulation (LANE) services running for an Emulated LAN (ELAN) named `default`. Preconfigured LANE services include a LAN Emulation Configuration Server (LECS), a LAN Emulation Server (LES), and a Broadcast and Unknown Server (BUS).

There are different instructions for configuring an ELAN, depending on how your network is currently configured. Please see Chapter 3 in the *ATM Switch Network Configuration Manual* for more information.

CHAPTER 4 Software Upgrade

This chapter details the procedures for upgrading the *ForeThought* software on your existing *ForeRunnerLE* 25 or *ForeRunnerLE* 155 ATM Workgroup Switch. Some instructions in this chapter apply only in certain situations, and you may or may not have to go through every section. This chapter is organized into the following sections:

- **Section 4.1 -** Obtaining the Software Upgrade File via FTP
- **Section 4.2 -** Performing the Software Upgrade
- **Section 4.3 -** Setting Up a TFTP Server
- **Section 4.4 -** Booting via the Serial Port

CAUTION

As a precaution, it is recommended that you back up your configuration database (CDB) before beginning the upgrade process. For more information, see Part 3 of the *AMI Configuration Commands Reference Manual*.

If you have configured the switch to use TFTP as the transfer protocol using the configuration system protocol command, the operation upgrade command can be issued one of two ways, depending on how TFTP is configured on the UNIX workstation that holds the upgrade file. For more information about using this command with TFTP, see Section 4.2.1.

The *ForeRunnerLE* 25 switch only supports *ForeThought* 5.3 or later.

4.1 Obtaining the Software Upgrade File via FTP

Before beginning the upgrade process, you will need the upgrade file from FORE Systems.

If your tftp server is on a UNIX workstation, the workstation must have at least 5 MB of free disk space. The UNIX workstation must be connected (via ATM) to the switch being upgraded.

The software upgrade can be retrieved from FORE Systems via anonymous FTP using the following procedure.

Please contact FORE Systems' Technical Assistance Center using one of the methods described in the Preface of this manual, to obtain the proper directory name and the latest list of file names.

1. FTP to **`ftp.fore.com`** and log in as **`anonymous`**.
2. Enter your full e-mail address (e.g., **`jdoe@somewhere.com`**) when you are prompted for a password.

For security reasons, your password is not echoed.

3. Once you connect to FORE's FTP site (you will see the `ftp>` prompt), you must change to the directory name which you obtained from the Technical Assistance Center (e.g., **`cd /some/software/directory`**). This directory contains the *ForeThought* software upgrade files and the .readme files which contain important information about the software release.
4. The .readme files can be retrieved as ASCII text. However, before you retrieve the software files, you must switch the transfer mode to `binary` by typing **`binary`** at the `ftp>`prompt.

The following script is an example of how you might retrieve the software and .readme files. For the actual file names, please contact FORE Technical Assistance Center. User input is shown in **bold courier** font.

```
server-jdoe:52=> ftp ftp.fore.com
Connected to ftp.fore.com.
220-FORE Systems Inc. FTP Server
220-
220-This FTP site is only for authorized customers and employees of FORE
220-Systems, Inc.  Unauthorized access or use is subject to discipline,
220-criminal, and/or civil sanctions.  This system will be monitored for
220-unauthorized users.  All users consent to monitoring.
220-
220 ftp.fore.com FTP server (Version wu-2.4(4) Tue Apr 11 13:53:34 EDT 1995) ready.
Name (ftp.fore.com:jdoe): anonymous
331 Guest login ok, send your complete e-mail address as password.
Password:  TYPE YOUR FULL E-MAIL ADDRESS HERE <ENTER>
230 Guest login ok, access restrictions apply.
ftp> cd /some/software/directory <ENTER>
250 CWD command successful.
ftp> get LE_switch_5.3.0_1.13304.readme <ENTER>
200 PORT command successful.
150 Opening ASCII mode data connection for LE_switch_5.3.0_1.13304.readme (51578 bytes).
226 Transfer complete.
local: LE_switch_5.3.0_1.13304.readme remote: LE_switch_5.3.0_1.13304.readme
51578 bytes received in 1 seconds (50 Kbytes/s)
ftp> binary <ENTER>
200 Type set to I.
ftp> get LE_switch_5.3.0_1.13304.Z <ENTER>
200 PORT command successful.
150 Opening BINARY mode data connection for LE_switch_5.3.0_1.13304.Z (8147013 bytes).
226 Transfer complete.
local: LE_switch_5.3.0_1.13304.Z remote: LE_switch_5.3.0_1.13304.Z
8147013 bytes received in 2.3e+02 seconds (35 Kbytes/s)
ftp> quit <ENTER>
221 Goodbye.
```

5. If you have retrieved a software file with a .Z extension, you need to uncompress the file using the following command:

uncompress *<filename>*

where *<filename>* represents the full name of the upgrade file you have retrieved. For example, using the software file from the previous example:

uncompress LE_switch_5.3.0_1.13304.Z

If you have retrieved a software file with a .tar extension, do NOT untar it. The **system upgrade** command in the ATM Management Interface (AMI) will expect the upgrade file to be in tarfile format.

If you have difficulty retrieving the files or if you have any other questions regarding the FTP site, please contact FORE Systems' Technical Assistance Center using one of the methods described in the Preface of this manual.

Once you have successfully retrieved the software upgrade file via FTP, follow the instructions in Section 4.2.

4.2 Performing the Software Upgrade

The software upgrade is performed using the **system upgrade** command in AMI. The default underlying file transfer mechanism used in the upgrade is Trivial File Transfer Protocol (TFTP). The first time you upgrade from *ForeThought* 4.x to 5.x, you must use TFTP. However, after you are running *ForeThought* 5.x, for subsequent upgrades, you can change this transfer protocol to FTP by using the **system modify** command. (See Part 3 of the *AMI Configuration Commands Reference Manual* for more information.) If you are using TFTP, then follow the upgrade instructions in Section 4.2.1. If you are using FTP, then follow the upgrade instructions in Section 4.2.2.

You must upgrade to *ForeThought* 5.3.x for a *ForeRunnerLE* 25 switch. Any software version prior to 5.3.x is not supported in the LE25.

4.2.1 Upgrading the Software Using TFTP

TFTP can run in "secure" or "unsecure" mode, and it is assumed that your TFTP server is running in secure mode. Therefore, if TFTP is to run properly between, the file(s) being transferred must reside in the `/tftpboot` directory on the source machine (see Section 4.3 for more information). When using UNIX to perform these commands, each version of UNIX may be slightly different.

To perform an upgrade, the switch initiates a TFTP session with the specified host, which searches for the file requested. The host, which is running TFTP, looks for the file in `/tftpboot`. The TFTP process on the server automatically adds `/tftpboot` in front of the path or filename specified by the client.

For example, issuing **system upgrade 169.144.3.54:LE_switch_5.3.0_1.13304** causes the TFTP server to locate and transfer the file `/tftpboot/LE_switch_5.3.0_1.13304`. For this reason, it is imperative that you place the upgrade file in the `/tftpboot` directory on the workstation to which you downloaded or extracted the file. If this directory does not already exist, it is likely that TFTP is not running on the workstation. See Section 4.3 for instructions on setting up a TFTP server and placing the upgrade file in the `/tftpboot` directory.

Once you have verified your TFTP server and placed the software upgrade file, you need to invoke the upgrade process on the SCP. Use the following steps to upgrade the software using TFTP:

1. Log in to AMI and enter the following command:

system upgrade *[***file**|**ftp**|**tftp:***//]host/full path to backup file*

where <host> would be the remote machine name or IP address of the workstation which holds the upgrade file and <full path to backup file> would be the filename of the upgrade file.

If you obtained the upgrade file via FTP, *<full path to backup file>* is the name of the uncompressed file.

For example, if you used TFTP, you would enter something similar to the following:

system upgrade tftp://169.144.3.54/LE_switch_5.3.0_1.13304

You should receive messages similar to the following:

```
Will upgrade directly to flash
{Transfer successful.}
Notice:  A backup cdb for this version of software should be made in case
a downgrade to this version is performed in the future.
```

2. When prompted to back up the CDB, type **y** and press **<ENTER>** or just press **<ENTER>**.

```
Do you wish to back up the cdb [y]? y
```

3. When prompted to enter the host file name, you would enter something similar to the following:

```
Enter host file:169.166.3.56:myswitch.cdb
```

4. To use the new version of software that you have just loaded, type **y** and press **<ENTER>** or simply press **<ENTER>** to reboot.

```
Reboot the switch[y]? y
```

Once the SCP reboots, all active AMI sessions will be terminated on the SCP. You need to log in to AMI again if you want to begin another session.

NOTE

If something went wrong during the upgrade process, a new file named UPGRADE appears in the FLASH file system and you are not prompted with the "Reboot the switch [y]?" message.

If the upgrade is unsuccessful or if you have any other problems with the upgrade, please contact FORE Systems' Technical Assistance Center using one of the methods described in the Preface of this manual.

4.2.2 Upgrading the Software Using FTP

To upgrade the software using FTP, use the following steps:

1. Log in to AMI and enter the following command:

system upgrade *[***file**|**ftp**|**tftp:***//]host/full path to backup file*

where <*host*> would be the remote machine name or IP address of the workstation which holds the upgrade file and <*full path to backup file*> would be the full filename of the upgrade file.

NOTE

If you obtained the upgrade file via FTP, <*full path to backup file*> is the name of the uncompressed file.

