Model 5399 Remote Access Concentrator Module

Hardware Installation Guide

Part No. 166-024-162 Rev. A
April 1997

Bay Networks

Electromagnetic Compatibility Statements

FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

Note: This equipment has 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 this 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.

Declaration of Conformance

This is to certify that the Bay Networks products in this book are shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022: 1987 Class A (CISPR 22: 1985/BS 6527: 1988), EN 50082-1, and EN 60950.

Industry Canada Notice

Canadian Department of Communications Radio Interference Regulations

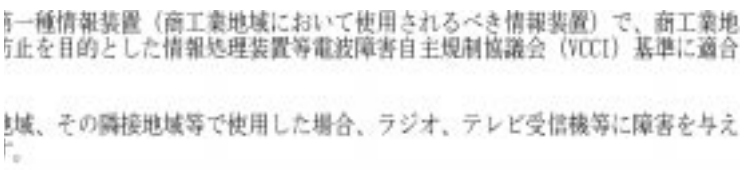
This digital apparatus does not exceed the Class A limits for radio-noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Réglement sur le brouillage radioélectrique du ministère des Communications

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

Japan/Nippon Requirements Only

Voluntary Control Council for Interference (VCCI) Statement



Voluntary Control Council for Interference (VCCI) Statement

This equipment is in the 1st category (information equipment to be used in commercial
and/or industrial areas) and conforms to the standards set by the Voluntary Council for Interference by Data Processing Equipment and Electronic Office Machines that are aimed at preventing radio interference in commercial and/or industrial areas.

Consequently, when this equipment is used in a residential area or in an adjacent area thereto, radio interference may be caused to equipment such as radios and TV receivers.

Notice

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repair to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Notice to Users of T1 and ISDN Services

The following instructions are provided to ensure compliance with the Federal Communications Commission (FCC) Rules, Part 68.

1 All direct connections to T1 and ISDN lines must be made using standard plugs and jacks.

2 Before connecting your unit, you must inform the local telephone company of the following information:

Port ID	REN/SOC	FIC	USOC
WAN 1, WAN 2	6.0Y	04DU9-BN 04DU9-DN 04DU9-1KN 04DU9-1ZN 04DU9-1SN	RJ48C

3 If the unit appears to be malfunctioning, it should be disconnected from the telephone lines until you learn if your equipment or the telephone line is the source of the trouble. If your equipment needs repair, it should not be reconnected until it is repaired.

4 This device has been designed to prevent harm to the network. If the telephone company finds that the equipment is exceeding tolerable parameters, the telephone company can temporarily disconnect service, although they will attempt to give you advance notice if possible.

5 Under the FCC Rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.

6 If the telephone company alters their equipment in a manner that will affect use of this device, they must give you advance warning so as to give you the opportunity for uninterrupted service. You will be advised of your right to file a complaint with the FCC.

7 In the event of equipment malfunction, all repairs should be performed by our Company or an authorized agent. It is the responsibility of users requiring service to report the need for service to our Company or one of our authorized agents. For more details, see *Technical Support and Online Services* on page xix.

Revision Level History

Revision	Description
A	Initial release.

Contents

Figures

Tables

This guide describes how to install a Model 5399 Remote Access Concentrator Module in a Bay Networks Lattice System 5000 Hub.

Refer to the *Remote Annex Software Installation Notes* that come with your Model 5399 for a description of the software installation. Refer to the *Remote Annex Administrator's Guide for UNIX* for configuration information.

About this Guide

This guide includes the following chapters and appendices:

Chapter 1 **Introduction**
Contains an overview of the Model 5399 Remote Access Concentrator Module, and describes the hardware features and firmware functions.

Chapter 2 **Installing the Model 5399 Remote Access Concentrator Module**
Describes how to install the Model 5399 in a System 5000 Hub and how to confirm its operating status.

Chapter 3 **ROM Monitor Commands**
Describes the ROM Monitor commands that modify specific configuration parameters, perform diagnostic tests, and load the operational code.

Chapter 4 **Troubleshooting Procedures**
Provides troubleshooting and verification procedures.

Appendix A **Port Pins and Signals**
Details the port connectors located on the Model 5399 Remote Access Concentrator.

Appendix B **Modem Upgrade Instructions**
Describes how to install and remove modem cards on the Model 5399 Remote Access Concentrator.

Printing Conventions

This manual uses the following printing conventions:

Convention:	Represents:
special type	In examples, special type indicates system output.
special type	Bold special type indicates user input.
Return	In command examples, this notation indicates that pressing Return enters the default value.
bold	Bold indicates commands, pathnames, or filenames that must be entered as displayed.
italics	In the context of commands and command syntax, lowercase italics indicate variables for which the user supplies a value.
[ ]	In command dialog, square brackets indicate default values. Pressing Return selects this value. Square brackets appearing in command syntax indicate optional arguments.
{ }	In command syntax, braces indicate that one, and only one, of the enclosed value must be entered.

Convention:	Represents:
|	In command syntax, this character separates the different options available for a parameter.
	Notes provide important information.
	Warnings inform you about conditions that can have adverse effects on processing.
	Cautions notify you about dangerous conditions.

Related Documents

Each hardware product ships with the appropriate hardware guide. The remaining documentation is included with the software.

To ensure comprehensive network support to our customers and partners worldwide, Bay Networks Customer Service has Technical Response Centers in key locations around the globe:

- Billerica, Massachusetts
- Santa Clara, California
- Sydney, Australia
- Tokyo, Japan
- Valbonne, France

The Technical Response Centers are connected via a redundant Frame Relay Network to a Common Problem Resolution system, enabling them to transmit and share information, and to provide live, around-the-clock support 365 days a year.

Bay Networks Information Services complement the Bay Networks Service program portfolio by giving customers and partners access to the most current technical and support information through a choice of access / retrieval means. These include the World Wide Web, CompuServe, Support Source CD, Customer Support FTP, and InfoFACTS document fax service.

Bay Networks Customer Service

If you purchased your Bay Networks product from a distributor or authorized reseller, contact that distributor's or reseller's technical support staff for assistance with installation, configuration, troubleshooting, or integration issues.

Customers can also purchase direct support from Bay Networks through a variety of service programs. As part of our PhonePlus™ program, Bay Networks Service sets the industry standard, with 24-hour, 7-days-a-week telephone support available worldwide at no extra cost. Our complete range of contract and noncontract services also includes equipment staging and integration, installation support, on-site services, and replacement parts delivery -- within approximately 4 hours.

To purchase any of the Bay Networks support programs, or if you have questions on program features, use the following numbers:

Region	Telephone Number	Fax Number
United States and Canada	1-800-2LANWAN; enter Express Routing Code (ERC) 290 when prompted (508) 436-8880 (direct)	(508) 670-8766
Europe	(33) 92-968-300	(33) 92-968-301
Asia / Pacific Region	(612) 9927-8800	(612) 9927-8811
Latin America	(407) 997-1713	(407) 997-1714

In addition, you can receive information on support programs from your local Bay Networks field sales office, or purchase Bay Networks support directly from your authorized partner.

Bay Networks Information Services

Bay Networks Information Services provide up-to-date support information as a first-line resource for network administration, expansion, and maintenance. This information is available from a variety of sources.

World Wide Web

The Bay Networks Customer Support Web Server offers a diverse library of technical documents, software agents, and other important technical information to Bay Networks customers and partners.

A special benefit for contracted customers and resellers is the ability to access the Web Server to perform Case Management. This feature enables your support staff to interact directly with the network experts in our worldwide Technical Response Centers. A registered contact with a valid Site ID can:

- View a listing of support cases and determine the current status of any open case. Case history data includes severity designation, and telephone, e-mail, or other logs associated with the case.
- Customize the listing of cases according to a variety of criteria, including date, severity, status, and case ID.
- Log notes to existing open cases.
- Create new cases for rapid, efficient handling of noncritical network situations.
- Communicate directly via e-mail with the specific technical resources assigned to your case.

The Bay Networks URL is *http://www.baynetworks.com*. Customer Service is a menu item on that home page.

Customer Service FTP

Accessible via URL *ftp://support.baynetworks.com* (134.177.3.26), this site combines and organizes support files and documentation from across the Bay Networks product suite, including switching products from our Centillion™ and Xylogics® business units. Central management and sponsorship of this FTP site lets you quickly locate information on any of your Bay Networks products.

Support Source CD

This CD-ROM -- sent quarterly to all contracted customers -- is a complete Bay Networks Service troubleshooting knowledge database with an intelligent text search engine.

The Support Source CD contains extracts from our problem-tracking database; information from the Bay Networks Forum on CompuServe; comprehensive technical documentation, such as Customer Support Bulletins, Release Notes, software patches and fixes; and complete information on all Bay Networks Service programs.

You can run a single version on Macintosh, Windows 3.1, Windows 95, Windows NT, DOS, or UNIX computing platforms. A Web links feature enables you to go directly from the CD to various Bay Networks Web pages.

CompuServe

For assistance with noncritical network support issues, Bay Networks Information Services maintain an active forum on CompuServe, a global bulletin-board system. This forum provides file services, technology conferences, and a message section to get assistance from other users.

The message section is monitored by Bay Networks engineers, who provide assistance wherever possible. Customers and resellers holding Bay Networks service contracts also have access to special libraries for advanced levels of support documentation and software. To take advantage of CompuServe's recently enhanced menu options, the Bay Networks Forum has been re-engineered to allow links to our Web sites and FTP sites.

We recommend the use of CompuServe Information Manager software to access these Bay Networks Information Services resources. To open an account and receive a local dial-up number in the United States, call CompuServe at 1-800-524-3388. Outside the United States, call 1-614-529-1349, or your nearest CompuServe office. Ask for Representative No. 591. When you are on line with your CompuServe account, you can reach us with the command **GO BAYNET**.

InfoFACTS

InfoFACTS is the Bay Networks free 24-hour fax-on-demand service. This automated system has libraries of technical and product documents designed to help you manage and troubleshoot your Bay Networks products. The system responds to a fax from the caller or to a third party within minutes of being accessed.

To use InfoFACTS in the United States or Canada, call toll-free 1-800-786-3228. Outside North America, toll calls can be made to 1-408-764-1002. In Europe, toll-free numbers are also available for contacting both InfoFACTS and CompuServe. Please check our Web page for the listing in your country.

How to Get Help

Use the following numbers to reach your Bay Networks Technical Response Center:

Technical Response Center	Telephone Number	Fax Number
Billerica, MA	1-800-2LANWAN	(508) 670-8765
Santa Clara, CA	1-800-2LANWAN	(408) 764-1188
Valbonne, France	(33) 92-968-968	(33) 92-966-998
Sydney, Australia	(612) 9927-8800	(612) 9927-8811
Tokyo, Japan	(81) 3-5402-0180	(81) 3-5402-0173

Chapter 1
Introduction

The Model 5399 Remote Access Concentrator Module is a dial-in remote access server that supports mixed traffic, such as analog modems, V.120 ISDN Terminal Adapters, and devices supporting synchronous PPP. The Model 5399 Remote Access Concentrator module is designed to operate within the Bay Networks Lattice System 5000 Series Hub. Figure 1-2 illustrates a Model 5399.

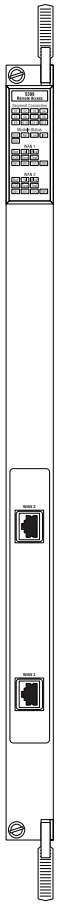


Figure 1-1. Model 5399 Remote Access Concentrator Module

Remote Network Access

The Model 5399 provides remote network access to the following networks (see Figure 1-2):

- Novell Netware
- TCP/IP
- AppleTalk

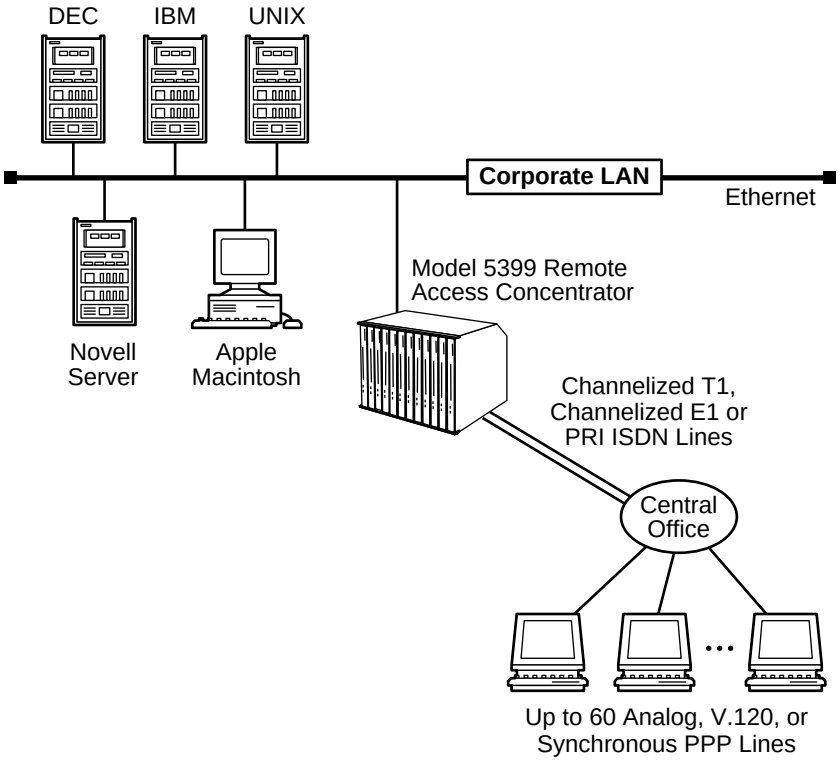


Figure 1-2. The Model 5399 as a Remote Access Server

The Model 5399 also provides terminal to host connectivity to the following:

- UNIX hosts (using TCP/IP)
- VMS hosts (using LAT)
- IBM hosts (using TN3270)

The Remote Access Concentrator supports Windows NT® host tools. Remote Annex Server Tools for Windows NT® allows you to boot and configure the Remote Access Concentrator on a Windows NT® network. For more information, refer to the *Remote Annex Server Tools for Windows NT® User Guide*.