2. Since you are using FTP, you are prompted for the remote userid and password of the remote host from which you are retrieving the upgrade file. For example:

system upgrade ftp://169.144.3.54/LE_switch_5.3.0_1.13304

```
Will upgrade directly to flash
remote userid: <remote userid>
remote password: <remote password>
```

Once the proper userid and password are entered, you should receive messages similar to the following:

```
{Transfer successful.}

Notice:  A backup cdb for this version of software should be made in case
a downgrade to this version is performed in the future.
```

3. When prompted to back up the CDB, type **y** and press **<ENTER>** or simply press **<ENTER>**.

```
Do you wish to back up the cdb [y]? y
```

4. When prompted to enter the host file name, you would enter something similar to the following:

```
Enter host file:169.166.3.56:myswitch.cdb
```

5. To use the new version of software that you have just loaded, type **y** and press **<ENTER>** or simply press **<ENTER>** to reboot.

```
Reboot the switch[y]? y
```

Once the SCP reboots, all active AMI sessions will be terminated on the SCP. You will need to log in to AMI again if you want to begin another session.

If something went wrong during the upgrade process, a new file named `UPGRADE` appears in the FLASH file system and you are not prompted with the "`Reboot the switch [y]?`" message.

If the upgrade is unsuccessful or if you have any other problems with the upgrade, please contact FORE Systems' Technical Assistance Center using one of the methods described in the Preface of this manual.

4.2.3 Performing a Serial Upgrade

This procedure is useful when the switch needs to be upgraded before it is placed into the network or if a TFTP server is not configured. A serial upgrade saves the upgrade file to FLASH and will persist across reboots. Mini Loader software is required.

You can obtain the Mini Loader software just as you obtained the software upgrade file, via FTP. If you are obtaining the Mini Loader software via FTP, following the same instructions as in Section 4.1 of this manual, but substitute the Mini Loader filename for the upgrade filename.

To perform a serial upgrade on your *ForeRunnerLE* 25 or *ForeRunnerLE* 155 switch, you will need the following:

- Personal computer with a serial communications (COM) port (DB9 Male)
- Terminal emulation or serial communications software (such as Procomm Plus for DOS, Procomm for Windows, or Hyperterminal)
- DB9 Female to DB9 Female, null modem serial cable
- Switch software file

The serial communications software package you use must support the **X-Modem** transfer protocol and **VT220** to communicate with the switch.

Use the following procedure to perform a serial upgrade:

1. Check the amount of FLASH available and remove any existing code.
   a. Check the amount of FLASH available using the following AMI command:

```
myswitch:system filesystem-> free
Available space on flash (in bytes): 143894
```

   b. Identify existing code on the FLASH using the following AMI command

```
myswitch:system filesystem-> dir
Contents of  :
      Size  Date         Time      Name
 ---------  -----------  --------  ------------
      4507  AUG-11-1999  06:17:46  Q
         0  OCT-20-1999  00:18:58  FT6.1/
         6  OCT-20-1999  00:18:58  CURRENT
```

c. Remove existing code using the following AMI command:

You must delete the `foreox.exe` file from the `ft6.0` directory, then delete the `ft6.0` directory itself.

```
myswitch:system filesystem-> delete ft6.0/foreos.exe
myswitch:system filesystem-> delete ft6.0
```

If there are any other files or directories stored in FLASH, except the active version of switch software, you should delete them according to the above procedures.

You can also remove existing code from within Mini Loader.

If there is not enough room on the FLASH for the new code and the existing code was not removed, you will receive the following error:

```
Insufficient flash for upgrade
```

2. Reboot the switch by entering the **`system reboot`** command at the prompt and pressing **<ENTER>**. When prompted to reboot the switch, type **`y`** and press **<ENTER>**.

```
myswitch::operation> reboot
WARNING: about to reboot the switch
Do you wish to continue? (y or n):y
ColdBoot

Serial OK
Testing DRAM...
10 MB DRAM on board
DRAM Test Passed
```

3. As soon as the `Testing Peripherals...` message displays, send a <BREAK> signal from the host PC (refer to the documentation or on-line help of your serial communications program to find out how to send a <BREAK>. This will take you to the SCP Debug Monitor. When prompted to exit to monitor, type **y** and press **<ENTER>**.

```
Switch Control Processor CF-16  Oct 30 1996
Copyright 1995, FORE Systems, Inc.
Copyright 1992, Intel Corporation

Testing Peripherals...
Timer OK
Clock OK
SRAM OK
SDB OK

Exit to monitor [n]? y
linebuff = y
input = y
SCP Debug Monitor
                i
Switch Control Processor CF-16  Oct 30 1996
Copyright 1995, FORE Systems, Inc.
Copyright 1992, Intel Corporation

=>
```

4. Load Mini Loader. Make sure you load the correct Mini Loader version associated with the code revision you are loading.

   a. Initiate the upload from your terminal emulation software by typing **`boot-ser`** from the Monitor Mode prompt (=>) and pressing **<ENTER>**.

```
=>boot-ser
Downloading
```

b. Select the Mini Loader file to upload and send the file using Xmodem. The file transfer progress window displays. The transfer will take several minutes.

After the Mini Loader is loaded and initialized, you will see the following:

```
Decompressing...

Adding 2214 symbols for standalone.

VxWorks version: 5.2
Kernel version: WIND version 2.4
CPU: FORE Systems SCP CF-16
BSP version: 1.0
Creation date: Wed Apr 9 13:51:17 EDT 1997

ForeWorks Loader 1.0
Copyright (c) 1996 FORE Systems, Inc.
All Rights Reserved

VxWorks
Copyright (c) 1984-1996 Wind River Systems, Inc.
All Rights Reserved

Attaching network interface lo0... done.
Attaching network interface ei0...
ei: device did not initialize
failed: errno = 0x3d0002.

loader::>
```

5. Change the baud rate to 115200. This step is optional since the upgrade procedure will work at 9600, but at a slower rate. Skip to step 6 if you do not want to change your baud rate to 115200.

Hyperterminal does not support a baud rate of 115200.

a. Type **`configuration rs232 115200`** at the loader prompt and press **<ENTER>**.

```
loader::> configuration rs232 115200
Changing the baud rate to : 115200
Please reset the baud rate on your terminal.
-
```

b. Change the terminal emulation program to 115200 to match the baud rate of the system.

6. Start the upgrade process by typing **`upgrade`** at the loader prompt and pressing **<ENTER>**. When prompted for a transfer protocol, type **`xmodem`** .

```
loader::> upgrade
free flash space = 2719884
Protocol (ftp|tftp|xmodem): xmodem
Begin transmitting tar file via XMODEM
```

7. Choose the code file to upload and send the file using Xmodem. The file transfer progress window displays. This will take several minutes.
8. Verify that the code is loaded onto FLASH by typing **`flash dir`** at the loader prompt and pressing **<ENTER>**.

```
Creating flash file fs:/CURRENT

loader::> flash dir
FT5.3/
CURRENT 6
```

9. If the baud rate was changed to 115200 in step 5, change the baud rate back to 9600.
   a. Type **`configuration rs 9600`** at the prompt and press **<ENTER>**.

```
loader::> configuration rs 9600
Changing the baud rate to : 9600
Please reset the baud rate on your terminal.
```

   b. Change the baud rate of the terminal emulation program to match the baud rate of the system.

10. Reboot the switch by typing **reboot** at the prompt and pressing **<ENTER>**.

```
loader::> reboot
ColdBoot

Serial OK
Testing DRAM...
10 MB DRAM on board
DRAM Test Passed

Switch Control Processor CF-16  Oct 30 1996
Copyright 1995, FORE Systems, Inc.
Copyright 1992, Intel Corporation

Testing Peripherals...
Timer OK
Clock OK
SRAM OK
SDB OK
________
Decompressing...

Adding 2377 symbols for standalone.
Done...
Attaching network interface lo0... done.

ForeThought Switch Control Software
Copyright (C) 1992-1997  FORE Systems, Inc.
All rights reserved.

S_ForeThought_5.3.0 FCS (1.22051) (le155) (ATM SWITCH)
```

11. Login to AMI and verify the upgrade using the **system filesystem dir**, **system show**, and **system version** AMI commands.

```
myswitch:system filesystem-> dir
Contents of  :
      Size  Date         Time      Name
 ---------  -----------  --------  ------------
         0  APR-15-1999  13:45:56  FT6.1/
         6  APR-15-1999  13:45:56  CURRENT

myswitch:system-> show

Description:                     FORE Systems LE 155
Switch Uptime:                   16:13
Hardware Version:                0
Software Version:                S_ForeThought_6.1.0 FCS (1.49367)
System Name:                     sts74
System Contact:                  Unknown
System Location:                 Unknown
Maximum Virtual Paths:           32768
Maximum Virtual Channels:        16384
Fabric ID (MAC Address)          00:20:48:0f:04:db     (   Default   )
SPANS Address:                   00000038.f20f04db
PMP Minimum Reserved VCI:        155
PMP Maximum Reserved VCI:        255
Transfer Protocol:               tftp
PVC/PVP Connection Preservation: N/A
ATM Layer OAM Processing:        disabled
HTTP Help Url:                   default
Clock Scaling Factor             1

myswitch:system-> version
Software versions installed: FT6.1
Current Software Version:    FT6.1
```

4.3 Setting Up a TFTP Server

To set up a TFTP server, on a SunOS 4.1.x system, perform the following steps:

This procedure only has to be performed once. The next time that the software is upgraded, put the upgrade file in `/tftpboot`.