Model 5399 Description

The Model 5399 is a Wide Area Network server capable of supporting domestic ISDN, European ISDN, channelized T1, channelized E1, and other channelized protocols. The Model 5399 can house up to 62 modems to provide the flexibility of terminating calls originated by analog modems, terminal adapters, and routers.

The Model 5399 Remote Access Concentrator module occupies one slot in a System 5000 Hub.

Module Features

Processors

The module utilizes three 80486 DX2 clock-doubled processors, operating at 64 MHz.

WAN Interfaces

These interfaces reside on the module and are accessible via an RJ48C connector on the front panel. Each WAN interface is controlled by one of the 80486 DX2 processors, which also controls the internal modems. The WAN interfaces can accept channelized T1, channelized E1, or ISDN PRI lines.

Memory

The module has 8 megabytes of main DRAM. An additional 4 megabytes of DRAM is provided for each WAN interface controller.

Flash Memory

The module is equipped with 2 megabytes of Flash memory for image storage.

Modems

The Model 5399 Remote Access Concentrator Module can be configured with up to 62 internal DSP-based digital modems. The modems are dynamically downloaded with images to configure them to the appropriate protocol. The modems are located on plug-in modem cards installed on the module.

System 5000 Common Management Bus

The management section of the backplane is the common management bus (CMB), a high-speed, multimaster, shared-memory communication channel that connects all modules installed in the hub to one another and to the supervisory module. The modules installed in the hub use the CMB to acquire and distribute configuration and status information.

The supervisory module is an intelligent interface between the Model 5000 chassis and user-installed modules. The supervisory module provides the following services to other modules across the CMB:

- Maintains chassis component information and environmental status
- Stores the primary module configurations
- Restores the module configuration after the module power is cycled or the module is reset

The supervisory module also supports configuration terminal support through the service port on the front panel of the chassis.

System 5000 Backplane Ethernet Segment Banks

The chassis backplane Ethernet bus consists of 12 Ethernet segments, divided into two banks of six segments each: segments 1 through 6 and segments 7 through 12. Each Model 5399 Remote Access Concentrator module installed in the chassis can be configured to access one bank of six segments, either segments 1 through 6 or segments 7 through 12. For more information, see *Setting the Backplane Ethernet Segment* on page 2-3.

Within a segment bank, the specific segment to which a Model 5399 Remote Access Concentrator module is connected is determined by setting the segment selection DIP switch on the module. For more information, see *Setting the Backplane Ethernet Segment* on page 2-3.

System 5000 Service Port Management

The service port, located on the front panel of the chassis, provides a switched serial communication link between the service port and any module in the hub, including the supervisory module. By connecting a terminal to this port, you can change the configuration parameter values for the Remote Access Concentrator installed in the hub.

For more information, see *Connecting a Service Port Terminal* on page 2-14, *Remote Access Concentrator Parameters* on page 2-18, and *Installing the Model 5399 Remote Access Concentrator* on page 2-3.

Firmware and Software

Firmware

The Model 5399 Remote Access Concentrator's ROM contains firmware for performing power-up self-tests and loading operational code. A non-volatile EEPROM stores the configuration parameters.

The Remote Access Concentrator can boot from the boot image in its Flash memory or can boot an image received from a boot server on the network.

ROM Monitor

The ROM monitor is an interactive command interpreter that is used to define basic configuration parameter values. All of the information that the Model 5399 Remote Access Concentrator needs to boot an operational image is defined using the ROM monitor and its command set. ROM Monitor commands are issued from a terminal connected to the service port on the hub chassis. When the Remote Access Concentrator completes its self tests, the service port terminal displays the ROM monitor prompt. Using the ROM Monitor commands (see Chapter 3), you can:

- Modify and display a set of configuration parameters stored in EEPROM.
- Execute interactive diagnostic tests.
- Receive information and statistics for the hardware configuration and the network.
- Boot the Remote Access Concentrator manually.

Once the Remote Access Concentrator has obtained a boot image and is booted, the service port terminal leaves the ROM monitor and displays the Console monitor (for more details, see Chapter 2).

Supported Configurations

You can self-boot the Model 5399 Remote Access Concentrator from the image contained in its Flash ROM. The Remote Access Concentrator can also obtain full operational code over the network from one of the following devices:

- UNIX host
- Another Model 5399 Remote Access Concentrator configured as a load server
- NT host

Watchdog Timer

The Model 5399 Remote Access Concentrator utilizes a watchdog timer that is reset by the software at regular intervals. The watchdog timer reboots the Remote Access Concentrator in the unlikely event of an internal software error. This feature enables the Remote Access Concentrator to run for long periods of time without intervention.

Front Panel

The Model 5399 Remote Access Concentrator's front panel consists of:

- Annunciator LED
- Segment Connection LEDs
- Module Status LEDs
- WAN 1 Network Status, Alarm, and Port Usage LEDs
- WAN 2 Network Status, Alarm, and Port Usage LEDs
- WAN 1 Port Connector
- WAN 2 Port Connector

Figure 1-3 illustrates the Model 5399 Remote Access Concentrator's front panel. The front panel components are described in the following paragraphs.

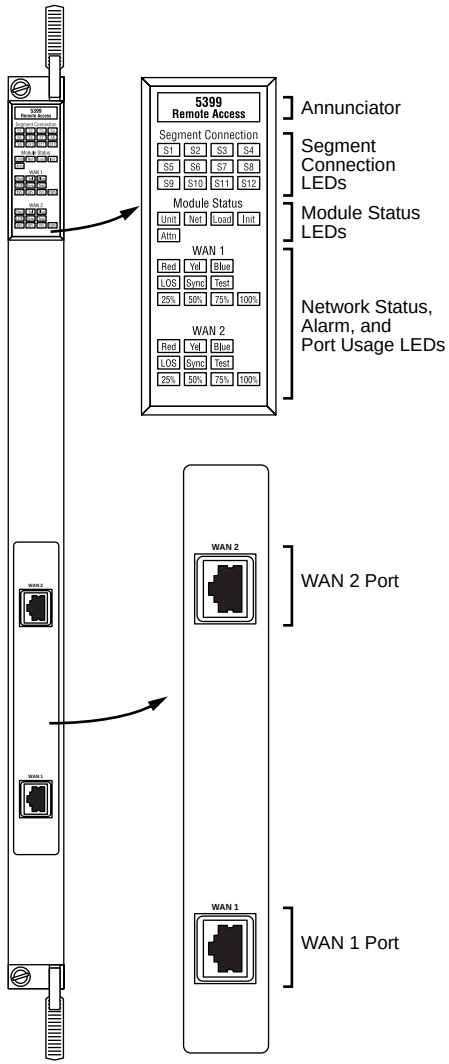


Figure 1-3. Model 5399 Remote Access Concentrator Front Panel

Front Panel Components

Annunciator

The Annunciator backlights the model number of the module and indicates, by its color, the operational condition of the module. Table 1-1 describes the Annunciator conditions.

Table 1-1. Annunciator Conditions

Color	Operational Condition
Green	The module is performing normally.
Amber	Some portion of the module has failed, or the module is being initialized.
Off	The module is not receiving +5 volt power, or the power level is below the reset limit (4.65 volts).

Segment Connection LEDs

The Segment Connection LEDs indicate which backplane Ethernet LAN segments are being used. There are 12 green LEDs, labeled S1 through S12, for the 12 Ethernet segments. When an LED is illuminated, it indicates that the Model 5399 Remote Access Concentrator is connected to the corresponding backplane Ethernet LAN segment; when off it indicates that the corresponding backplane Ethernet LAN segment is not connected.

Module Status LEDs

The Module Status LEDs are a group of five LEDs that display the status of the activity of the Model 5399 Remote Access Concentrator. Table 1-2 describes the Module Status LEDs.

Table 1-2. Module Status LEDs

LED	Description
Init	Turns green when the Remote Access Concentrator begins the initialization process after a power-up or reset. This is the first LED that lights after power-up or reset. The Init LED turns off after the diagnostics have successfully completed.
Unit	Turns green after the Remote Access Concentrator passes the power-up diagnostics. Turns amber if the power-up diagnostics fail.
Net	Turns green after the Remote Access Concentrator verifies that a valid Ethernet connection exists.
Attn	Turns green when the Remote Access Concentrator requires operator attention, that is, in monitor mode. Turns amber when the diagnostic tests fail.
Load	Turns green when the Remote Access Concentrator is loading the operational image or dumping a RAM image if there is a failure. The LED turns amber if a load error is detected.

Network Status and Alarm LEDs

The Network Status and Alarm LEDs display network activity during system operation. Table 1-3 describes the alarms. There are two sets of Network Status and Alarm LEDs, one set for each WAN port.

Technical Support personnel can use this information to diagnose problems.

Table 1-3. Network Status and Alarm LEDs

Alarm	Description
TEST	The network TEST indicator is ON (amber) when the WAN Interface is looped back. Loopback tests are activated either locally by the user or by the telephone company.
SYNC	The SYNC indicator is ON (green) when the WAN interface is properly synchronized with the received network signal and is receiving proper framing information.
LOS	The LOS indicator is ON (amber) when the WAN interface is detecting invalid synchronization pulses on the network interface receiver. When a LOS condition exists, the Remote Access Concentrator transmits a YELLOW alarm to the remote system.
RED	The RED alarm indicator is ON (amber) during a locally detected carrier failure. During the RED alarm condition, a YELLOW alarm is transmitted across the telephone network.
YELLOW	The YELLOW alarm indicator is ON (amber) when receiving a YELLOW alarm condition from the telephone network. This indicates a failure detected at the other end of the link (the Central Office).
BLUE	The BLUE alarm indicator is ON (amber) when receiving an unframed, all-ones Alarm Indication Signal (AIS) from the network. This condition exists upon a loss of originating signal, or when any action is taken that would cause a signal disruption.

Port Usage LEDs

The Port Usage LEDs, labelled 25%, 50%, 75%, and 100%, indicate the approximate percentage of B channels that are being utilized. There are two sets of Port Usage LEDs, one set for each WAN Port. These LEDs are normally green. If all available B channels are in use, they turn amber until at least one call disconnects.

WAN Interface Ports

The two WAN interface ports provide access to Channelized T1, Channelized E1, or ISDN PRI lines. The WAN Interface ports come with 8-pin, RJ48C jacks for attaching the T1, E1 or ISDN cable connectors.

Physical Characteristics

The Model 5399 Remote Access Concentrator module has the following characteristics:

- **Dimensions:**

  Height: 19 in. (47.5 cm)
  Width: 1.2 in. (3 cm)
  Depth: 11 in. (27.5 cm)

- **Weight:**

  10 lbs (4.5 kg).

- **Electrical Specifications:**
  - Power Consumption: 90 W at 48 VDC
  - Thermal Rating: 307 BTU/hr maximum

- **Environment:**
  - Operating temperature: 5° to 40°C.
  - Non-operating temperature: -25° to 65°C.
  - Operating humidity: 85% maximum relative humidity, non-condensing.
  - Non-operating humidity: 95% maximum relative humidity, non-condensing.
  - Operating shock: 10G peak 1/2 sine wave, 11 ms duration.
  - Operating vibration: random vibration 1.2 $*10^{-3}$ G^2/Hz, 12 to 198 Hz.
  - Operating altitude: 0 to 4,000 meters.
  - Storage altitude: 0 to 15,000 meters.

- Transportation vibration and shock: NSTA project 1A standard in shipping container.

- **Approvals:**
  - Meets safety requirements of Underwriters Laboratories for UL 1950 and CSA C22.2 No. 950.
  - Meets EMI requirements of FCC Class A and EN55022 Class A with shielded and unshielded cables.
  - Meets US and Canadian Telcom requirements per FCC Part 68 and IC CS-03.

- **MTBF:**

  50,000 hrs. (estimated), calculated @ 25°C (Mil Std 217).

- **Front clearance requirement (for connectors and cables):**

  6 in. (15 cm).

Chapter 2
Installing the Model 5399 Remote Access Concentrator Module

This chapter describes how to install your Model 5399 Remote Access Concentrator Module hardware and software, and connect it to a System 5000 Hub. This chapter provides the following information:

- *Before You Begin*
- *Installing the Model 5399*
- *Testing the Installation*
- *Connecting a WAN Interface*
- *Connecting a Service Port Terminal*
- *Initial Setup and Using the ROM Monitor*
- *Auto-initializing the ROMs*
- *Installing the Software and Loading the Operational Image*
- *Self-booting the Model 5399*
- *Invoking the Console Monitor*

Before you Begin

To successfully install the Model 5399, you need:

- A 3/16-inch flat-tip screwdriver
- An antistatic mat and wrist strap (attached to an antistatic leash)
- A service port terminal and cable
- A valid IP address

- An appropriate subnet mask
- A host with Model 5399 software installed (if not booting from FLASH memory)

The Model 5399 can receive its operational image from any one of these sources:

- A UNIX host running erpcd
- FLASH memory (self boot)
- Another Model 5399 configured as a boot host
- Any host supporting TFTP
- A Windows NT host running erpcd

The Remote Access Concentrator supports Windows NT® host tools. Remote Annex Server Tools for Windows NT® allows you to boot and configure the Remote Access Concentrator on a Windows NT® network. For more information, refer to the *Remote Annex Server Tools for Windows NT® User Guide*.

Table 2-1 outlines the different configurations the Model 5399 supports.

Table 2-1. Model 5399 Configuration Options

Device on which the Operational Software and Image is installed	Model 5399 Must Be Connected to the Network	Input Device used to Enter Basic Configuration Parameter Values
UNIX Load Host	Yes	Service Port Terminal
Another Model 5399 configured as a load server	Yes	Service Port Terminal
Self-boot (from the image contained in Flash memory)	No	Service Port Terminal
Windows NT® host	Yes	Service Port Terminal

Installing the Model 5399 Remote Access Concentrator

This section describes how to install the Model 5399 Remote Access Concentrator Module in a System 5000 Hub. Installing the Model 5399 involves seating the backplane connectors to the Model 5000 Hub backplane and verifying the installation.