1. In `/etc/inetd.conf`, uncomment the last line shown below so that the file appears as follows:

```
#
# Tftp service is provided primarily for booting.  Most sites
# run this only on machines acting as "boot servers."
# Since these can be security holes, they are commented out by default.
#
tftp   dgram   udp    wait    root    /usr/etc/in.tftpd     in.tftpd -s /tftpboot
```

`-s /tftpboot` in the line above indicates the server is running secure TFTP. If `-s /tftpboot` does not appear, many of the command examples in this chapter are invalid.

2. Add the following line to `/etc/services`:

```
tftp          69/udp
```

3. Set up the `tftpboot` directory with the following command lines:

```
host: mkdir  /tftpboot
host: cp <upgrade-file>  /tftpboot
```

4. At the root level, determine the process number of `inetd` by entering the following:

```
host: ps -aux | grep inetd
```

Something similar to the following is displayed:

```
root       216  0.0  0.0   48    0 ?  IW   Jan 27  0:14 inetd
```

where `216` represents the process number of `inetd`..

5. Enter the following command to make `inetd` re-read its configuration file:

```
host: kill -HUP 216
```

4.4 Booting via the Serial Port

If the software image in FLASH memory of your *ForeRunnerLE* switch becomes corrupt, it may be necessary to boot your switch via the serial port. This section details the steps necessary to boot your switch if it will not boot from FLASH.

To boot your *ForeRunnerLE* switch over the serial port, you will need the following:

- Switch software file
- Personal computer with a serial communications (COM) port (DB9 Male)
- Terminal emulation or serial communications software
- DB9 Female to DB9 Female, null modem serial cable (supplied with switch)

The switch software file must be a **.tar file**, and the serial communications software package you use must support the **X-Modem** transfer protocol.

Perform the following steps to boot your switch over the serial port:

1. Connect the COM port of the host PC to the serial port of the switch using the supplied null modem serial cable.
2. Run the serial communications program on the host and set the baud rate to 9600.
3. Plug in your switch. If the switch is already plugged in, then unplug it and plug it in again. The following messages are displayed on the screen of the host PC:

```
Serial OK
Testing DRAM...
10 MB DRAM on board
DRAM Test Passed

Switch Control Processor CF-16 Dec 3 1996
Copyright 1995, FORE Systems, Inc.
Copyright 1992, Intel Corporation

Testing Peripherals...
```

4. As soon as the `Testing Peripherals...` message appears, send a <BREAK> signal from the host PC (refer to the documentation or on-line help of your serial communications program to find out how to send a <BREAK>.)

   If there are no hardware failures on the switch, the following messages will be displayed on the screen of the host PC:

   ```
   Timer OK
   Clock OK
   SRAM OK
   SDB OK
   ```

   These messages are followed by a question:

   ```
   Exit to monitor [n]?
   ```

5. Type **y** and press <ENTER>. The following is displayed:

   ```
   SCP Debug Monitor
               i
   ```

6. At this point, set the speed of your serial communications program to its maximum (but no higher than 128K baud).
7. Press <ENTER> a few times until the following is displayed:

   ```
   Switch Control Processor CF-16 Dec 3 1996
   Copyright 1995, FORE Systems, Inc.
   Copyright 1992, Intel Corporation

   =>
   ```

8. At the => prompt, type **`boot-ser`** and press <ENTER>. The following message is displayed:

   ```
   Downloading
   §§§
   ```

9. Send the switch software file (.tar format) to the switch from the host PC using the serial communications program.

The download can take anywhere from two to 20 minutes, depending on the speed selected in Step 6 above.

Once the downloaded file is decompressed and executed, an AMI session will be opened over the serial port.

10. Change the baud rate back to 9600.
11. Log in to the AMI session from the host PC and upgrade the software image on the FLASH of the switch (as described in this chapter).

APPENDIX A AMI Overview

ForeThought switch software provides switch and connection management, IP connectivity, and SNMP network management. The Switch Control Software (SCS) is the “brains” of the switch. The SCS controls the switch board(s) and handles connection set-up and tear-down duties. The SCS can also communicate with other FORE Systems switches to learn network topology and establish connections across multiple switches. In addition, there is an SNMP agent built into the SCS to allow SNMP management and control.

The user interface to the SCS is called the ATM Management Interface (AMI). AMI can be run on any *ForeRunner* switch running *ForeThought* switch software version 3.0.1 or later. This chapter contains a description of how to log in to AMI, how to open or close an AMI session, and how to perform other AMI root level commands. AMI allows you to configure and to make statistical queries of various hardware and software aspects of *ForeRunner* switches and network modules by providing a hierarchical menu system similar to a UNIX file system. A single root menu provides a number of commands. Some of those commands, in turn, call submenus which provide a number of subcommands. At any given time, you work within a particular submenu which is indicated by the prompt. You can traverse a submenu one level at a time, or can traverse a number of levels simultaneously if the entire command string is known.

A.1 AMI Syntax

AMI is described throughout this chapter using the following conventions:

- All AMI output, including user prompts, is shown in `courier` font.
- All user input is shown in **`bold courier`** font.
- Each submenu is described in a separate section.
- Commands that are submenus are immediately followed by a ">" symbol. The ">" should not be entered as part of the command.
- Parameter values that require a choice are separated by vertical bars and are enclosed in parentheses "(|)" Neither the vertical bar nor the parentheses should be entered as part of the command.
- Flag names are indicated with dashes "-". The dash must be entered as part of the command.
- All port names and ATM interface (AtmIf) names are in BNP (board, network module, port) notation. For example, 1A4 indicates the first switch fabric, network module A, port 4. For more information about port numbering, see the *Installation and Maintenance Manual* for your switch.
- AMI commands are not case-sensitive.
- Integers that are input with a leading zero are interpreted as OCTAL numbers. Integers that are input with a leading 0x are interpreted as HEX.

The following is an example of the syntax:

```
myswitch:connections channel-> new
Usage:
   [-iatmif] <AtmIf>            Input AtmIf
   [-ivpi] <integer>            Input VPI
   [-ivci] <integer>            Input VCI
   [-oatmif] <AtmIf>            Output AtmIf
   [-ovpi] <integer>            Output VPI
   [-ovci] <integer>            Output VCI
  [[-upc] <UPC Index>]          UPC Contract (default: 0)
  [[-name] <text>]              Name
  [[-ctype] <connection_type>]  Connection Type
```

Some parameters are required and some are optional. Any flag or parameter that is enclosed in square brackets "[ ]" is optional. The following is an example:

```
   [-iatmif] <AtmIf>            Input AtmIf
```

In this case, you do not have to specify the flag **-iatmif**, but you must specify the flag argument "<AtmIf>."

In the following example, both the flag **-upc** and the flag/parameter pair are enclosed in square brackets so neither need to be specified:

```
  [[-upc] <UPC Index>]          UPC Contract (default: 0)
```

Commands may be entered in either of the following two ways:

1. You can enter the flags as part of the command. Once you enter an option in this way, you must enter all subsequent options with the flag name (along with the dash) for each parameter that you are using. The flags may be in any order. For example:

```
myswitch:connections channel-> new
Usage:
   [-iatmif] <AtmIf>            Input AtmIf
   [-ivpi] <integer>            Input VPI
   [-ivci] <integer>            Input VCI
   [-oatmif] <AtmIf>            Output AtmIf
   [-ovpi] <integer>            Output VPI
   [-ovci] <integer>            Output VCI
  [[-upc] <UPC Index>]          UPC Contract (default: 0)
  [[-name] <text>]              Name
  [[-ctype] <connection_type>]  Connection Type

myswitch:connections channel-> new -iatmif 1a1 -ivpi 0 -ivci 100 -oatmif 1b2
-ovpi 0 -ovci 100 -upc 3
```

The flags may also be in any order when the flags names are used throughout as follows:

```
myswitch:connections channel-> new -ivci 100 -iatmif 1a1 -upc 3 -ivpi 0 -oatmif
1b2 -ovpi 0 -ovci 100
```

2. You can simply enter the parameter values. However, these values must be entered in the order shown in the command. For example:

```
myswitch:connections channel-> new 1a1 0 100 1b2 0 100 3
```

A.2 AMI Features

AMI consists of commands placed in a directory hierarchy. AMI assumes an 80-column display with 24 rows, but the number of rows can be adjusted using the **rows** command. (See Chapter 2 in Part 1 of this manual for more information.) AMI works with any ANSI-compatible terminal and can be accessed via the serial port or through a telnet session.

A.2.1 Implicit Command Path

AMI allows you to configure and to make statistical queries of various hardware and software aspects of *ForeRunnerLE* switches and network modules by providing a hierarchical directory system similar to a UNIX file system. The different levels of this hierarchy are called directories. A single root directory provides a number of commands and subdirectories.

At any given time, the AMI prompt indicates your current location within the AMI hierarchy. The switch name is displayed in the prompt as shown by "`myswitch:->`" in the examples in this manual. The prompt can be customized to display something other than the switch name using the **system prompt** command. (See Chapter 4 in Part 3 of this manual for more information.)