Preparing for Hardware Installation

This section explains how to prepare the Model 5399 for installation in the chassis.

System 5000 equipment uses electronic components that are sensitive to static electricity. Static discharge from your clothing or other fixtures around you can damage these components. You should take all possible precautions to prevent static discharge damage when working with printed circuit boards. If possible, place all printed circuit boards on an antistatic mat until you are ready to install them. If you do not have an antistatic mat, wear a discharge leash to free yourself of static before touching any of the printed circuit boards, or free yourself of static by touching the metal of the chassis before handling a printed circuit card.

Setting the Backplane Ethernet Segment

Table 2-1 shows the locations of the configuration jumper and DIP switch that you must set to select an Ethernet segment. They are:

- Ethernet segment bank selector (J5)
- Ethernet segment selection DIP switch (S1)

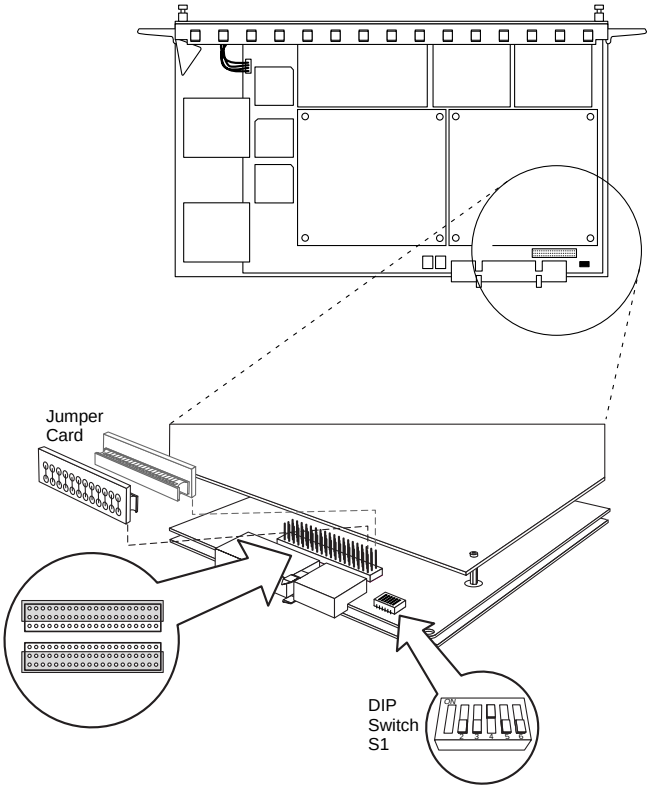


Figure 2-1. Model 5399 Jumper and Connector Locations

Ethernet Segment Bank Selector

The Ethernet segment bank selector (see Figure 2-1), consisting of three rows of 20 pins (labeled J5, J21 and J22) and a jumper card, determines whether the module connects to Ethernet segments 1 through 6 or segments 7 through 12 at power up. When the jumper card is installed on the two rows of pins nearest the front of the module (using J21), the module has access to segments 1 through 6 (the factory default setting); when the jumper card is installed on the two rows of pins nearest the back of the module (using J22), the module has access to segments 7 through 12.

When the jumper card is installed between J5 and J21, the printed circuit card handle is nearest the front of the module. To install the jumper card between J5 and J22, remove the jumper card, rotate it 180 degrees (so that the printed circuit card handle is nearest the back of the module) and push it onto the pins (see Figure 2-1).

The specific segment connection for the module is determined by the segment selection DIP switch (described in the next section).

Network management software cannot override the bank selector setting. The setting (segments 1–6 or 7–12) can only be set while the module is outside the chassis.

Segment Selection DIP Switch

DIP switch S1 on the module (see Figure 2-1) is used to set the default segment selections. Segment selection DIP switch settings are listed in Table 2-2. Turning a DIP switch number ON selects a particular segment within the Ethernet segment bank. For example, turning on DIP switch number 1 selects either segment 1 or 7, depending on the position of the Ethernet segment bank selector jumper card.

If no DIP switch numbers are turned on, the unit defaults to Segments 1 or 7 (depending on the position of the Ethernet segment bank selector jumper card).

Table 2-2. Segment Selection DIP Switch Settings

DIP Switch S1 Switch Number	Jumper Card Connects J5, J21 (Segment Bank 1-6)	Jumper Card Connects J5, J22 (Segment Bank 7-12)
1 (default)	Segment 1	Segment 7
2	Segment 2	Segment 8
3	Segment 3	Segment 9
4	Segment 4	Segment 10
5	Segment 5	Segment 11
6	Segment 6	Segment 12

Network management software can override this DIP switch setting, so an installed module may connect to a different segment (within the segment bank) than is indicated by the DIP switch setting.

Installing the Module into the Hub

To install and secure the module into the System 5000 Hub, follow these steps:

1. **Remove the blank filler panel from the chassis slot where you intend to install the module.**
2. **Verify that the module jumpers are set correctly (see *Setting the Backplane Ethernet Segment* on page 2-3).**
3. **Extend the inserter/extractor levers to their fully extended positions (see Figure 2-2).**

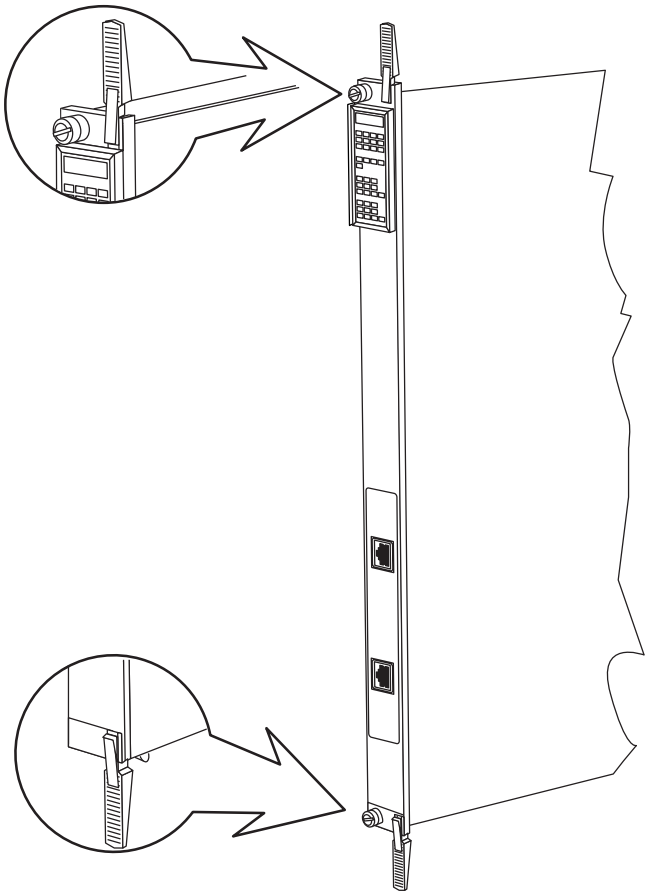


Figure 2-2. Inserter/Extractor Lever

4. **Align the top and bottom edges of the module in the card guides of the target slot, and push the module into the chassis until the inserter/extractor levers just engage the front edges of the chassis (see Figure 2-3).**

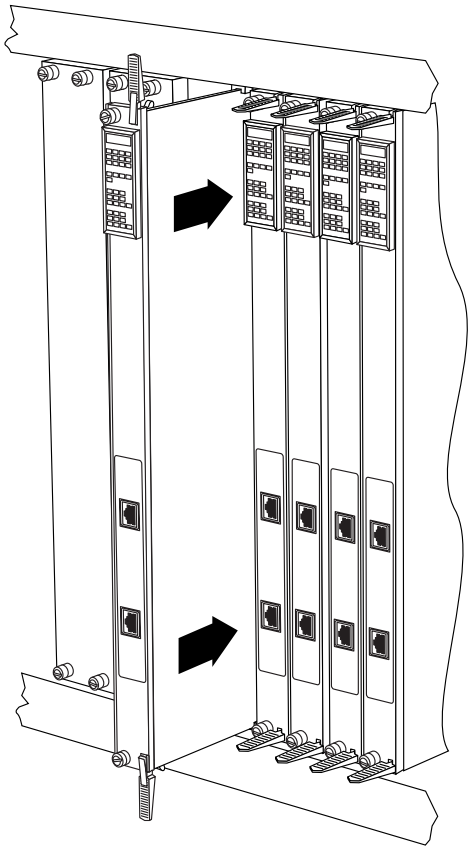


Figure 2-3. Inserting the Module

5. **Seat the module backplane connectors by simultaneously pushing the inserter/extractor levers toward the center of the module front panel (see Figure 2-4).**

   When the front panel of the module is flush with the front of the chassis, the module backplane connectors are properly seated.

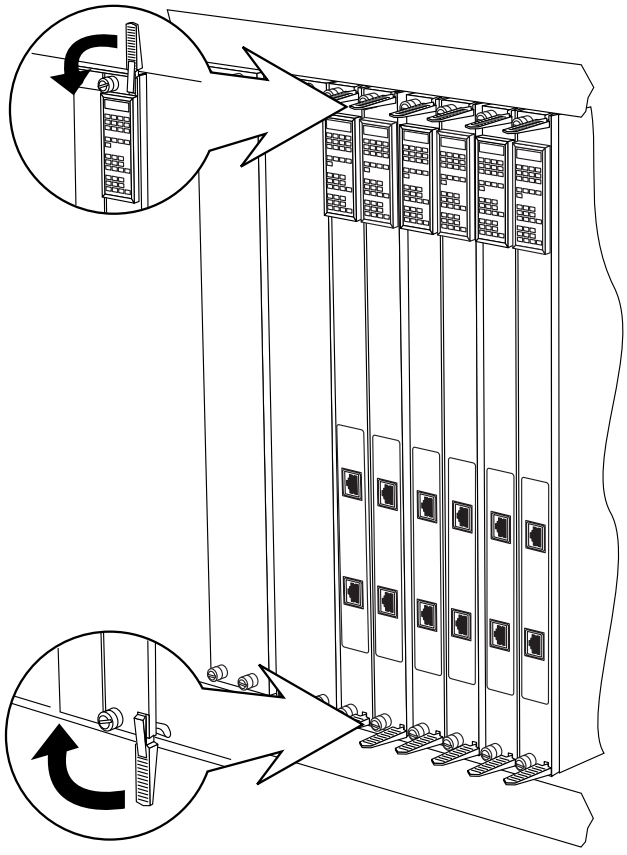


Figure 2-4. Seating Module Connectors

6. **Tighten the captive retaining screws at both ends of the module front panel.**

Testing the Installation

After installing and connecting the Remote Access Concentrator, verify that you have performed the installation correctly by observing the LED indicators and system operation displays on the front panel of the Remote Access Concentrator (see Figure 2-5).

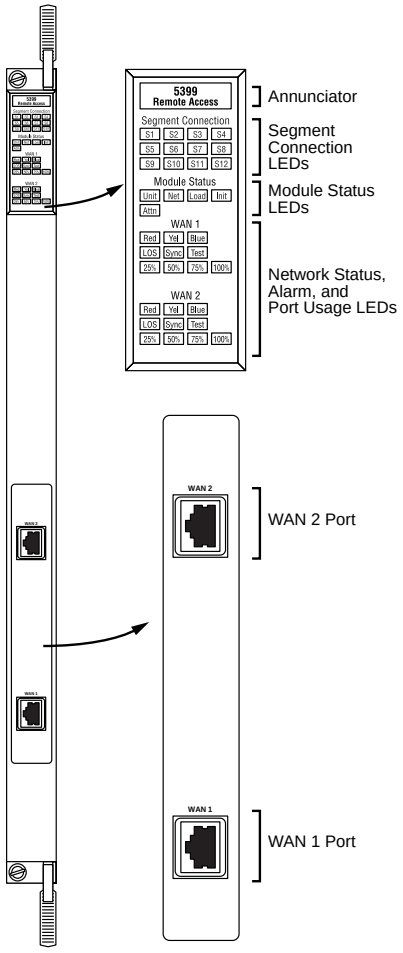


Figure 2-5. Module LED Display

The Model Remote Access Concentrator performs a series of self-test diagnostics each time it is reset or powered up. These tests take about a minute to complete and cannot be deactivated. While these tests are running, the annunciator remains amber. The annunciator changes to green upon successful test completion. For information about possible error conditions, see Chapter 4.

LED Indicators

When the Remote Access Concentrator is operating correctly, the front-panel LEDs (see Figure 2-5) should appear as follows:

- Annunciator: The annunciator should be green. If the annunciator remains amber after completing the self-tests, refer to Chapter 4.
- Segment Connection LEDs: A steady green indicates which Ethernet LAN segment the module is using.
- Module Status LEDs:
  - **Init**: Turns green when the module begins the initialization process after a power-up or reset. Typically, this is the first LED that lights after power-up. The Init LED turns off after the initial diagnostics have successfully completed.
  - **Unit**: Turns green after the module passes the power-up diagnostics. If the Unit LED turns amber, refer to Chapter 4.
  - **Net**: Turns green after the module verifies that a valid Ethernet connection exists.

- **Attn**: The Attn LED should be off. The Attn LED turns green if the Remote Access Concentrator is in Monitor Mode. If the Attn LED is amber or flashing, one of the following failures has occurred:
  - Hardware failure. Contact technical support.
  - Network or network interface failure. Error message displays on the terminal. If a network or network interface failure occurs, typing **q** accesses the ROM Monitor prompt. Check the network connection and then see *net* on page 3-19.
- **Load**: Turns green when the Remote Access Concentrator is loading the operational image or dumping a RAM image if there is a failure.

- Verify that the hub front-panel LEDs are properly illuminated.

If the LEDs do not light in the proper manner, or if the system operation displays indicate problems, see Chapter 4 for more details.