You can traverse a directory one level at a time, or can traverse a number of levels simultaneously if the entire command path is known. When a command is entered, AMI searches an implicit path in the AMI command hierarchy to find the command. First, it searches for the command in the current directory. If it cannot find any matches in the current directory, it then searches the entire command hierarchy. For example, if you type **r?** you get the commands and directories that begin with **r** as follows:

```
myswitch:-> r?
  redo                      Execute a previous command
  redundancy>               The redundancy directory
  routing>                  The routing directory
  rows                      Show/Set the rows for this AMI session
myswitch:-> r
```

A.2.2 Context-Sensitive Help

Entering **?** provides a context-sensitive help message. If you enter **?** at a blank command line, the commands and directories under the current directory are listed, along with a short description of each. The following is an example:

```
myswitch:-> ?
  exit                    Quit the AMI session
  top                     Go to the top-level directory
  up                      Go up one directory
  about                   Display copyright information
  connections>            The connections directory
  debug>                  The debug directory
  hardware>               The hardware directory
  history                 Show the history of commands for this AMI session
  interfaces>             The interfaces directory
  redo                    Execute a previous command
  routing>                The routing directory
  rows                    Show/Set the rows for this AMI session
  security>               The security directory
  services>               The services directory
  signalling>             The signalling directory
  system>                 The system directory
  whereis                 Show old command to new command mapping
```

Entering **?** immediately after the command name, displays all of the commands that begin with those letters.

Typing a command, an extra space after the command (to designate the end of the command string), and then typing a **?** displays context-sensitive help for that command.

Entering **?** does not change the line you are currently typing. When the prompt reappears, anything that you have typed before entering **?** also reappears.

A.2.3 Partial Commands

You only need to enter the minimum number of letters in a command which would make the command unique to that level. For example, you could enter **co c sh** instead of **connections channel show**. However, the minimum number of letters entered must also distinguish the command from root commands, such as **up**. For example, you would have to enter **upc** to distinguish **upc** from the root command **up**.

You can also abbreviate arguments in a command as long as enough characters are entered to distinguish between arguments. For example, you could enter **conn chan new -ia** instead of **conn chan new -iatmif**.

A.2.4 Command Completion

If you type the first character of a command and press the **<Tab>** key, AMI attempts to finish typing as much of the command at the current cursor position as it can until an ambiguity is encountered. If AMI cannot add any more characters to the command line because it is too ambiguous at that level, AMI lists all the possible choices that can entered at the current cursor position. When performing command completion, AMI ignores all characters after the current cursor position. If AMI cannot add characters and cannot provide a completion list, the console bell rings.

Here is an example of command completion:

```
myswitch:-> ro <Tab>
    routing rows
```

The **<Tab>** key does not remove the line you are currently typing, although it may add characters to it when it is able to complete a command. At this point, if you type **u** and hit the **<Tab>** key once more, AMI completes the command as **routing** since there is only one possibility that starts with **rou**.

```
myswitch:-> routing
```

Pressing the **<RETURN>** key changes the prompt to the routing directory.

```
myswitch:-> routing <RETURN>

myswitch:routing->
```

A.2.5 Generic Query Mechanism

The generic query mechanism allows you to query on any argument in a command. For example, by simply typing the **show** command, you can display all of the channels.

```
myswitch:connections channel-> show
          Input                Output
AtmIf     VPI  VCI   AtmIf     VPI  VCI   ServCat Protocol Name
1A1       0    5     1CTL      0    45    nrtVBR  fsig     N/A
1A1       0    16    1CTL      0    46    nrtVBR  fsig     N/A
1A1       0    123   1A1       0    124   UBR     pvc      N/A
1A2       0    5     1CTL      0    47    nrtVBR  fsig     N/A
1A2       0    14    1CTL      0    36    UBR     spans    N/A
1A2       0    15    1CTL      0    35    nrtVBR  spans    N/A
1A2       0    16    1CTL      0    48    nrtVBR  fsig     N/A
Press q to quit, any other key to continue... q
```

You can also display just the channels that have an input VCI of 16 as follows:

```
myswitch:connections channel-> show -ivci 16
          Input                Output
AtmIf     VPI  VCI   AtmIf     VPI  VCI   ServCat Protocol Name
1A1       0    16    1CTL      0    46    nrtVBR  fsig     N/A
1A2       0    16    1CTL      0    48    nrtVBR  fsig     N/A
Press q to quit, any other key to continue... q
```

When the prompt "`Press <return> for more, or 'q' to quit...`" is displayed, you may type any key to stop the output. Typing **q** simply stops the output. Typing any other key(s) stops the output and echoes those characters on the command line so that you may begin typing a new command.

A.2.6 Wild Cards

AMI interprets an asterisk (*) as a wild card character. An asterisk matches zero or more characters. Each field in a query can have several asterisks. For example:

```
myswitch:security ipfiltering-> show 1*
Addresses being denied:
1.2.3.4
11.22.33.44

myswitch:security ipfiltering-> show *3*
Addresses being denied:
1.2.3.4
11.22.33.44
```

The following example would delete signalling on all ports with a VPI of 3 or 4.

```
myswitch:signalling-> delete * -vpi 3|4
```

This type of query can only be used with **show**, **modify**, and **delete** commands.

A.2.7 Ranges

When querying on a range, AMI interprets 2 dots (..) as the range operator. It matches against any value that is defined as being in the specified range, inclusively. The range cannot contain a wild card. The following are some examples:

```
myswitch:security ipfiltering-> show 1.2.3.4..7.0.0.0
Addresses being denied:
1.2.3.4
6.7.8.9
```

The following example deletes all the SPVXs from 1 to 10 which have a **-callingvpi** of 32:

```
myswitch:connections smartchannel pnni pp-> delete 1..10 -callingvpi 32
```

This type of query can only be used with **show**, **modify**, and **delete** commands.

A.2.8 Lists

AMI interprets a vertical bar as an OR operator. It matches against any of the query values in the bar-separated list. Each field in a query can have several bar-separated members, each of which can also contain wild cards. The following are some examples:

```
myswitch:security ipfiltering-> show 1.2.3.4|6.0.0.0..7.0.0.0
Addresses being denied:
1.2.3.4
6.7.8.9

myswitch:security ipfiltering-> show *66*|*3*
Addresses being denied:
1.2.3.4
11.22.33.44
66.77.88.99
```

The following example would delete signalling on all ports with a VPI of 3 or 4.

```
myswitch:signalling-> delete * -vpi 3|4
```

The following example would delete all SPVXs which have a **`-callingvpi`** of 32 or 34:

```
myswitch:connections smartchannel pnni pp-> delete * -callingvpi 32|34
```

This type of query can only be used with **`show`**, **`modify`**, and **`delete`** commands.

A.2.9 Command Line Editing

This feature allows easier configuration of the switch. You scroll through the commands stored in AMI's history. Then you can edit the lines by deleting, inserting, and replacing characters. This is particularly useful if you need to enter several long command strings that are similar.

When editing a line, the current cursor position is always in "insert" mode. Cursor movements are controlled using standard ANSI terminal escape sequences. Non-ANSI terminals are not supported.

The following key sequences are supported by this feature:

Key Sequence	Description
up and down arrow keys	The up and down arrows keys on a standard keyboard let you toggle through the history of AMI commands. The up arrow displays the previous command in AMI's history. The down arrow displays the following command in AMI's history.
left and right arrow keys	The left and right arrows let you move the cursor over a displayed AMI command. The displayed line is not modified. Only the cursor position is changed.
Control-P	This key sequence has the same effect as using the up arrow key.
Control-N	This key sequence has the same effect as using the down arrow key.
Control-B	This key sequence has the same effect as using the left arrow key.
Control-F	This key sequence has the same effect as using the right arrow key.
Control-A	This key sequence moves the cursor to the beginning of the line being edited.
Control-E	This key sequence moves the cursor to the end of the line being edited.
Control-H	This key sequence deletes the character before the current cursor position.
Control-D	This key sequence deletes the character under the current cursor position.
Control-K	This key sequence deletes everything on the line being edited from the current cursor position to the end of the line. The deleted characters are saved in a temporary buffer.
Control-U	This key sequence deletes all characters on the current line. The deleted characters are saved in a temporary buffer.
Control-Y	This key sequence restores the characters that were deleted by the last Control-K or Control-U sequence. This key sequence has no effect if nothing has been deleted.
Control-J	This key sequence returns the current line to AMI to be executed.
Control-L	This key sequence clears the terminal screen. The current AMI prompt and the current AMI command are re-displayed at the top of the screen.

A.2.10 Command Confirmations

Certain command actions need to be confirmed. When an action is asked to be confirmed, AMI displays the messages, and then asks the user for confirmation. For example, if the confirmation message is "This will cause the switch to reboot," then the AMI session would look similar to the following:

```
myswitch:-> reboot
WARNING: This will cause the switch to reboot.
Do you wish to continue? (y or n): n
myswitch:->
```

To abort the command, type **n**. To continue with the command, type **y**.

A.3 Logging in to a Switch

You can log in to a switch in several different ways:

- via the serial port
- via telnet
- via *Element Manager*

The first two methods are described here. For information about logging in via *Element Manager*, please see the *ForeThought Element Manager Quick Start Guide*.

Initially, you must log in to the switch through the serial port.

A.3.1 Login from the Serial Port

On a new switch, there is one default userid: `ami`. This userid is configured with the `password` authentication method (the user is prompted for a login ID (userid) and a password) and with an `admin` profile (meaning you are allowed to use all AMI commands) for http, telnet, and console (serial port) logins. This userid is assigned a null password.

Older switches that have been upgraded may also have a default userid called `asx`. This userid is assigned a null password, and configured with the `password` authentication method and an `admin` profile for http, telnet, and console (serial port) logins.

A.3.1.1 Login from the Serial Port with a Userid

When configured to log in with a userid, at the login prompt, you must enter your userid and the password that has been assigned for your userid. For security reasons, the switch does not echo your keystrokes when you enter a password. For example:

```
login: ami <ENTER>
Password:
```

After you log in, if your userid has no assigned password, the following message is displayed:

```
Warning : This userid does not have a local password set.
          Please type “security login password ami”
          to set the local password.
```

NOTE

It is highly recommended that you assign a password to the `ami` userid and to the `asx` userid (on older switches), since these userids have `admin` privileges by default. For more information, see the *ATM Switch Network Configuration Manual* and see Part 2 of the *AMI Configuration Commands Reference Manual*.

NOTE

After three unsuccessful login attempts, there is a five-second delay before you may attempt to login again.

A.3.1.1.1 Login from the Serial Port with SecurID

If you login with a userid that has been configured for SecurID authentication, you are prompted for a login ID (userid) and a password. For the password, you need to enter the two-part SecurID passcode.

The two-part passcode consists of: a secret, memorized personal identification number (PIN) and the current code generated by the user's assigned SecurID token. After a validation check is made, an AMI session is started (provided that a local AMI session is not already running).

```
login: securid_userid <ENTER>
Password: <PIN><Code on SecurID Token> <ENTER>
```

If you enter an incorrect passcode three times in a row, you are prompted to enter the two-part SecurID passcode and the next Tokencode. At the next Tokencode prompt, wait until the display changes on your SecurID token and enter either your PIN number and that next code number, or just that next code number.

```
login: test1
Password:
Login incorrect

login: test1
Password:
Login incorrect

login: test1
Password:
Login incorrect
```

```
login: test1
Password:
next Tokencode:
```

Once you enter either the correct local password or the correct SecurID passcode, the following is displayed and a session is opened on the SCP:

```
ATM Management Interface v6.1.0
Copyright (c) 1994-1998 FORE Systems, Inc.
General commands:
  '?' to get list of commands at the current level
  'up' to go up one menu level
  'top' to go to the root menu
  'exit' to leave AMI
Opening a session for "127.0.0.1", please wait...
Connected to "127.0.0.1" (asx200bx).
myswitch::>
```

There are several possible login scenarios. See the *ATM Switch Network Configuration Manual* for your switch for a list of scenarios and the action the switch takes for each.

A.3.2 Login from Telnet

Three different types of telnet sessions can be requested, depending on the authentication type you are assigned:

- password authentication
- Kerberos authentication
- SecurID authentication

A.3.2.1 Using Password Authentication

To telnet to the SCP, enter the following parameters at the > prompt on the host:

```
> telnet <address>
```

This parameter is defined as follows:

Parameter	Description
address	The IP address of the SCP.

For example, to telnet to an SCP with the IP address 204.95.89.231, enter the following:

```
> telnet 204.95.89.231
```

Only one user at a time may telnet to an AMI session on an SCP, although a user may be logged in through the serial port and another may be logged in through telnet at the same time. If a telnet AMI session is already in use, and you attempt to log in through a telnet session, you receive a message similar to the following and are prevented from logging into the switch:

```
Userid <<userid>> is already logged into AMI.
Exiting...
```

If no other AMI session is running, something similar to the following is displayed:

```
Trying 204.95.89.231 ...
Connected to fishtank.
Escape character is '^]'.

S_ForeThought_6.1.0 (1.44214) (asx200bx) (fishtank)
```

A.3.2.1.1 Using Kerberos Authentication

If a DES encrypted telnet session has been requested and authentication has been successful, the following displays:

```
Trying 169.20.4.21...
Connected to fishtank.
Escape character is '^]'.
[ Kerberos V5 accepts you as ''jsmith@FORE.COM'' ]

S_ForeThought_6.1.0 (1.44214) (asx200bx) (fishtank)
```

If Kerberos authentication has failed, the following displays:

```
Trying 172.19.4.20...
Connected to magic-swslab.eng.fore.com.
Escape character is '^]'.
Authentication negotiation has failed, which is required for encryption.
Good bye.
```

`S_ForeThought_6.1.0 (1.44214)` indicates the version of software, `(asx200bx)` indicates what type of switch this is, and `(fishtank)` indicates the name that has been assigned to this SCP. If `(ATM SWITCH)` is displayed for the SCP name, this means that no host name has been assigned yet.

On a new switch, there is one default userid: `ami`. This userid is configured with the `password` authentication method (the user is prompted for a login ID (userid) and a password) and with an `admin` profile (meaning you are allowed to use all AMI commands) for http, telnet, and console (serial port) logins. This userid is assigned a null password.

Older switches that have been upgraded may also have a default userid called `asx`. This userid is assigned a null password, and configured with the `password` authentication method and an `admin` profile for http, telnet, and console (serial port) logins.

At the login prompt, you must enter your userid. Type your assigned userid for the login and then enter the assigned password. For example:

```
login: myuserid <ENTER>
Password:       <ENTER>
```

For security reasons, the switch does not echo your keystrokes when you enter a password.

After three unsuccessful login attempts, there is a five-second delay before you may attempt to login again.

If you do not log in and enter the password within 60 seconds, the telnet session times out with the following message:

```
login: Login timed out after 60 seconds
```

A.3.2.1.2 Using SecurID Authentication

If you login with a userid that has been configured for SecurID authentication, you are prompted for a login ID (userid) and a password. For the password, you need to enter the two-part SecurID passcode.

The two-part passcode consists of: a secret, memorized personal identification number (PIN) and the current code generated by the user's assigned SecurID token. After a validation check is made, an AMI session is started (provided that a local AMI session is not already running).

```
login: securid_userid <ENTER>
Password: <PIN><Code on SecurID Token> <ENTER>
```

If you enter an incorrect passcode three times in a row, you are prompted to enter the two-part SecurID passcode and the next Tokencode. At the next Tokencode prompt, wait until the display changes on your SecurID token and enter either your PIN number and that next code number, or just that next code number.

```
login: test1
Password:
Login incorrect

login: test1
Password:
Login incorrect
```

```
login: test1
Password:
Login incorrect

login: test1
Password:
next Tokencode:
```

Once you enter either the correct local password or the correct SecurID passcode, the following is displayed and a session is opened on the SCP:

```
ATM Management Interface v6.1.0
Copyright (c) 1994-1998 FORE Systems, Inc.
General commands:
  '?' to get list of commands at the current level
  'up' to go up one menu level
  'top' to go to the root menu
  'exit' to leave AMI
Opening a session for "127.0.0.1", please wait...
Connected to "127.0.0.1" (asx200bx).
myswitch::>
```

There are several different possible login scenarios. See the *ATM Switch Network Configuration Manual* for your switch for a list of scenarios and the action the switch takes for each.

APPENDIX B Hardware Specifications

This section provides information about the hardware for the *ForeRunnerLE* ATM Workgroup Switch products. Information provided includes cabling specifications, pinout specifications, and hardware and general operating specifications. The following are described in this section:

- ForeRunnerLE 25 Specifications
- ForeRunnerLE 155 Specifications
- ForeRunnerLE Port Interface and Port Expansion Module Specifications

B.1 *ForeRunnerLE* Switch Specifications

The following sections detail the technical and operating specifications for the ForeRunnerLE 25 and ForeRunnerLE 155 switches.

B.1.1 *ForeRunnerLE* 25 Specifications

The *ForeRunnerLE* 25 ATM Workgroup Switch has the following specifications:

Features	Specification
Switching Fabric	2.5 Gbps, non-blocking
Number of Ports	24 interface ports of 25 Mbps plus 2 or 4 PEM ports of 155 Mbps or one PEM port of 622 Mbps
Traffic Policing	UPC, dual leaky bucket support
Switch Transit Delay	< 10 microseconds
Connection Setup Time	< 10 milliseconds, 88 calls / second
Control Processor	i960 CF switch control processor
Maximum Port Speed	622 Mbps (OC-12c / STM-4c) - PEM
Serial Interface	DB-9 male connector
Power (nominal)	100-127 VAC to 200-250 VAC at 50-60 Hz, 2.2 to 4.2 amps max

Features	Specification
Dimensions	H: 3.13" (7.95 cm) W: 17.5" (44.45 cm) D: 11.98" (30.43 cm)
Weight	14.30 lbs (6.50 kg) maximum
Standards Compliance	ITU I.361 ATM Layer, ATM Forum UNI v3.x
Emissions	FCC Part 15, Class A; EN 55022 / CISPR 22, Class A; VCCI Class 1; EN 60950; IEC950
Safety	US: UL 1950; Canada: CSA 22.2; No. 950-M89; Europe: EN 60950
Operating Temperature	0°C to 40°C up to 10,000 ft
Operating Humidity	15 to 85% relative humidity, non-condensing
Storage Temperature	-40°C to 70°C up to 30,000 ft
Storage Humidity	10 to 95% relative humidity, non-condensing

B.1.2 *ForeRunnerLE* 155 Specifications

The *ForeRunnerLE* 155 ATM Workgroup Switch has the following specifications:

Features	Specification
Switching Fabric	2.5 Gbps, non-blocking
Number of Ports	12 interface ports plus up to 4 PEM ports
Traffic Policing	UPC, dual leaky bucket support
Switch Transit Delay	< 10 microseconds
Connection Setup Time	< 10 milliseconds, 100 calls / second
Control Processor	i960 CF switch control processor
Maximum Port Speed	622 Mbps (OC-12c / STM-4c) - PEM
Serial Interface	DB-9 male connector
Power (nominal)	100-127 VAC to 200-250 VAC at 50-60 Hz; 2.2 to 4.2 amps maximum
Dimensions	H: 2.95" (7.49 cm) W: 17.5" (44.45 cm) D: 11.82" (30.02 cm)
Weight	14.30 lbs (6.50 kg) maximum
Standards Compliance	ITU I.361 ATM Layer, ATM Forum UNI v3.x
Emissions	FCC Part 15, Class A; EN 55022 Class A; VCCI Class 1; EN 50082-1
Safety	US: UL 1950; Canada: CSA 22.2; No. 950-M89; Europe: EN 60950
Operating Temperature	0°C to 40°C up to 10,000 ft
Operating Humidity	15 to 85% relative humidity, non-condensing
Storage Temperature	-40°C to 70°C up to 30,000 ft
Storage Humidity	10 to 95% relative humidity, non-condensing

B.2 *ForeRunnerLE* Port Interface and Port Expansion Module Specifications

The following subsections detail the technical and operating specifications for the *ForeRunnerLE* 25 integrated port interfaces and the integrated port interfaces available on the *ForeRunnerLE* 155. Port Expansion Modules (PEMs) that can be installed in either the *LE*25 or *LE*155 are also included.