Connecting a WAN Interface

Be sure to properly configure the interface before connecting the cable. Some switch types will disable lines connected to an improperly configured device. See the *Model 5399 Remote Access Concentrator Module Network Administrator's Guide* for details.

A WAN Interface is used to connect the Remote Access Concentrator to channelized T1, channelized E1, or ISDN PRI lines. Follow the instructions in this section to connect the line to the WAN Interface port.

Observe handling precautions: digital telecommunications cable(s).

1. **Plug the cable into the WAN Interface port located on the front panel of the Remote Access Concentrator (Figure 2-6).**

   When the connector clicks into place, the connection is secure. Appendix A describes the WAN Interface port's signal/pin allocation.

   For T1 applications, the Remote Access Concentrator utilizes an internal Channel Service Unit (CSU). An internal CSU is not used in E1 applications.

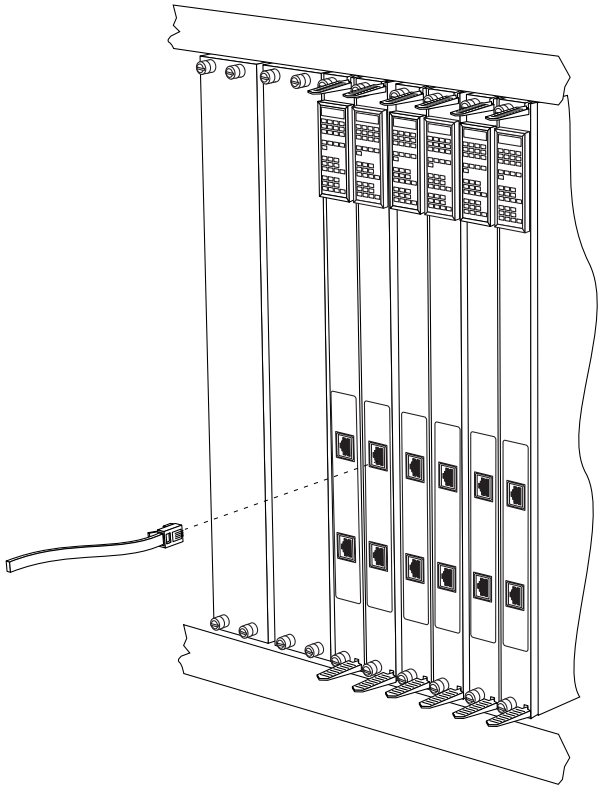


Figure 2-6. Connecting a WAN Interface

Connecting a Service Port Terminal

If your network does not include a BOOTP or RARP server, you must connect a terminal to the service port on the System 5000 chassis front panel and manually configure the Remote Access Concentrator before booting.

To configure the Remote Access Concentrator through the chassis service port, you need:

- An ascii terminal or a portable computer with a serial port and the ability to emulate an ascii terminal. The terminal should be set up for:
  - 9600 bps (default)
  - 8 data bits
  - No parity
  - 1 stop bit
  - No flow control
  - ASCII
- An RS-232 modem cable with a female DB-9 connector to connect to the service port on the chassis front panel. The other end of the cable must have a connector appropriate to the serial port on your computer or terminal. (Most terminals or computers use a male DB-9 or DB-25 connector.) The cable should use the pin assignments in Table 2-3.

Table 2-3. Service Port Pin Assignments

Terminal DB-9	DB-25	Function	To Service Port DB-9 Pins	Function
2	3	Receive data	2	Transmit data
3	2	Transmit data	3	Receive data
5	7	Signal ground	5	Signal ground

RS-232 signals on other pins, such as DTR, CTS, and CD, are ignored.

Connecting the Terminal

To connect the terminal to the service port, follow these steps:

1. **Connect the terminal (or a computer in terminal emulation mode) to the chassis service port with the RS-232 cable.**
2. **Press Esc to display the Slot Selection menu.**

   The Slot Selection menu (Figure 2-7) shows the system date and time, lists the modules installed in the chassis by slot number, and lists the available commands.

```
Model 5399 Slot Selection Menu 01/15/97, 10:19:32 AM

Slot 1    Status:     Module Description:
1         On-line     5310 Ethernet NMM
2         Configuring 5308 Ethernet Host
3         Other       5308 Ethernet Host
4         (removed)   5308 Ethernet Host
5         Off-line    5308 Ethernet Host
6         Booting     5308 Ethernet Host
7         On-line     5308 Ethernet Host
8
9         Off-line    5399 Remote Access Concentrator
10
11
12
13
14


c - Connect to slot (Press CTRL-T to break connection)
s - Select Supervisory Module Main Menu r - Reset module


Enter selection:
```

Figure 2-7. Slot Selection Menu

Use this menu to reset the Remote Access Concentrator. For more information, see *Auto-initializing the IP Address Parameters* on page 2-23.

Initial Setup and Using the ROM Monitor

After installing the Remote Access Concentrator software on the file server host, collect the following information, which is required to determine the unit's boot parameters:

- The location (directory path) of the download files on the host (**tftp** only).
- Whether the Remote Access Concentrator and host are on the same subnet or separated by one or more routers.
- Whether the host going to use **tftp** or **erpcd** (requires a UNIX or Windows NT® host) to serve the Remote Access Concentrator download code.

The Remote Access Concentrator needs these parameters to perform an initial boot when loading the software. Enter these parameters into the EEPROM using the ROM monitor commands, which are accessed through a service port terminal. See Chapter 3 for more information about these commands.

The Remote Access Concentrator supports the Bootstrap Protocol (BOOTP) and the Reverse Address Resolution Protocol (RARP) which can be used to obtain some of the information listed. If you have a host running BOOTP or RARP to serve the Remote Access Concentrator the information, the server will boot without user intervention. For more information about using these protocols, see *Auto-initializing the IP Address Parameters* on page 2-23.

The Remote Access Concentrator supports Windows NT® host tools. Remote Annex Server Tools for Windows NT® allows you to boot and configure the Remote Access Concentrator on a Windows NT® network. For more information, see the *Remote Annex Server Tools for Windows NT® User Guide*.

Remote Access Concentrator Parameters

The Remote Access Concentrator requires that you set certain parameters from the ROM monitor before booting the unit from a host. Once the Remote Access Concentrator is booted, you can change these parameters using the **na** utility. Any changes to these parameters will require the unit to be rebooted to take effect. Table 2-4 provides a brief description of these parameters.

Table 2-4. Server Parameters

Parameter	Description
Internet address	A unique 32-bit universal identifier that is specified in dotted-decimal notation.
Subnet mask	Defines which portion of the Internet address is the network (all ones), the subnet (all ones), and the host (all zeros) address.
Preferred load host address	The Internet address of the host from which you want to boot.
Load/dump gateway Internet addres	The Internet address of the router, for which you will be prompted, if the preferred load host is on a different network.
Broadcast address	An Internet address with a host id of all ones (or all zeros for support of older 4.2 BSD systems) to which all hosts on a particular subnet will respond.
Type of IP encapsulation	Specifies the method for accessing the physical and network layer of the transmission media. The default is: ethernet (for DIX Ethernet-II). This parameter can also be set to ieee802 (also referred to as LLC/SNAP).
Broadcast flag	Determines whether the Remote Access Concentrator will broadcast for a load host if it doesn't have one.

Initializing the Remote Access Concentrator

This section describes how to set up the Remote Access Concentrator, make the connection to the System 5000 Hub for the first time, and enter Monitor Mode to configure the module.

To initialize the Remote Access Concentrator and enter Monitor Mode:

1. **Use a terminal connected to the chassis service port to verify that the Remote Access Concentrator is operating properly.**

   The Slot Selection menu is displayed. The Remote Access Concentrator should be listed next to the slot number in which it is installed.

2. **Reset the Remote Access Concentrator by typing** r **and then entering the slot number of the chassis that contains the server.**

   The following prompt is displayed:

   ```
   Are you sure you want to RESET this module? (Y/N):
   ```

3. **Answer the question by entering** y**.**

4. **Within 10 seconds, connect to the Remote Access Concentrator by typing** c **and then entering the slot number of the chassis that contains the server.**

5. **Wait for the following prompt:**

   ```
   To enter “Monitor Mode” please depress the SPACE key
   within 10 seconds.
   ```

   The prompt counts down from 10 seconds.

6. **Press the space bar within 10 seconds.**

   After a few seconds, the following message is displayed:

   ```
   Monitor Mode selected, please wait for Confidence tests
   to complete.
   ```

   After about a minute, the following message is displayed, followed by the monitor prompt:

   ```
   System Reset - Entering Monitor Mode
   monitor::
   ```

7. **If you want to clear out the stored parameters from a previously used slot (reset the hub slot), continue on with Step 8. If you do not want to reset the hub slot (if, for example, you are performing a hot swap), skip to Step 16.**

8. **On the service port terminal, press** Enter **then** Control **-**T **to display the Slot Selection menu.**

9. **Press** s**.**

   The Supervisory Module Main Menu is displayed.

10. **Press** m **to select the Module Information menu.**

    The following prompt is displayed:

    ```
    Enter slot # (1-14):
    ```

11. **Enter the slot number of the module you want to boot.**

    The module information and status are displayed and you are prompted to reset the module, set the module configuration to default, or return to the previous menu.

12. **Press** d **to select the module configuration default.**

    The following message is displayed:

    ```
    Are you sure you want to set module DEFAULT
    configuration? (Y/N):
    ```

13. **Press** y**.**

    The Module Information menu is displayed.

14. **Press** Escape **twice.**

    The Slot Selection menu is displayed.

15. **Press** c **and the slot number.**

16. **Verify the Remote Access Concentrator hardware configuration by typing** config **and pressing** Return **at the monitor prompt.**

    The screen display looks similar to this:

```
                    REVISION/CONFIGURATION INFORMATION

ROM Software Rev: 1110
Board ID: 64                    Board Type: 5399
CPU Type: 486DX2                Ethernet Address: 00-80-2d-xx-xx-xx
Memory size: 8 Meg              EEPROM size: 65504
Flash size: 2 Meg               Flash ID:0089

WAN 1: PRI E1 ETSI              Revision: VERSION A MGR=1.159
WAN 2: PRI E1 ETSI              Revision: VERSION A MGR=1.159

SLC 1
    SLC SRAM Size: 128 K        Modem Count: 31       Modem Rev: 0

SLC 2
    SLC SRAM Size: 128 K        Modem Count: 31       Modem Rev: 0

Hub Slot  Hub CMB HW Rev  Hub EE Rev  Hub EE Seg Sel  Hub Jmpr Seg Sel
   9             01           0.0           N/A              00
```

17. **To verify and record the unit's Ethernet address, type** addr -d **and press** Return **at the monitor prompt:**

    The screen display looks similar to this:

```
monitor:: addr -d
Ethernet address (hex): 00-80-2d-XX-XX-XX
Internet address: <uninitialized>
Subnet mask: 255.255.0.0
Broadcast address: 0.0.0.0
Preferred Load Host address: <any host>
Preferred Dump Host address: 0.0.0.0
Load/Dump Gateway address: 0.0.0.0
Type of IP packet encapsulation: <ethernet>
Load Broadcast: Y
```

18. **Verify that the Remote Access Concentrator is on-line by entering the** net **command. The following prompt appears:**

    ```
    Enter Segment to be used [1]:
    ```

    A "pass" or "fail" message is displayed. If fail is displayed, try verifying the network from another device.

Once the Remote Access Concentrator is on-line, you can download the image software to the server (see *Installing the Operational Software and Loading the Image* on page 2-32).

Booting the Remote Access Concentrator

You can boot the operational software by downloading the image from a host system or another Model 5399 Remote Access Concentrator, or by using the image contained in Flash memory (self-boot). However, before actually booting the unit, you must first initialize the IP address parameters either manually or by using the auto-initialize feature. The following sections describes the two methods of initializing the IP address parameters, and the various boot methods.

Auto-initializing the IP Address Parameters

The Remote Access Concentrator is distributed without an IP address or preferred load host defined in ROM. When the device is booted, the Remote Access Concentrator attempts to auto-initialize itself using BOOTP (bootstrap protocol) and RARP (Reverse Address Resolution Protocol).

This method of initializing the IP address parameters is generally done when booting from a host system (not when self-booting).

The Remote Access Concentrator supports the BOOTP and RARP protocols. Use these protocols to obtain boot information from a UNIX host without requiring any manual set-up on the Remote Access Concentrator.

- BOOTP allows a diskless client to determine its IP address, the IP address of the server, and the name of the file to be loaded into memory.
- RARP maps a hardware address into an IP address.

The ROMs invoke this system of acquiring boot information when a boot is initiated and the Remote Access Concentrator is not initialized. Under this condition, the Remote Access Concentrator first tries to get boot information via BOOTP or RARP.

If all requests fail, the Remote Access Concentrator will return to the ROM monitor (if in Test mode) or continue the auto-initializing procedure indefinitely (if in normal mode).

BOOTP

For a successful BOOTP retrieval, a **bootpd** must be running on a host on the same subnet as the Remote Access Concentrator (or have a correctly-configured router on the same subnet that supports BOOTP forwarding) and must have the appropriate information in the **bootptab** file. The Remote Access Concentrator's BOOTP implementation adheres to rfc951, rfc1048, and rfc1084. A sample **bootptab** file entry used to initialize the Remote Access Concentrator named *terminator* looks like this:

```
remoteannexdefault:\
          :sm=255.255.255.0:gw=132.245.22.66:\
           :hn:vm=auto:to=-18000:
terminator:\
          :ht=1:ha=00802d004879:ip=132.245.22.226:\
            :tc=remoteannexdefault:
```

In the previous example:

- *sm* is the subnet mask.
- *gw* is the load/dump gateway address.
- *vm* is the Vendor Magic Cookie.
- *ht* is host type (1=Ethernet).
- *ha* is the Remote Access Concentrator's hardware address (Ethernet Address).
- *ip* is the Remote Access Concentrator's Internet Address.

When the Remote Access Concentrator receives a BOOTP response with the *sm*, *gw*, and *ip* set, it sets the respective parameters: **subnet_mask**, **load_dump_gateway**, and **inet_addr**. The Vendor Magic Cookie must be set to **auto**. This indicates that **bootpd** should respond to the client (Model 5399 Remote Access Concentrator in this case) with whatever format the client requests; the Model 5399 Remote Access Concentrator (client) always makes requests with the Vendor Magic Cookie set to 99.130.83.99.

The **bootpd** adds the address of the host on which it is running as the *Server Address* in the **bootp** response message. The ROMs use the *Server Address* as the preferred load host and store it in the **pref_load_addr** parameter.

The host running **bootpd** (the preferred load host) must also be running **erpcd** or **tftpd**.

RARP

If the Remote Access Concentrator does not receive a successful BOOTP response, it uses RARP to get the boot information. For a successful RARP retrieval, TCP/IP must be running on a host that is on the same subnet as the Remote Access Concentrator, and the host's ARP table must be initialized with the Remote Access Concentrator's Internet and Ethernet addresses (see the **arp** man page for **arp –s**).

The only boot information that RARP provides is the Remote Access Concentrator's Internet address. The ROMs save this information in the **inet_addr** parameter. The ROMs use default information for the subnet mask and preferred load host. This means the ROMs will broadcast their requests.

The host serving the Remote Access Concentrator its boot information must be running on the same subnet as the Remote Access Concentrator because the Remote Access Concentrator broadcasts BOOTP and RARP queries using the “this network” IP address, 255.255.255.255.

If BOOTP and RARP fail, the Remote Access Concentrator transmits an IPX Advertisement Request for Service.

If all requests fail, the Remote Access Concentrator returns to the ROM monitor (if in Test Mode) or continues the auto-initializing procedure indefinitely (if in Normal Mode).

Manually Initializing the IP Address Parameters

To configure the Remote Access Concentrator for your specific needs, the IP address parameters can be manually initialized by performing the following steps:

1. **Enter the** addr **command at the monitor prompt.**

   The following prompt is displayed:

   ```
   Enter Internet address::
   ```

2. **Enter the IP address for the Remote Access Concentrator.**

   You are prompted to enter the server subnet mask, preferred load host, preferred dump host, IP packet encapsulation, and load broadcast flag. The defaults are listed after each prompt.

3. **Modify the parameter next to each prompt, or press** Enter **to retain the current setting.**

Booting Using BFS

Perform the following steps to boot the Remote Access Concentrator using BFS:

1. **Initialize the IP address parameters using either the auto-initialize or manual initialize method.**

   The auto-initialization method is described in *Auto-initializing the IP Address Parameters* on page 2-23. The manual initialization method is described in *Manually Initializing the IP Address Parameters* on page 2-26.

2. **Enter the** boot **command.**

   If you do not enter a file name with the command, you are prompted for one (the default file name is displayed at the prompt: oper.64.enet). Press Enter to boot using the default file name.

   The following example shows a typical screen display for a BFS boot using **erpcd** on UNIX or Windows NT:

```
Enter boot file name[oper.64.enet]::

Waiting for CMB Config Block Info...

Requesting boot file "oper.64.enet".
Unanswered requests shown as '?',transmission errors
as '*'.

Requesting boot from 192.9.200.88 via Ethernet...
Booting BFS file using open delay of 8
Booting BFS file from 192.9.200.88
Header received OK. Received data blocks shown as '.'.
. . . . . .
. . .. . . . . . .
. . . . . ? . . .
. . . . . .
. . . . . * . . . .
. . . . . * . . .
. . . . . .
. . . . . ? . . . . .
. . . . . EOF
```

The download takes between 30 and 60 seconds for a Model 5399 Remote Access Concentrator booting over the local network. After the download is complete, the Power, Unit, and Net LEDs remain on. If these LEDs do not remain on (indicating a problem), see Chapter 4.

Once the Remote Access Concentrator is booted, Monitor Mode is no longer operational. The Remote Access Concentrator is up and running, and the following message is displayed:

```
Console monitor ready; Press CR to start
```

Booting Using TFTP

The procedures detailed in this section assume that your TFTP daemon (tftpd) is started in `/etc/inetd.conf` (or other appropriate directory on your system) with a configuration line similar to this:

```
tftp dgram udp wait root /usr/etc/in.tftpd in.tftpd
-s/tftpboot
```

If you leave off the `-s /tftpboot`, a chroot will not be done, and your system will be insecure.

To set up directories and files, and use TFTP to boot the Remote Access Concentrator, follow these steps:

1. **Initialize the IP address parameters using either the auto-initialize or manual initialize method.**

   The auto-initialization method is described in *Auto-initializing the IP Address Parameters* on page 2-23. The manual initialization method is described in *Manually Initializing the IP Address Parameters* on page 2-26.

2. **Enter the** image **command at the monitor prompt.**

   As prompted, enter the following information:

   - Appropriate boot image name
   - Boot directory
   - Dump filename

   The default image file name is: `oper.64.enet`

   The following example shows how the image command is used to set up a Remote Access Concentrator boot from the */tftpboot/annex/* directory. When you enter the load directory name, make sure you end the pathname with a slash character.

```
Image name: <invalid or uninitialized> Default:
“oper.64.enet”
Enter Image name::oper.64.enet
Image name: “oper.64.enet”
TFTP load directory:
Enter TFTP load directory::/annex
TFTP Dump path/filename: <uninitialized> Default :
“dump.134.117.6.34”
Enter TFTP Dump path/filename::/annex/mydumpfile
Using current TFTP Dump path/filename.
monitor::
```

3. **Issue the following commands to prepare the tftp dump file.**

```
touch /tftpboot/annex/mydumpfile
```

```
chmod 622 /tftpboot/annex/mydumpfile
```

4. **Enter the** boot **command.**

The **boot** command display looks similar to this:

```
Enter boot file name[oper.64.enet]::

Waiting for Config Block Info...

Requesting boot file ”oper.64.enet”.
Unanswered requests shown as ’?’,transmission errors
as ’*’.

Requesting boot from 192.9.200.88 via Ethernet...
Booting BFS file using open delay of 8?
Booting TFTP file using open delay of 8
Booting TFTP file from 192.9.200.88
Header received OK. Received data blocks shown as ’.’.
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . EOF
```

Once the Remote Access Concentrator is booted, Monitor Mode is no longer operational. The Remote Access Concentrator is up and running, and the following message is displayed:

```
Console monitor ready; Press CR to start.
```

Self-booting the Remote Access Concentrator

The Remote Access Concentrator comes equipped with Flash memory that contains an operational image you can use to self-boot the module. To self-boot your Remote Access Concentrator, perform the following steps:

1. **Initialize the IP address parameters using the manual initialize method.**

   The manual initialization method is described in *Manually Initializing the IP Address Parameters* on page 2-26.

2. **Enter the** sequence **command at the monitor prompt.**

   The following prompt is displayed:

   ```
   Enter interface sequence [net]::
   ```

3. **Enter** self, net **as the sequence.**

   The monitor prompt is displayed.

4. **Enter the** boot **command at the monitor prompt.**

   The display looks similar to this:

   ```
   monitor:: boot

   Waiting for CMB Config Block Info...

   Requesting default boot file “OPER_64_ENET.SYS” for
   MOP/VMS\ loads and “oper.64.enet” for all other
   protocols. Unanswered requests shown as ‘?’,
   transmission errors as ‘*’.

   Booting file: “OPER_64_ENET.SYS” from SELF

   Loading image from SELF ...
   ..............................................
   Load Completed
   ```

   The self-boot takes 10 seconds to complete. Once the Remote Access Concentrator has booted, Monitor Mode is no longer active.

Booting from a Windows NT® Host

To boot the Remote Access Concentrator from a Windows NT® host, you must have Remote Annex Server Tools for Windows NT® installed. Remote Annex Server Tools for Windows NT® uses the expedited remote procedure call daemon (**erpcd**) running on a Windows NT® server. **Erpcd** responds to all Remote Access Concentrator boot and dump requests. Refer to the *Remote Annex Server Tools for Windows NT® User Guide* for additional information.

Booting from Another Model 5399 Remote Access Concentrator

You can boot from another Model 5399 Remote Access Concentrator, if the Model 5399 Remote Access Concentrator you are trying to boot from is configured as a boot server. You can do this by using **na** or **admin** to set the **annex server_capability** to **image**. See the *Remote Annex Administrator's Guide for Unix* for additional information.

Installing the Operational Software and Loading the Image

Use this section if you have successfully connected the Remote Access Concentrator to your LAN.

This section describes:

- How to install the Remote Access Concentrator module's operational software and image on a device that resides on a network accessible to the module.
- How to download the operational image from the device to the Remote Access Concentrator module.

Installing to and Loading from a UNIX Host

This section contains a description of what you need to do to install the Remote Access Concentrator module's operational software and image to a UNIX host. See the *Remote Annex Administrator's Guide for UNIX* for more details.

1. **Install the image on a UNIX host. The software installation notes describe how to do this.**

   If you have a configured BOOTP server, boot the Remote Access Concentrator module. Otherwise, continue to the next step.

2. **Execute the ROM Monitor** addr **command:**

   - Enter the module's Internet address.
   - Modify any other parameters that the Remote Access Concentrator may require for the initial boot, i.e., the preferred load host's Internet address and the subnet mask (see *addr* on page 3-4).

3. **Execute the** boot **command.**

   After successful execution of the **boot** command, the module is up and running (see *boot* on page 3-8).

Invoking the Console Monitor

After the image boots, you can invoke the Console Monitor by pressing Return on the service port terminal. The following prompt appears:

```
Console monitor:
```

At the Console Monitor prompt, entering **help** or **?** displays the available options:

- **afd** (displays the status of the Automatic Firmware Download process - used only for the WAN interfaces).
- **cli** (starts the Command Line Interpreter on the current port)
- **dump** (from the Remote Access Concentrator to the host and reboots).
- **help** or **?** (displays the available options).
- **info** (displays configuration information for the Annex).
- **leds** (displays the current front panel LED status).
- **quit** (quits and returns to quiet console)
- **reboot** *filename* (reboots the Annex).
- **rom** (returns the Remote Access Concentrator to the ROM Monitor).
- **syslog** (displays syslog messages).

Chapter 3
ROM Monitor Commands

This chapter describes the ROM Monitor commands that are available in Monitor Mode. Access these commands through a terminal connected to the service port (located on the front of the hub chassis).

The ROM Monitor commands allow you to set a subset of the configuration (EEPROM) parameters. Some of these parameters, like the unit's IP address, are required for booting the Model 5399 Remote Access Concentrator; some parameters, like the broadcast address, are required if the network configuration differs from the supplied defaults. Table 3-1 lists the ROM Monitor commands.

Other parameters, although not required, are recommended for the Remote Access Concentrator's initial boot. Setting these parameters, rather than using the assigned defaults, minimizes errors during the initial boot. For example, setting the parameter that defines the preferred load host enables the Remote Access Concentrator to load by requesting assistance from a specific host, rather than by broadcasting that request to all hosts on the subnet.

After the Remote Access Concentrator has booted, you can define the same parameters you defined using the ROM Monitor, by using the host-based **na** utility, the local CLI **admin** command, or SNMP. The *Remote Annex Administrator's Guide for UNIX* describes the **na** utility in detail. See Chapter 4 for information on power-up and boot procedures.

ROM Monitor commands generally provide data about a subset of current configuration (EEPROM) parameters. When appropriate, they also display a prompt that allows the operator to change those parameters.

Default or current values for parameters are displayed in brackets. For example:

```
Enter broadcast address [132.245.6.255]:
```

At the prompt, enter a different value, or press Return to leave the displayed value unchanged.

You can use unique abbreviations for all ROM Monitor commands except **erase**. For example, enter **boot** as **bo**, and enter **net** as **n**. If you enter an abbreviation that is not unique, an error message describing the command as ambiguous is displayed on the service port terminal.

Command Descriptions

Table 3-1 lists the ROM Monitor commands; the following subsections describe them.

Table 3-1. ROM Monitor Commands

Command	Description	Use
addr [-d]	Displays and sets EEPROM values relevant to IP network addressing, including the unit's IP address.	Changing IP configuration parameters.
boot [-v] [<*file*>]	Manually boots and loads the unit's operating code.	Changing the address of the boot image.
boot [-l] [<*file*>]	Erases the existing Flash memory and copies a new image to Flash memory.	Upgrading or replacing the Flash image.

(continued on next page)

Table 3-1. ROM Monitor Commands (continued)

Command	Description	Use
config	Displays the current hardware configuration and revision levels.	Identifying your hardware, memory, and ROM versions.
erase	Erases non-volatile memory.	Clearing out old parameters.
help	Displays the list of ROM Monitor commands.	Referencing the ROM monitor commands.
image [-d | <*file*>]	Displays and/or sets the load image and **tftp** load dump names.	Loading an image that differs from the default.
lat_key [-d]	Sets the LAT key.	Connecting to a DEC VMS host.
net	Executes an Ethernet transceiver loopback test.	Checking your Ethernet connection.
ping	Sends ICMP ECHO_REQUEST datagram to a host or gateway.	Checking to see if a host or gateway can be reached.
ports [-d]	Shows the current status of a WAN interface port.	Testing a WAN interface port or modem hardware.
sequence [-d | <*list*>]	Displays and edits the load/dump interface list.	Checking or changing the load/dump interface list.
stats	Displays current network statistics gathered by the ROM.	Checking the network resources.

addr

The **addr** command displays and sets several Remote Access Concentrator operating parameters (EEPROM values) relevant to IP network addressing:

- Internet address.
- Subnet mask.
- Broadcast address.
- Preferred Load Host address.
- Preferred Dump Host address.
- Load/Dump Gateway address.
- Type of IP Packet encapsulation.
- Load Broadcast

The **addr -d** command displays the unit's ROM-resident Ethernet address in hexadecimal notation. (For a description of Internet addresses, see the *Remote Annex Administrator's Guide for UNIX*.) The command syntax is:

addr [**–d**]

If you enter the **addr** command without the **–d** argument, you will be prompted for each Internet address. Enter Internet addresses using the standard decimal dot (.) notation.