B.2.1 25 Mbps TP25 Port Interface Specification

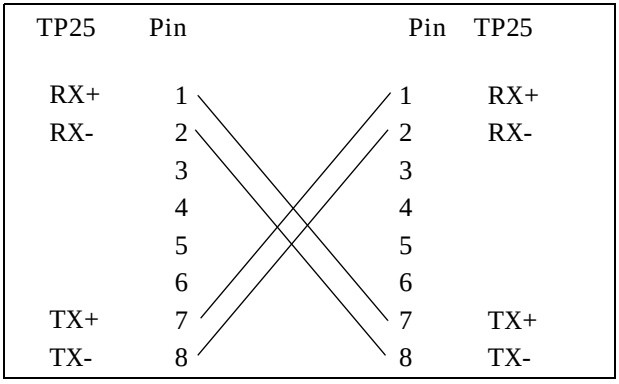
The following specifications apply to the 25 Mbps TP25 integrated port interfaces for the *ForeRunnerLE* 25:

Description	Specification
Port Capacity	Eight TP25 ports per interface group
Data Rate	25.6 Mbps
Output Buffer	2,560 cell capacity - Series LE
Media	Cat. 3, 4, or 5 Unshielded Twisted Pair (UTP)
Max. Line Length	~100 m
Connector	RJ-45
Line Encoding	4B / 5B with Non-Return to Zero Inverted (NRZI)
Clock Accuracy	±100 ppm
Timing	Primary and secondary 8kHz reference from internal (default) or network
Loopbacks	Line loopback
Impedance	100 ohms
Statistics / Alarms	Header Check Sequence (HCS) errors, cells received (RxCells), cells transmitted (TxCells), and symbol errors
Compliance	ATM Forum 25.6 Mbps specification AF-PHY-0040.000

B.2.1.1 Connecting Switches with TP25 Interface Ports

The TP25 interface ports have a standard RJ45 connector that uses pins 1, 2, 7 and 8. When connecting switches using TP25 network modules, you will need to use a UTP crossover cable with the following specification:

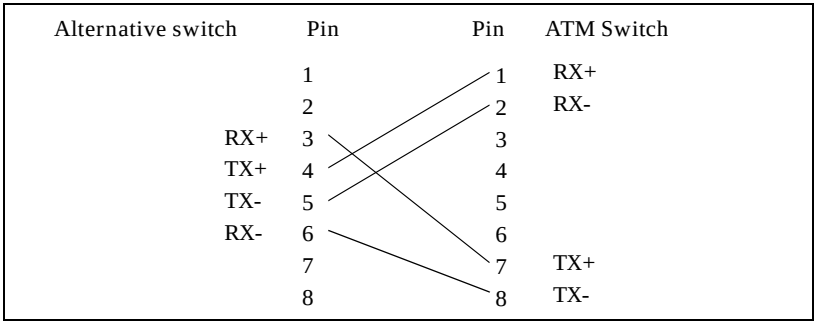
- Pin 1 to pin 7 in both directions.
- Pin 2 to pin 8 in both directions.



B.2.1.2 Connecting Switches with Token Ring Pinouts to *ForeRunner* Switches

Although FORE Systems' switches use the 1, 2, 7 and 8 pin assignment recommended by the ATM Forum, some switches use pins 3, 4, 5 and 6. Connecting one of these switches to a *ForeRunner* switch would require the connections to be mapped as follows:

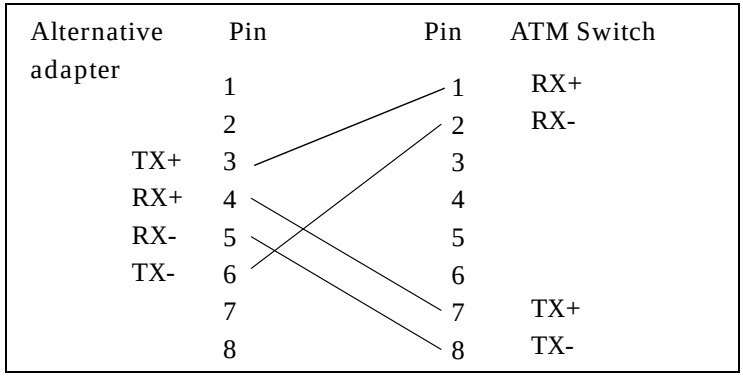
- Pin 3 to pin 7 in both directions.
- Pin 4 to pin 1 in both directions.
- Pin 5 to pin 2 in both directions.
- Pin 6 to pin 8 in both directions.



B.2.1.3 Connecting Adapters with Token Ring Pinouts to *ForeRunner* Switches

Like switches, some adapters use different pin assignments than those mentioned before. Connecting one of these adapters to a *ForeRunner* switch would require the connections to be mapped as follows:

- Pin 3 to pin 1 in both directions.
- Pin 4 to pin 7 in both directions.
- Pin 5 to pin 8 in both directions.
- Pin 6 to pin 2 in both directions.



NOTE

The cable used in the connections shown in Section B.2.1.2 and Section B.2.1.3 must be either a UTP-3 or UTP-5 bidirectional crossover cable, with 8-pin male RJ-45 modular connectors at each end.

B.2.2 155 Mbps OC-3c/STM-1 MM Port Interfaces and PEM Specifications

The following specifications apply to the 155 Mbps OC-3c/STM-1 port interfaces and to the 155 Mbps OC-3c/STM-1 PEM:

Description	Specification
Port Capacity	Four SONET/SDH ports per interface group
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Multimode fiber
Maximum Line Length	~2 km
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c/STM-1
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Loopbacks	Transmit and receive loopbacks
Power	-14 to -20 dBm transmit, -14 to -30 dBm receive, 0 to 10 dB path attenuation
Core Diameter	62.5 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Statistics/Alarms	SONET/SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2/93-020, T1S1/92-185, ITU-T G.957, GR-253-CORE

B.2.3 155 Mbps STS-3c/STM-1 UTP Port Interfaces and PEM Specifications

The following specifications apply to the 155 Mbps STS-3c / STM-1 UTP port interfaces and to the 155 Mbps STS-3c / STM-1 UTP PEM:

Description	Specification
Port Capacity	Four SONET / SDH ports per interface group Four SONET / SDH ports per PEM
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Category 5 Unshielded Twisted Pair (UTP)
Maximum Line Length	100 m
Connectors	RJ-45
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c / STM-1
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Loopbacks	Transmit and receive loopbacks
Statistics / Alarms	SONET / SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2 / 93-020, T1S1 / 92-185, ATM Forum AF-PHY-0015.000

B.2.3.1 155 Mbps UTP Pinouts

The 155 Mbps UTP port interfaces have a standard RJ-45 female connector and have the pinout specifications as listed in the table below:

Table 2.1 - UTP Pinout Specifications

Pin Number	Signal Mnemonic	Signal Name
1	RX+	Receive Data +
2	RX-	Receive Data -
3		Not Used
4		Not Used
5		Not Used
6		Not Used
7	TX+	Transmit Data +
8	TX-	Transmit Data -

B.2.4 155 Mbps OC-3c/STM-4c MM PEM Specifications

The following specifications apply to the 155 Mbps OC-3c/STM-4c MM PEM:

Description	Specification
Port Capacity	Two SONET/SDH ports per PEM
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Multimode fiber
Maximum Line Length	~2 m
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c/STM-4c
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Power	-14 to -20 dBm transmit, -14 to -30 dBm receive, 0 to 10 dB path attenuation
Core Diameter	62.5 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Loopbacks	Transmit and receive loopbacks
Statistics/Alarms	SONET/SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2/93-020, T1S1/92-185, ATM Forum AF-PHY-0015.000

B.2.5 622 Mbps OC-12c/STM-4c MM PEM Specifications

The following specifications apply to the 622 Mbps OC-12c / STM-4c MM PEM:

Description	Specification
Port Capacity	One SONET / SDH port per PEM
Data Rate	622.08 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Multimode fiber
Maximum Line Length	500 m
Connectors	SC
Line encoding	Non-Return to Zero (NRZ)
Framing	STS-12c / STM-4c
Clock Accuracy	±20 ppm
Timing	Primary and secondary reference from internal (default) or network
Loopbacks	Transmit and receive loopbacks
Power	-20 to -14 dBm transmit power, -26 to -14 dBm receive sensitivity, 0 to 6 dB path attenuation for 62.5 µm fiber, 0 to 2 dB path attenuation for 50 µm fiber
Core Diameter	62.5 µm, 50 µm
Fiber Diameter	125 µm
Wavelength	1270 - 1380 nm
Statistics / Alarms	SONET / SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity (Line BIP-24, Section BIP-8, Path BIP-8) errors, Header Check Sequence (HCS) errors, cells received (RxCells), cells transmitted (TxCells)
Compliance	ATM Forum AF-PHY-0046.000, ITU-T I.432, ANSI T1E1.2 / 93-020, T1S1 / 92-185, ITU-T G.957, GR-253-CORE

B.2.6 155 Mbps OC-3c/STM-1 2MM STS-3c/STM-1 2UTP PEM Specifications

The 155 Mbps OC-3c/STM-1 2MM STS-3c/STM-1 2UTP PEM contains two 155 Mbps STS-3c/STM-1 UTP ports (ports 1 and 2) and two SONET/SDH multimode ports (ports 3 and 4).