The **addr –d** command displays the Remote Access Concentrator's Ethernet address, IP address, subnet mask, broadcast address, preferred load host address, preferred dump host address, load/dump gateway address, IP encapsulation type, and Load Broadcast flag. The **addr -d** command cannot be used to make changes to any of the displayed parameters.

The **addr** command display looks similar to this:

```
monitor:: addr

Enter Internet address [<uninitialized>]:: 192.9.200.214
     Internet address: 192.9.200.214

Enter Subnet mask [255.255.255.0]::

Enter Broadcast address [0.0.0.0]:: 192.9.200.0
     Broadcast address: 192.9.200.0

Enter Preferred Load Host address [<any host>]:: 192.9.201.88
     Preferred Load Host address: 192.9.200.88

Enter Preferred Dump Host address [0.0.0.0]:: 192.9.201.88
     Preferred Dump Host address: 192.9.200.88

Enter Load/Dump Gateway address [<uninitialized>]:: 192.9.200.10

Load/Dump Gateway address: 192.9.200.88

Select type of IP packet encapsulation (ieee802/ethernet)
[<ethernet>]::

Load Broadcast Y/N [Y]::
```

The **addr -d** command display looks similar to this:

```
monitor:: addr -d
Ethernet address (hex): 00-00-81-00-18-B6
Internet address: 192.9.200.214
Subnet mask: 255.255.255.0
Broadcast address: 192.9.200.0
Preferred Load Host address: 192.9.200.88
Preferred Dump Host address: 192.9.200.88
Load/Dump Gateway address: 192.9.200.10
Type of IP packet encapsulation: <ethernet>
Load Broadcast: Y
```

The Remote Access Concentrator must have an Internet (IP) address in its memory before it can load its operational image across the Ethernet via the IP protocol. Therefore, you *must* enter the IP address before booting the Remote Access Concentrator from a UNIX load host. If you do not define a subnet mask, the Remote Access Concentrator uses the generic mask for the specified IP address.

The subnet mask must be set correctly for the network you are using or erratic operation will result (boot failure or ICMP "redirect" storms are likely results).

The Remote Access Concentrator tries to boot from a preferred UNIX load host. If you do not define a preferred load host, the Remote Access Concentrator broadcasts its load request and loads software from the first host that responds.

If the part of the IP address containing the network or subnet address differs from that of the preferred load or dump host, the host must be reached through a gateway (or router). The **addr** command prompts you for this gateway's IP address.

The Remote Access Concentrator uses the broadcast address parameter when loading a file. If this parameter contains a specific address (for example, 132.245.6.255), the Remote Access Concentrator uses only that address for broadcast. If the value is all zeroes (0.0.0.0), the ROM Monitor tries various combinations of broadcast addresses and subnet or network broadcasts. The Remote Access Concentrator broadcasts its request three times for each possible combination of broadcast addresses.

You can specify the IP encapsulation type as either **ethernet** for DIX Ethernet-II, or **ieee802** for IEEE 802.2/802.3. The default IP encapsulation is **ethernet**. All systems that have Ethernet interfaces are IEEE 802.3 compliant, but very few actually do 802.3 packet encapsulation.

Do not change this parameter unless you know absolutely that your Ethernet hosts are using 802.2/802.3 packet encapsulation. An incorrect encapsulation type prevents your Remote Access Concentrator from booting.

boot

The **boot** command requests the loading of appropriate Remote Access Concentrator operating software from a cooperating host on the network or from Flash memory. The command syntax is:

boot [**–lv** | *filename*]

Typing the letter **q** or Control-C interrupts the boot.

A successful boot disables the ROM Monitor.

The **boot** command accepts a file name for the Remote Access Concentrator's image. If the file name is not specified, **boot** displays the file name that was entered using the **image** command, and prompts for one. If you do not provide a file name, or have not defined one for the Remote Access Concentrator using the **image** command, **boot** requests the default **oper.64.enet** file.

For more information on the **image** command, see *image* on page 3-17.

The interface used for booting is determined by the **sequence** command.When SELF is selected, the Remote Access Concentrator checks to be sure that the selected image matches what is in Flash memory. If it matches, the image in Flash memory is decompressed and loaded into RAM. If it doesn't match, the Remote Access Concentrator uses the next interface specified by the **sequence** command.

For more information on the **sequence** command, see *sequence* on page 3-22.

The Remote Access Concentrator boots from the defined preferred load host. If the preferred load host is not defined or does not respond, the Remote Access Concentrator optionally broadcasts on the Ethernet and loads from the first host that responds, if the Load Broadcast flag is set.

To initiate loading, the Remote Access Concentrator sends a load request message to the selected host. After receiving a response, the Remote Access Concentrator loads its operational code to RAM. When loading is complete, it transfers control to the newly-loaded program. The Remote Access Concentrator displays a symbol on the service port terminal for each data block received during the boot.

When the Remote Access Concentrator begins to boot, it displays the load server host's Internet address. If the unit does not boot successfully after several attempts, it displays a *boot attempt failed* message; if the unit has opened the boot file and an error occurs during the boot process, it displays a boot error report on the service port terminal and returns to the ROM Monitor. The boot error report can help determine the cause of the boot failure (see *Boot Error Report* on page 4-8).

During a boot, the service port terminal may display four possible status symbols: "**.**" indicates received data blocks, "**?**" indicates unanswered requests, "*****" indicates transmission errors, and "! ~XXXX~" is a status word from the Ethernet chip on the Annex indicating a serious problem with the Ethernet connection (if this symbol appears in your **boot** command display, contact technical support).

The status word "! ~XXXX~", where XXXX are four hexadecimal digits, decodes as follows:

8000 = Command complete
4000 = Chip is busy
2000 = Command completed without error
1000 = Command aborted issuance of an ABORT command
800 = Late collision detected
400 = Carrier lost
200 = CTS lost
100 = DMA underrun
80 = Transmission deferred because link was busy
40 = Collision detected during interframe spacing (SQE/Heartbeat detected)
20 = Excessive collisions
10 = Reserved

The lowest nibble (bits 3 to 0) are a count of collisions during this transmission. For example:

~8802~ = Complete, Late collision, 2 collisions
~8841~ = Complete, Late Collision, SQE detected, 1 collision

The **boot** command display (using **bfs**) looks similar to this:

```
monitor:: boot
Enter boot file name[(ip) "oper.64.enet",\
     (mop) "OPER_64_ENET.SYS"]::

Waiting for CMB Config Block Info...

Requesting default boot file "OPER_64_ENET.SYS" for MOP/VMS\
     loads and "oper.64.enet" for all other protocols.
Unanswered requests shown as '?',transmission errors as '*'.
Requesting boot from 192.9.200.88 via Ethernet...
Booting BFS file using open delay of 8
Booting BFS file from 192.9.200.88
Header received OK. Received data blocks shown as '.'.
. . . . . .
.. . . . . .
.. . . . . ? . . . . . .
. . . . . .
. . . . . ? . . . . . .
. . . . . EOF
```

The next example shows a boot using **tftp**. The Remote Access Concentrator always tries to open a file using **bfs** first. If unsuccessful, the Remote Access Concentrator uses **tftp** to open the file.

```
monitor:: boot
Enter boot file name [(ip) “oper.64.enet”, \
   (mop) “OPER_64_ENET.SYS”]::

Waiting for CMB Config Block Info...

Requesting default boot file “OPER_64_ENET.SYS” for MOP/VMS\
    loads and “oper.64.enet” for all other protocols.
Unanswered requests shown as ‘?’,transmission errors as ‘*’.
Requesting boot from 192.9.200.88 via Ethernet...
Booting BFS file using open delay of 8
?
Booting TFTP file using open delay of 8
Booting TFTP file from 192.9.200.88
Header received OK. Received data blocks shown as ’.’.
.. . . . . .
. . . . .. . . . . . ? . . . . . .
. . . . . .
. . . . * . . . . . .
. * . . . . . ? . . . . . .
. . . . . EOF
```

The next example shows a self boot.

```
monitor:: boot

Waiting for CMB Config Block Info...

 Requesting default boot file “OPER_64_ENET.SYS” for MOP/VMS\
 loads and “oper.64.enet” for all other protocols.Unanswered
 requests shown as ‘?’,transmission errors as ‘*’.

 Booting file: “OPER_64_ENET.SYS” from SELF

Loading image from SELF ...
.....................................................
Load Completed
```

The **boot –l** command downloads and saves the operational image to RAM, erases the existing Flash memory, copies the new image from RAM to Flash memory in compressed form, and then executes the image.

After executing a **boot –l**, the **ls** command may not show the newly-loaded image. If this happens, the image is not stored in Flash memory. This indicates that you could have a problem with your Flash memory.

The **boot –l** command display looks similar to this:

```
monitor:: boot -l
Enter boot file name [(ip) “oper.64.enet”, \
   (mop) “OPER_64_ENET.SYS”]::

Waiting for CMB Config Block Info...

Requesting default boot file “OPER_64_ENET.SYS” for \
MOP/VMS loads and “oper.64.enet” for all other protocols.
Unanswered requests shown as ‘?’,transmission errors as‘*’.

Requesting boot from 192.9.200.88 via Ethernet...
  Booting BFS file using open delay of 8

Booting from 192.9.200.88

Header received OK.  Received data blocks shown as ‘.’.
. . . . . .
.. . . . . .
. . . . . .EOF

           Saving image into storage device ...

Erasing device
|-----------------------------------------------------|
.....................................................
Erase completed

Storing image ...
.....................................
Storage completed

Beginning execution of image...
```

Use **boot –l** only when reloading your Flash memory. Typically, you reload your Flash memory when you are upgrading to a new version of software.

The **boot –v** command displays the boot in verbose mode. This output includes the turnaround time in milliseconds for each request. This value equals the time lapse between sending the request and receiving the proper reply from the host.

When the boot is complete, verbose output includes a display of network statistics:

```
monitor:: boot –v
Enter boot file name [(ip) “oper.64.enet”, \
   (mop) “OPER_64_ENET.SYS”]::

Waiting for CMB Config Block Info...

Requesting default boot file “OPER_64_ENET.SYS” for MOP/VMS\
    loads and “oper.64.enet” for all other protocols.
Unanswered requests shown as ‘?’, transmission errors as ‘*’.

  Requesting boot from 192.9.200.88 via Ethernet...
  Booting from 192.9.200.88 (42 msec)
  Header received OK.  Received data blocks shown as msec
  turnaround time.
4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 4 4 4 4 4 4 4 4
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 4 4 4 4
4 4 4 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 4 4 4 4 4
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 24 4 4 6 4 10 4 6 4 4 4 4
73 4 4 5 4 4 4 4 4 9 4 4 11 4 4 4 4 4 4 4 4 4 4 4 4 4 3 4 4 4 4 4 4 5 4 4
4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 11 6 4 4 4 4 4 4 5 4
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 5
4 4 4 4 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 4 4 4 4 4 4
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 6 EOF

     Ethernet Statistics

     Frames Received:   1031       Frames Sent:                1031
     CRC Errors:        0          Carrier Sense Losses:       0
     Alignment Errors:  0          Clear to Send Losses:       0
     Resource Drops:    9          Collisions Detected:        9
     Bus Wait Drops:    0          Excessive Collision Losses: 0
     Bad Types/Lengths: 0
```

config

The **config** command displays the current configuration information and revision levels for the Remote Access Concentrator. The **config** command displays revision information, the amount of memory installed, T1 or E1 configuration information, and a description of the number and type of modems installed. The command syntax is:

config

The **config** command display for a Remote Access Concentrator with 24 modems (T1) looks similar to this:

```
                    REVISION/CONFIGURATION INFORMATION

ROM Software Rev: 1110
Board ID: 64                  Board Type: 5399
CPU Type: 486DX2              Ethernet Address: 00-80-2d-xx-xx-xx
Memory size: 8 Meg            EEPROM size: 65504
Flash size: 2 Meg             Flash ID: 0089

WAN 1: PRI E1 ETSI            Revision: VERSION A MGR=1.159
WAN 2: PRI E1 ETSI            Revision: VERSION A MGR=1.159

SLC 1
    SLC SRAM Size: 128 K      Modem Count: 31      Modem Rev: 0

SLC 2
    SLC SRAM Size: 128 K      Modem Count: 31      Modem Rev: 0

Hub Slot  Hub CMB HW Rev  Hub EE Rev  Hub EE Seg Sel  Hub Jmpr Seg Sel
   10             01           0.0           N/A               00
```

This display is typical for E1 versions. For T1 and modem-less versions, the information displayed in some of the fields will be different than that shown in this example.

erase

The **erase** command erases the contents of non-volatile memory (EEPROM memory). Erasing EEPROM restores all parameters to factory default values. The syntax is:

erase

The **erase** command prompts for confirmation before erasing the non-volatile (EEPROM) memory.

The **erase** command does not erase the Ethernet address.

Since the **erase** command erases the IP address, you may need to use the **addr** command to re-enter the Remote Access Concentrator's IP address before reloading any software (if you are using BOOTP or RARP, you should *not* set the IP address).

The **erase** command display looks like this:

```
monitor:: erase
Erase all non-volatile EEPROM memory? (y/n) [n]:: y
Erasing <65504 or 8160 bytes> of non-volatile memory.
Please wait...
                                16K->|Data 0x0
.....................................
.....................................
.....................................
.....................................
Initialized checksum record installed
.
.
.
```

help

Entering **help**, or **?**, displays brief descriptions of the Remote Access Concentrator ROM Monitor commands.

image

The **image** command sets and displays the name of the image file containing the Remote Access Concentrator's software. The syntax is:

image [**–d** | *filename*]

The *filename* argument permits up to 100 characters. To return the image name to its default, enter a pair of double-quote characters (""). The default image name is **oper.64.enet**. The **image** command display looks like this:

```
monitor:: image
Enter Image name: [(ip)"oper.64.enet", \
 (mop) "OPER_64_ENET.SYS"]::
Enter TFTP Load Directory [""]::
Enter TFTP Dump path/filename ["dump.192.9.200.88"]::
```

The **image –d** command display looks like this:

```
monitor:: image -d

Image name:Default (ip): "oper.64.enet"
           Default (mop):"OPER_64_ENET.SYS"
TFTP Load Directory: ""
TFTP Dump path/filename: "dump.192.9.200.88"
SELF image name: "oper.64.enet"
```

The *SELF image name* appears only if the self-boot image is loaded.

lat_key

The **lat_key** command allows you to set the LAT key from the ROM monitor.

The **lat_key** is optional and may be purchased separately.

The command syntax is:

lat_key [**–d**]

The **lat_key** command display looks like this:

```
monitor:: lat_key
Enter LAT Key [<uninitialized>]::
```

The **lat_key –d** command displays the current LAT key setting:

```
monitor:: lat_key -d
     LAT Key <uninitialized>::
```

net

The **net** command executes an Ethernet transceiver loopback test on the local area network. The command syntax is:

net

When you enter the **net** command, you are prompted for the segment as shown in the following example:

```
monitor:: net
Enter Segment to be used (1-6) [1]: 1
```

This transceiver loopback test sends out a short test packet from the Remote Access Concentrator through the transceiver to test the integrity of the network.

The Ethernet transceiver loopback test causes the **Net** LED to turn off. If the unit passes this test, the service port terminal displays *PASSED*, as shown in the following example.

```
monitor:: net
Enter Segment to be used (1-6) [1]: 1

     Network test - PASSED
```

If the Remote Access Concentrator fails, the service port terminal displays an error message. Failing this test indicates that either the Remote Access Concentrator or the Ethernet is bad.

ping

The **ping** command sends an Internet Control Message Protocol (ICMP) mandatory ECHO_REQUEST datagram to elicit an ICMP ECHO_RESPONSE from a host or gateway. ECHO_REQUEST datagrams (pings) have an IP and ICMP header, followed by a structured time value and an arbitrary number of pad bytes that fill out the packet. The syntax for this command is:

ping *host_ip_address* [*data_size*] [*npackets*]

- The *host_ip_address* entry is the Internet address of the host or gateway from which you wish to elicit a response.
- The optional *data_size* entry is the number of bytes sent in a datagram packet. The default value is 64 and the maximum value is 1024.
- The optional *npackets* entry is the number of packets to transmit. If you specify *npackets*, you must also specify a *data_size*.

The **ping** command display looks similar to this:

```
monitor:: ping 132.245.33.69
     Enter Segment to be used (1-6) [1]: 1
     PING 132.245.33.69: 64 data bytes
```

If you enter the **ping** command without specifying an IP address, the display looks similar to this:

```
monitor:: ping
     Enter segment to be used (1-6) [1}: 1
     IP address required, ie: ping 132.245.33.69\
     [data bytes] [npackets]
```

When you enter the **ping** command, the following prompt is displayed:

```
Enter Segment to be used [1]:
```

To exit out of **ping** either wait for *npackets* to be transmitted or, at any point, type **q**. The ping statistics display upon exit.

ports

The **ports** command tests the WAN interface port. The syntax is:

ports

To test the WAN port, the interface must be connected to a loopback plug. No external clocking is required.

When invoked, the command displays a menu of options. The following is a sample screen display for a T1 (24 modems) or E1 (32 modems) version of the Remote Access Concentrator.

```
monitor:: ports

Some Important Notes:
- These tests require the WAN port to have a loopback
  plug installed.
- An even number of ports must be selected for the Modem
  Ports test because pairs of modems are connected
  together and data is looped back between them.

  1) Digital Ports
  2) Modem Ports

Selection (Return to exit)::
```

The following is a sample screen display for a modem-less version of the Remote Access Concentrator.

```
monitor:: ports

Some Important Notes:
- These tests require the WAN port to have a loopback
  plug installed.


  Ports with faulty Data Lines:
  Enter port number or range of ports to test
  (Return to exit)::
```

sequence

The **sequence** command edits the load/dump interface list. This list determines the order of the network interfaces the Remote Access Concentrator will use for loading and dumping. The default, **net**, uses the LAN interface. If the Remote Access Concentrator fails to boot using the first interface, it will try the next interface. The command syntax is:

sequence [**–d**] | [*interface*[,*interface*]. . .]

Specify the LAN interface by selecting **net**. Separate each interface with a comma or a space. Enter the interface list as an argument to the command, otherwise the service port terminal displays a list of available interfaces and prompts for a new list.

In the following example, interfaces are assigned to the load/dump sequence list.

```
monitor:: sequence

Enter a list of 1 to 4 interfaces to attempt to use for
downloading code or upline dumping. Enter them in the order
they should be tried, separated by commas or spaces.
Possible interfaces are:

     Ethernet:        net
     SELF:            self

Enter interface sequence [net]:: self, net

Interface sequence: self,net
```

If SELF is specified as the first sequencing option, it is recommended that NET be included as a second sequencing option as shown in the example above.

The **sequence –d** command displays the current load/dump interface list. You cannot specify both the **–d** argument and the interface list with the same command. The command display looks like this:

```
monitor:: sequence –d

     Interface sequence: self,net
```

stats

The **stats** command displays current network statistics gathered by the ROM. Use **stats** along with the **boot** command to help isolate problems. Table 3-2 describes the network statistics displayed by the **stats** command. The syntax is:

stats

The **stats** command display looks like this:

```
monitor:: stats
Ethernet Statistics

Frames Received:    398    Frames Sent:                3
CRC Errors:           0    Carrier Sense Losses:       0
Alignment Errors      0    Clear to Send Losses:       0
Resource Drops:       0    Collisions Detected:        0
Bus Wait Drops:       0    Excessive Collision Losses: 0
Bad Types/Lengths:    0
```

Table 3-2. Network Statistics

Statistic	Description
Frames Received	The number of frames received.
CRC Errors	The number of CRC checksum errors detected.
Alignment Errors	The number of frames received which do not contain enough bits to fill the last byte.
Resource Drops	The number of packets dropped because the ROM code could not buffer them quickly enough. The ROM code cannot always handle back-to-back incoming packets. The Remote Access Concentrator accepts the first response it receives and drops all others. Dropped packets are normal.

(continued on next page)

Table 3-0. Network Statistics (continued)

Statistic	Description
Bus Wait Drops	The number of packets dropped due to waiting too long for a bus to become available.
Bad Types/Lengths	The number of unknown packet types if Ethernet DIX encapsulation is being used. The number of packets with illegal lengths if IEEE 802.2/802.3 encapsulation is being used.
Frames Sent	The number of frames sent.
Carrier Sense Losses	The number of times packets could not be transmitted because the Remote Access Concentrator lost the Carrier Sense signal – usually the result of excessive traffic on the Ethernet.
Clear to Send Losses	The number of times packets could not be transmitted because the Remote Access Concentrator lost the Clear to Send signal – usually the result of a serious hardware failure or incompatibility.
Collisions Detected	The number of times the Remote Access Concentrator had to retry transmissions automatically – usually the result of normal Ethernet traffic. These retries do not cause the **boot** command to display ‘‘*.”
Excessive Collision Losses	The number of times the Remote Access Concentrator could not transmit packets because there were too many collisions – usually the result of excessive traffic on the Ethernet (but can be due to wiring errors or hardware failure). The **boot** command displays these retries as “*.”

Chapter 4
Troubleshooting Procedures

This chapter describes front panel alarms and LED indicators, power-up and booting, troubleshooting during booting, and the file created from a Remote Access Concentrator dump.

Front Panel Alarms and LED Indicators

The Model 5399's front panel contains a number of LEDs that provide information about normal operations and about problems that occur. Use these LEDs and the ROM Monitor commands to diagnose problems. Figure 4-1 illustrates the Model 5399's front panel LEDs.

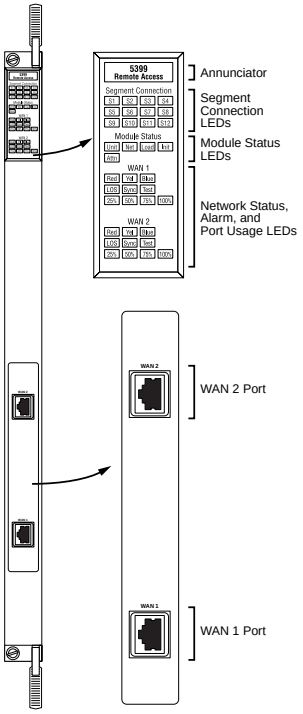


Figure 4-1. Model 5399 Front Panel Alarms and LEDs

Refer to Table 4-1 for a description of the LEDs located on the front of the Model 5399 Remote Access Concentrator Module.

Table 4-1. Model 5399 Front Panel LEDs

LED(s)	Description
Annunciator	The Annunciator backlights the model number of the module and indicates, by its color, the operational condition of the module. The conditions are: **Green** - The module is performing normally. **Amber** - Some portion of the module has failed, or the module is being initialized. **Off** - The module is not receiving +5 volt power, or the power level is below the reset limit (4.65 volts).
Segment Connection LEDs	These LEDs indicate which backplane Ethernet LAN segments are being used. There are 12 green LEDs, labeled **S1** through **S12**, for the 12 Ethernet segments. When an LED is illuminated, it indicates that the Remote Access Concentrator is connected to the corresponding backplane Ethernet LAN segment; when off it indicates that the corresponding backplane Ethernet LAN segment is not connected.
Module Status LEDs	**Init** - Turns green when the Remote Access Concentrator begins the initialization process after a power-up or reset. This is the first LED that lights after power-up or reset. The Init LED turns off after the diagnostics have successfully completed. **Unit** - Turns green after the Remote Access Concentrator passes the power-up diagnostics. Turns amber if the power-up diagnostics fail. **Net** - Turns green after the Remote Access Concentrator verifies that a valid Ethernet connection exists. **Attn** - Turns amber when the Remote Access Concentrator requires operator attention, that is, in Monitor Mode or when the diagnostic tests fail.

(continued on next page)

Table 4-1. Model 5399 Front Panel LEDs (continued)

LED(s)	Description
Module Status LEDs (continued)	**Load** - Turns green when the Remote Access Concentrator is loading the operational image or dumping a RAM image if there is a failure. The LED turns amber if a load error is detected.
Network Status LEDs	**TEST** - The network TEST indicator is ON (amber) when the WAN Interface is looped back. Loopback tests are activated either locally by the user or by the telephone company. **SYNC** - The green SYNC indicator is ON (green) when the WAN interface is synchronized with the received network signal and is receiving proper framing information. **LOS** - The LOS indicator is ON (amber) when the WAN interface is detecting invalid synchronization pulses on the network interface receiver. When an LOS condition exists, the WAN interface transmits a YELLOW alarm to the remote system.
Alarm LEDs	**RED** - The RED alarm indicator is ON (amber) during a locally detected carrier failure. During the RED alarm condition, a YELLOW alarm is transmitted across the telephone network. **YELLOW** - The YELLOW alarm indicator is ON (amber) when receiving a YELLOW alarm condition from the telephone network. This indicates a failure detected at the other end of the link (the Central Office). **BLUE** - The BLUE alarm indicator is ON (amber) when receiving an unframed, all-ones Alarm Indication Signal (AIS) from the network. This condition exists upon a loss of originating signal, or when any action is taken that would cause a signal disruption.

(continued on next page)

Table 4-1. Model 5399 Front Panel LEDs (continued)

Port Usage LEDs	The Port Usage LEDs, labeled **25%**, **50%**, **75%**, and **100%**, indicate the approximate percentage of B channels that are being utilized. There are two sets of Port Usage LEDs, one set for each WAN Port. These LEDs are normally green. If all available B channels are in use, they turn amber until at least one call disconnects.

During power-up and booting, it is more difficult to diagnose problems because they can originate in the Remote Access Concentrator, the Ethernet, or the load server host. However, the LEDs provide both a progress report and an error display to assist you in troubleshooting.

If an error occurs, save the status of these LEDs. Technical support personnel can use this information to diagnose problems.

Power-up and Boot Procedures

The Remote Access Concentrator has two modes of operation: Normal Mode and Monitor Mode. Normal Mode is the standard operational mode. Monitor Mode is a diagnostic mode that provides access to the ROM Monitor commands.

During its power-up and boot sequence, the Remote Access Concentrator runs a set of diagnostics. The system LEDs display the diagnostics' status. The pattern of the system LEDs identifies the error condition.

Table 4-2 lists abnormal operating conditions reported by the LED displays, points to possible causes, and recommends corrective actions.

Table 4-2. Troubleshooting Guide

Condition	Possible Cause	Corrective Action
Annunciator is amber.	You reset the module or cycled power by removing the module and reinserting it.	None required. The annunciator should turn green when the module successfully completes the power-up diagnostics.
Annunciator is amber.	Detectable module component failure.	Use a service port terminal to check the self-test diagnostic messages to determine whether you can resolve the problem; otherwise, replace the module.
Annunciator is off; other module annunciators are off; chassis LEDs off.	No power to chassis.	Turn on power to the chassis.
Annunciator is off; other module annunciators are off; chassis LEDs are on.	Chassis power is below required module threshold.	Check chassis power supply LEDs and power supplies.
Annunciator is off; other module annunciators are on; chassis LEDs are on.	Module is not seated properly.	Re-seat the module.

(continued on next page)

Table 4-2. Troubleshooting Guide (continued)

Condition	Possible Cause	Corrective Action
Annunciator is off; other module annunciators are on; chassis LEDs are on.	No power to module (blown fuse); failed DC-to-DC converter).	Replace the module.
The **Attn** and **Unit** Module Status LEDs are amber.	The Remote Access Concentrator did not pass its diagnostics or is not working normally.	Reset the Remote Access Concentrator.