The following specifications apply to ports 1 and 2:

Description	Specification
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Category 5 Unshielded Twisted Pair (UTP)
Maximum Line Length	100 m
Connectors	RJ-45
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c/STM-1
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Loopbacks	Transmit and receive loopbacks
Statistics/Alarms	SONET/SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2/93-020, T1S1/92-185, ATM Forum AF-PHY-0015.000

The following specifications apply to ports 3 and 4:

Description	Specification
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Multimode fiber
Maximum Line Length	~2 km
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c / STM-1
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Loopbacks	Transmit and receive loopbacks
Power	-14 to -20 dBm transmit, -14 to -30 dBm receive, 0 to 10 dB path attenuation
Core Diameter	62.5 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Statistics / Alarms	SONET / SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2 / 93-020, T1S1 / 92-185, ITU-T G.957, GR-253-CORE

B.2.7 155 Mbps OC-3c/STM-1 2MM 2SM PEM Specifications

The 155 Mbps OC-3c/STM-1 2MM 2SM PEM contains two SONET/SDH multimode ports (ports 1 and 2) and two SONET/SDH single mode ports (ports 3 and 4).

The following specifications apply to ports 1 and 2:

Description	Specification
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Multimode fiber
Maximum Line Length	~2 km
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c/STM-1
Clock Accuracy	±20 ppm
Timing	Per-port network timing
Loopbacks	Transmit and receive loopbacks
Power	-14 to -20 dBm transmit, -14 to -30 dBm receive, 0 to 10 dB path attenuation
Core Diameter	62.5 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Statistics/Alarms	SONET/SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence (HCS) errors
Compliance	ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2/93-020, T1S1/92-185, ITU-T G.957

The following specifications apply to ports 3 and 4:

Description	Specification
Data Rate	155.52 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Intermediate reach single mode fiber - Series LE
Maximum Line Length	~14 km
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-3c / STM-1
Clock Accuracy	±20 ppm
Timing	Primary and secondary 8kHz reference from internal (default) or network
Loopbacks	Transmit and receive loopbacks
Power - Intermediate Reach	-8 to -15 dBm transmit power, -8 to -34 dBm receive sensitivity, 0 to 19 dB path attenuation
Core Diameter	10 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Statistics / Alarms	SONET / SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Yellow Alarm, Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence errors (HCS)
Compliance	ANSI T1E1.2 / 94-002-R2

B.2.8 622 Mbps OC-12c/STM-4c SM PEM Specifications

The following specifications apply to the 622 Mbps OC-12c / STM-4c SM PEM:

Description	Specification
Port Capacity	One SONET / SDH port per PEM
Data Rate	622.08 Mbps
Output Buffer	32,768 cell capacity - Series LE
Media	Single mode fiber
Maximum Line Length	~15 km
Connectors	SC
Line Encoding	Non-Return to Zero (NRZ)
Framing	STS-12c / STM-4c
Clock Accuracy	±20 ppm
Timing	Primary and secondary 8kHz reference from internal (default) or network
Loopbacks	Transmit and receive loopbacks
Power - Intermediate Reach	-8 to -15 dBm transmit power, -8 to -28 dBm receive sensitivity, 0 to 13 dB path attenuation
Core Diameter	10 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Statistics / Alarms	SONET / SDH statistics include Loss of Signal (LOS), Loss of Frame (LOF), Loss of Pointer (LOP), Far End Block Errors (FEBE), Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Yellow Alarm, Bit Interleaved Parity errors (Line BIP-24, Section BIP-8, Path BIP-8), Header Check Sequence errors (HCS), cells received (RxCells), cells transmitted (TxCells)
Compliance	AF-PHY-0046.000

APPENDIX C Port Expansion Module Installation

This appendix provides the information necessary to install the Port Expansion Module (PEM) into Interface D of your *ForeRunnerLE* 25 or *ForeRunnerLE* 155 ATM Workgroup Switch. Instructions for removing and replacing a PEM in a *ForeRunnerLE* 25 switch are also included.

The *ForeRunnerLE* 25 and *ForeRunnerLE* 155 can be configured with or without a PEM already installed. If a PEM is already installed in your *ForeRunnerLE* 155, it cannot be removed and replaced. Attempting to remove a PEM in the LE155 may break the connectors and pins and damage the equipment. However, because of the motherboard PEM connectors on the *ForeRunnerLE* 25, this ensures that the motherboard standoffs and connector pins are aligned with the holes and connector in the module printed circuit board. This allows you to safely remove a PEM in an LE25 only. For information on removing an existing PEM in an LE25, see Section C.2.

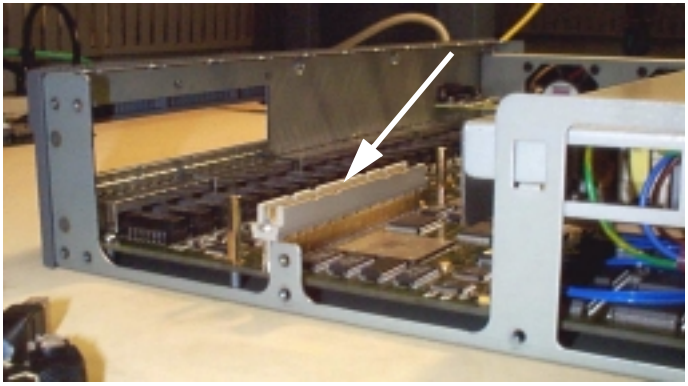


Figure C.1 - Motherboard Connector on the LE25

C.1 Installing a PEM in an LE25 or LE155

A blank faceplate covers the front of Interface D if a PEM is not already installed. This cover must be removed before attempting to install a PEM.

CAUTION

Use a grounding strap and ESD bench when performing all of the following steps.

WARNING!

Once a PEM is installed in a *ForeRunnerLE* 155, it cannot be removed. Attempting to remove an existing PEM in the LE155 may damage the equipment. You can only remove and replace a PEM in a *ForeRunnerLE* 25 switch. See Section C.2 for more information.

1. Unplug the switch from the power source.
2. Unplug any cables or fibers that are attached to the ports.
3. If necessary, remove the switch from the equipment rack and remove the stacking or mounting brackets.
4. Place the switch on a clean, sturdy work surface and remove the switch cover using the following steps:
   a. Remove and retain all of the black screws from the edges of the switch cover using a Phillips screwdriver. (There are five screws on the left side, five on the right side, and six on the back of the cover.)
   b. Grasp the front of the cover on each side and slide it back about three inches, then pull the cover straight up and lift it off.
5. Remove the blank faceplate using the following steps:
   a. Using a Phillips screwdriver, remove and retain the three screws on the back of the blank faceplate inside the front of the switch as shown in Figure C.2. These screws secure the blank faceplate in Interface D. Keep these screws as you will need them to secure the PEM once you have installed it.

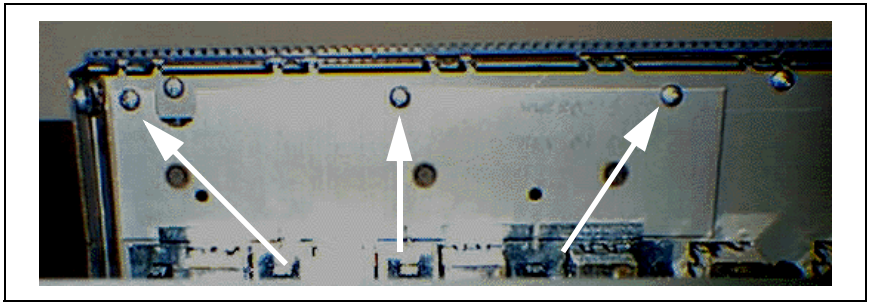


Figure C.2 - Remove the Three Retaining Screws

b. Carefully lift the blank faceplate out of the groove and pull it away.

6. Install the Port Expansion Module using the following steps:

   a. Install the Port Expansion Module so that the module faceplate is pushed through the opening on the front of the switch. Slide the module down along the front of the switch so that the bottom of the module faceplate slides into the groove beneath it.

CAUTION

When installing the PEM, visually ensure that the motherboard standoffs and connector pins are aligned with the holes and connector in the module printed circuit board as shown in Figure C.3. If the connectors and pins are not aligned properly, they will break and the module will be damaged.

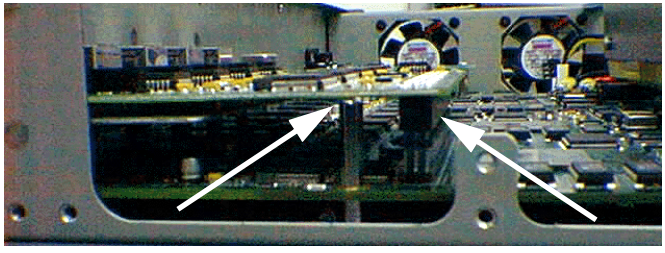


Figure C.3 - Align the Connectors and Standoffs

b. Once aligned properly, push down firmly but carefully on either side of the connectors to mate them. The module should be parallel to the motherboard and flush with the top of the standoffs when it is fully seated.

c. Looking at the front of the switch, visually ensure that the module is in the groove and is flush with the front of the switch. You should not see any unpainted metal below the module's faceplate.

d. Replace the three screws that you removed from the blank faceplate in step 5.

e. Insert and tighten one of the pan-head screws from the kit into each of the standoffs in the middle of the module to secure it as shown in Figure C.4.

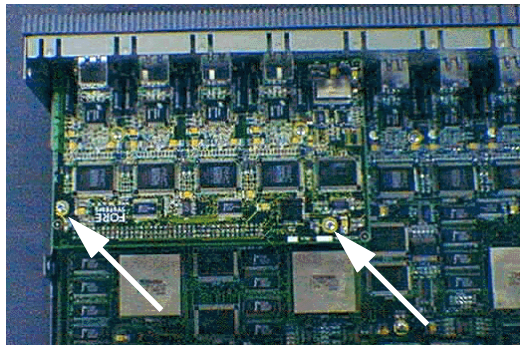


Figure C.4 - Secure the Module Using the Screws Provided

CAUTION

Be sure to use the screws provided in the Port Expansion Module Kit to secure the module. Use of screws other than those provided may result in damage to the module.

7. Replace the switch cover.
   a. Place the cover on the switch and slide it forward until it clicks into place.
   b. Use a Phillips screwdriver to replace all of the black screws on the cover that you removed in step 5.
8. If necessary, replace the stacking or mounting brackets as described in Chapter 2 of this manual.
9. Plug in any cables or fibers that had been attached to the ports.
10. Plug the switch to a power source to restore power.

C.2 Replacing a PEM in an LE25

NOTE

This section ONLY applies if you are replacing a PEM in a *ForeRunnerLE25* switch.

WARNING!

Attempting to remove an existing PEM in a *ForeRunnerLE* 155 switch may damage the equipment.

1. Unplug the switch from the power source.
2. Unplug any cables or fibers that are attached to the ports.
3. If necessary, remove the switch from the equipment rack and remove the stacking or mounting brackets.
4. Place the switch on a clean, sturdy work surface and remove the switch cover using the following steps:
   a. Remove and retain all of the black screws from the edges of the switch cover using a Phillips screwdriver. (There are five screws on the left side, five on the right side, and six on the back of the cover.)
   b. Grasp the front of the cover on each side and slide it back about three inches, then pull the cover straight up and lift it off.
5. Remove the PEM from Interface D using the following steps:

a. Using a Phillips screwdriver, remove the three screws on the back of the face-plate inside the front of the LE25 as shown in Figure C.5. These screws secure the PEM in Interface D of an LE25.

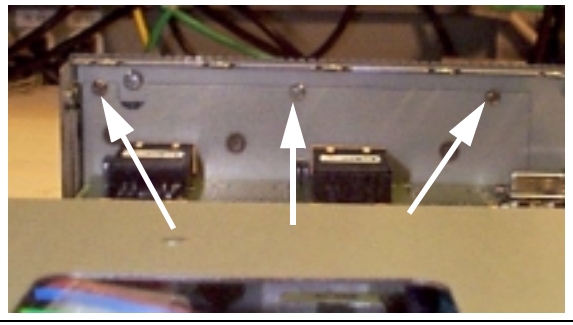


Figure C.5 - Remove the Three Retaining Screws

b. Remove the two screws from each standoff on the top of the module as shown in Figure C.6.

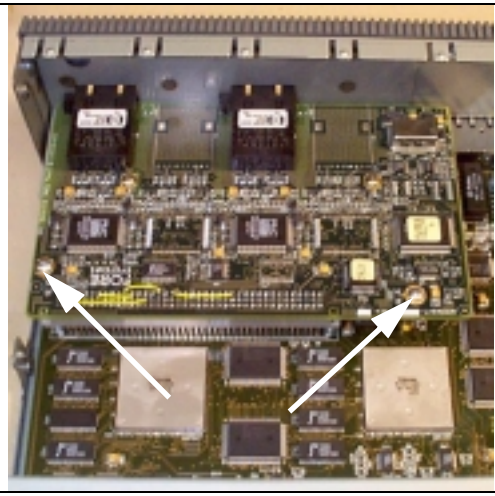


Figure C.6 - Remove the Top Two Screws from the Module

c. Grasp both sides of the module, then pull the module up and lift it out. You are now ready to install the replacement PEM into Interface D of your LE25 switch.

6. Install the replacement Port Expansion Module using the following steps:
   a. Install the Port Expansion Module so that the module faceplate is pushed through the opening on the front of the switch. Slide the module down along the front of the switch so that the bottom of the module faceplate slides into the groove beneath it.

CAUTION

When installing the PEM, visually ensure that the motherboard standoffs and connector pins are aligned with the holes and connector in the module printed circuit board as shown in Figure C.7. If the connectors and pins are not aligned properly, they will break and the module will be damaged.

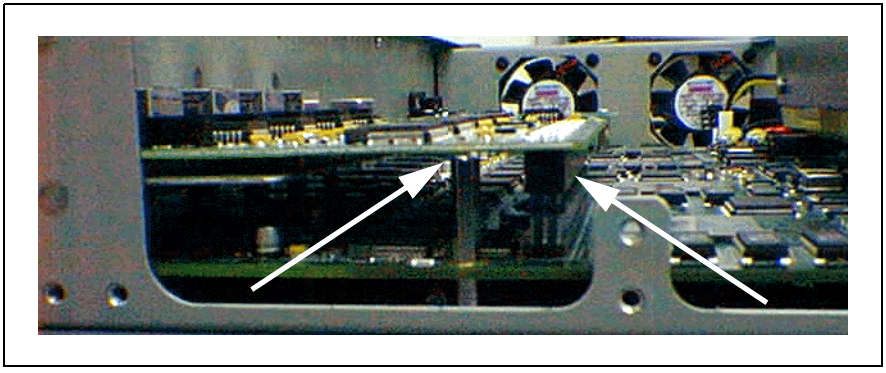


Figure C.7 - Align the Connectors and Standoffs

   b. Once aligned properly, push down firmly but carefully on either side of the connectors to mate them. The module should be parallel to the motherboard and flush with the top of the standoffs when it is fully seated.
   c. Looking at the front of the switch, visually ensure that the module is in the groove and is flush with the front of the switch. You should not see any unpainted metal below the module's faceplate.
   d. Replace the three screws that you removed from the back of the faceplate.
   e. Insert and tighten one of the pan-head screws from the kit into each of the standoffs in the middle of the module to secure it as shown in Figure C.8.

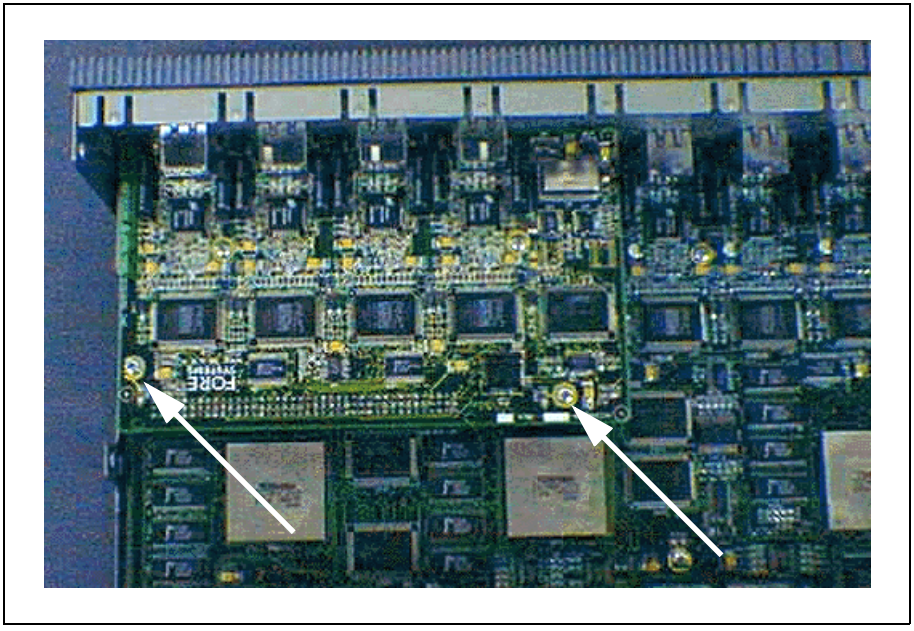


Figure C.8 - Secure the Module Using the Screws Provided

CAUTION

Be sure to use the screws provided in the Port Expansion Module Kit to secure the module. Use of screws other than those provided may result in damage to the module.

7. Replace the cover.
   a. Place the cover on the switch and slide it forward until it clicks into place.
   b. Use a Phillips screwdriver to replace all of the black screws on the cover that you removed in step 4.
8. If necessary, replace the stacking or mounting brackets you removed in step 3.
9. Plug in any cables or fibers that had been attached to the ports.
10. Plug in the switch to a power source to restore power.

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