Power-Up Diagnostic Messages

Power-up diagnostics run when the Remote Access Concentrator is powered up or reset. During the power-up process the following text is displayed on the service port terminal:

```
To enter "Monitor Mode" please depress the SPACE key within
10 seconds.
```

If you press the space bar within 10 seconds, the following text is displayed:

```
Monitor Mode selected, please wait for Confidence tests to
complete.
```

If you do not press the space bar within the time allotted, the following text is displayed:

```
Defaulting to Normal Boot Mode.
```

If an error occurs during confidence tests, the following message is displayed:

```
Fatal Error
```

Boot Failures

The procedures for tr:oubleshooting a power-up failure established that:

- The hardware is functional.
- The Ethernet interface is functional.
- The Remote Access Concentrator can communicate with the Ethernet.

If the Remote Access Concentrator still is not booted, you must pinpoint the problem. The boot error report can help in this process.

The Remote Access Concentrator generates a boot error report only if it opens the boot file and an error occurs during the boot process.

Generally, two problems cause boot failures:

- The Remote Access Concentrator is not configured properly.
- The load server host is not responding.

The Remote Access Concentrator requests a boot image from a pre-defined load host or by broadcasting a boot request. When a host responds, the Remote Access Concentrator loads its operational image.

The Remote Access Concentrator requires setting certain configuration parameters. Enter these parameters using the Monitor Mode commands for the initial boot sequence. See Chapter 3 for more information on these commands.

If the problem is a non-responsive host, the boot error report displays that information under the *Rsp T/O's* field. This field indicates that the Remote Access Concentrator timed out while waiting for a response to its boot request; if this field is empty, check the Remote Access Concentrator's configuration parameters.

Boot Error Report

If an error occurs, a Remote Access Concentrator *boot error report* is generated *only* if the Remote Access Concentrator has opened the boot file. The report is displayed using the following format:

```
BOOT ERROR REPORT (for BFS files only)
Boot attempt from host nn.nn.nn.nn:
Errors from Last Open Request:
0 ARP errors 0 ERPC layer errors 0 Aborts rx'd
Errors from Last Read Request:
0 Msgs w/ wrong size 0 ERPC layer errors 0 Aborts rxd
Errors from Last ERPC Layer Invocation:
0 H/W errors 1 Msgs from wrong host 0 Rsp T/O's 0 Msgs of wrong type
```

TFTP error reporting complies with the standard, predefined TFTP error codes.

The Remote Access Concentrator generates a boot error report for the Internet address from which it tried, and failed, to boot. Table 4-4 contains a description of the Errors from the Last Read Request; and Table 4-3 contains a description of the Errors from Last ERPC Layer Invocation.

The error count pinpoints the error that caused the boot failure. For example, if the boot failed during a Read Request due to excessive Expedited Remote Procedure Call (ERPC) layer errors, the Errors from Last ERPC Layer Invocation lists only errors that occurred during the failed Read Request (see Table 4-3). The report does not list errors that occurred during any other Read Request (see Table 4-4) or during the Open Request (see Table 4-5).

The Open Request and the Read Request layers communicate with the block file server (BFS) on the host. The ERPC layer resides below the Open Request and the Read Request layers. It is responsible for sending a given message to a specific host UDP port, and for receiving the correct response to that message from the port.

Table 4-3. Errors from Last ERPC Layer Invocation

Error	Description
H/W errors	The Remote Access Concentrator sensed a hardware error during message transmission or reception. This error indicates a fault with the Remote Access Concentrator LAN interface. Use the **net** command to isolate the problem (see *net* on page 3-19).
Msgs from wrong host	The Remote Access Concentrator received a message from an incorrect host. This indicates that the Remote Access Concentrator received, and ignored, an unsolicited packet.
Rsp T/O's	The Remote Access Concentrator never received a correctly formatted response from the correct host, or any response from any load server hosts.
Msgs of wrong type	The correct host sent a message to the Remote Access Concentrator, but the message was not a correctly formatted response to the transmitted request.

Table 4-4. Errors from Last Read Request

Error	Description
Msgs with wrong size	The correct host responded to the Read Request, but the data size is incorrect.
ERPC layer errors	See Table 4-3.
Aborts rx'd	The host's BFS transmitted an abort in response to the Remote Access Concentrator's Read Request. Run **erpcd –D** on the host to obtain more information.

Table 4-5. Errors from Last Open Request

Error	Description
ARP errors	Address Resolution Protocol (ARP) errors indicate that the Remote Access Concentrator is configured to boot from a specified host, but the host would not transmit its Ethernet address to the Remote Access Concentrator. Possibly, the Remote Access Concentrator configuration includes the wrong IP encapsulation, or the subnet mask is misconfigured on the host or the Remote Access Concentrator.
ERPC layer errors	See Table 4-3.
Aborts rx'd	The host's BFS transmitted an abort in response to the Remote Access Concentrator's Open Request. This often means that the requested file does not exist on that server, or that it is installed in the wrong directory or with the wrong permissions. Run **erpcd –D** on the host to obtain more information.

Correcting Remote Access Concentrator Parameters

The following parameters must accurately reflect both the Remote Access Concentrator and the network environment in which it operates.

Verify the Remote Access Concentrator's IP address using the **addr** command. If your network configuration does not support the factory defaults, verify the following parameters using the **addr** command:

- The broadcast address.
- The subnet mask.
- The load/dump gateway address (which must be specified if the preferred load server host is located on another network or subnet).

- The IP encapsulation type. All systems that have Ethernet interfaces are IEEE 802.3 compliant, but very few actually do 802.3 (LLC/SNAP) packet encapsulation. Use the default, Ethernet, unless you know absolutely that your LAN does 802.2/802.3 (LLC/SNAP) packet encapsulation.

You can use the defaults for the name of the image file containing the Remote Access Concentrator's software and the address of the preferred load server host. If the value for the image name is incorrect, the Remote Access Concentrator cannot boot. Correct the name using the **image** command. If the address for the preferred load server host is incorrect, the boot takes longer, since the Remote Access Concentrator has to broadcast for a host. Correct the load host's address using the **addr** command.

Confirm that the Remote Access Concentrator's boot parameters are correct by using the appropriate ROM Monitor commands. Modify any boot parameters that are incorrect or missing. Boot the Remote Access Concentrator either by entering the **boot** command at the service port terminal, or by resetting the module.

Load Server Host Not Responding

The Remote Access Concentrator can boot from one of the following hosts acting as a load server host:

- A UNIX host on the LAN using BFS via **erpcd**.
- Another Remote Access Concentrator using BFS.
- Any host (UNIX or non-UNIX) using **tftp**.
- A Windows NT host using BFS via **erpcd**.

The following subsections discuss troubleshooting for some of these load server hosts.

UNIX Host on the LAN

When troubleshooting a UNIX host on the LAN, make sure that:

- The host is booted and functioning properly.
- The host can communicate with other network nodes using standard UNIX networking features and utilities.
- All Remote Access Concentrator software is installed properly on the host. See the *Software Installation Notes* that come with the Remote Access Concentrator software release.
- The **erpcd** daemon or **tftp** server (which loads the operational image to the Remote Access Concentrator) is running.

In Test Mode, **erpcd** on the load server host displays boot progress reports. In Monitor Mode, the Remote Access Concentrator displays boot progress reports. The Remote Access Concentrator displays its reports on the service port terminal that invokes its Monitor Mode; **erpcd** displays its reports on the UNIX terminal that invokes its Test Mode.

When running **erpcd**, all paths are relative to the **/usr/spool/erpcd/bfs** directory for both boots and dumps. The **/usr/spool/erpcd/bfs** directory is a default pathname and can be changed.

1. **To place** erpcd **on the load server host into Test Mode, kill the** erpcd **program (requires superuser privileges) and restart it using the** –D **option:**

   ```
   # /usr/annex/erpcd –D5
   ```

2. **Place the Remote Access Concentrator into Monitor Mode. (This resets the Remote Access Concentrator, so warn users before you do it.) Then, at the monitor prompt, enter:**

   ```
   monitor:: boot -v
   ```

When the Remote Access Concentrator boots in Monitor Mode, the service port terminal displays the load server host's Internet address, and indicates whether it receives a response to its Open File Request and to any of its Read File Requests. The host's progress report indicates receipt of any File Server Requests and its responses to such requests.

The host displays *erpc_return 0* if it successfully receives a request and is sending out an affirmative response. If any Remote Access Concentrator-related files are missing or cannot be installed, contact technical support.

Windows NT Host on the LAN

When troubleshooting a Windows NT host on the LAN, make sure that:

- The host is booted and functioning properly.
- The host can communicate with other network nodes using standard Windows NT networking features and utilities.
- All Remote Access Concentrator software is installed properly on the host. See the *Software Installation Notes* that come with the Remote Access Concentrator software release.
- The **erpcd** daemon or **tftp** server (which loads the operational image to the Remote Access Concentrator) is running.

In Test Mode, **erpcd** on the load server host displays boot progress reports. In Monitor Mode, the Remote Access Concentrator displays boot progress reports. The Remote Access Concentrator displays its reports on the service port terminal that invokes its Monitor Mode; **erpcd** displays its reports on the terminal that invokes its Test Mode.

1. **Stop the** erpcds **service from the Control Panel. Then open a DOS command shell and manually start** erpcd **with the** -D **option.**
2. **Place the Remote Access Concentrator into Monitor Mode. (This resets the Remote Access Concentrator, so warn users before you do it.) Then, at the monitor prompt, enter:**

```
monitor:: boot -v
```

When the Remote Access Concentrator boots in Monitor Mode, the service port terminal displays the load server host's Internet address, and indicates whether it receives a response to its Open File Request and to any of its Read File Requests. The host's progress report indicates receipt of any File Server Requests and its responses to such requests.

The host displays *erpc_return 0* if it successfully receives a request and is sending out an affirmative response. If any Remote Access Concentrator-related files are missing or cannot be installed, contact technical support.

Another Model 5399 Remote Access Concentrator Module

When troubleshooting a Model 5399 configured as a load server host:

1. **Use** ping **from any host on your network to make sure the Model 5399 Remote Access Concentrator can be reached.**
2. **Either use** telnet **or** na **to verify the unit's configuration.**

The *Remote Annex Administrator's Guide for UNIX* provides more information on these commands.

A Model 5399 that has been reconfigured as a load server host, but not rebooted, cannot boot another Model 5399 on the network. Rebooting the Model 5399 load server host ensures that the parameters are set.

Do not set the preferred dump address to point to another Model 5399 Remote Access Concentrator. Set it to a host address, or to 127.0.0.1 to disable dumping.

Remote Access Concentrator Dumps

The Remote Access Concentrator dumps its memory image to a host running load server software when certain software or hardware events occur.

Dump files are generated for use by technical support personnel only.

Events that trigger Remote Access Concentrator dumps are:

- Non-recoverable hardware or software errors.
- Software fails to reset the Remote Access Concentrator's watchdog timer.
- Software fails one or more internal consistency checks.
- Hardware detects an internal fault.

The Remote Access Concentrator sends a dump file to a preferred load dump host. If you do not define this host by specifying an address, the Remote Access Concentrator broadcasts a request and dumps to the first host that responds.

The Remote Access Concentrator sends a dump to the **/usr/spool/erpcd/bfs** directory on the dump host. The **/usr/spool/erpcd/bfs** directory is a default pathname and can be changed. The receiving Remote Access Concentrator assigns a unique file name for each device that it receives a dump from but not for each crash dump.

Rename any crash dumps that you want to save. Erpcd overwrites crash dumps if the same unit dumps again.

The assigned name depends on the number of characters per file name that the dump host supports. For hosts supporting file names longer than 14 characters (e.g., most modern UNIX hosts), dump files are named **dump.addr**. The file extension **addr** is the Remote Access Concentrator's IP address.

For hosts that may limit file names to 14 characters (e.g., System V hosts), a dump creates two additional directories under **/usr/spool/erpcd/bfs**. The name of the first directory is **dump**; the second directory uses the Remote Access Concentrator's IP network address as its name. The dump file uses the Remote Access Concentrator's IP host address as its name. For example: **/usr/spool/erpcd/bfs/dump/192.9.200/5**.

The **tftp** dump names are user-defined. If a name is not specified, the Remote Access Concentrator uses the **bfs** convention.

Each dump file contains a complete image of the Remote Access Concentrator RAM memory and hardware state. The amount of space required for a dump file varies according to the port configuration. The ROM Monitor **config** command displays the amount of memory for the Remote Access Concentrator.

Table 4-6 shows sample dump file names. All pathnames are relative to the file **/usr/spool/erpcd/bfs**.

Table 4-6. Remote Access Concentrator Dump File Naming Conventions

Remote Access Concentrator Address	Network Address	BSD Filename	System V Pathname
63.0.0.75	63	dump.63.0.0.75	dump/63/0.0.75
131.140.23.1	131.140	dump.131.140.23.1	dump/131.140/23.1
195.46.2.15	195.46.2	dump.195.46.2.15	dump/195.46.2/15

Conditions for Replacing a Module

Replace a Remote Access Concentrator with another module of the same type under any of the following conditions:

- If the annunciator on the module front panel remains off, indicating that the module is not receiving +5 volt power or that the power level is below the reset limit (4.65 volts) when other modules in the hub are receiving normal operating power. For more information, see Table 4-2.
- If the annunciator remains amber, indicating that some portion of the module has failed and a check of the self-test messages indicates that the problem cannot be fixed. For more information, see Table 4-2.

Module Configuration Management

Each module installed in a Model 5000 chassis operates according to software parameter values and hardware option settings. You can use these to customize module operation for that particular hub. This combination of software and hardware values is the module configuration, of which there are actually two types:

- “Primary” configuration, which is the set of base values built into the module at the time it is manufactured. A user cannot change this configuration.
- “Default” configuration, which is the permanent configuration plus any changes to jumper or switch settings. The default configuration is valid for any hub slot at any time. Each module must have a default configuration. This configuration is stored in two places: on the module itself and on the supervisory module. You can change this configuration through a network management module (NMM) or through a terminal connected to the chassis service port.

The supervisory module, located in slot 0 of the 5000 hub, performs several functions for the hub and the modules installed in the hub. The supervisory module stores the primary configurations of all modules installed in the hub. Each user-installed module also stores a working copy of its configuration information. When a change is made to this working copy, the module stores the new user configuration in its onboard nonvolatile memory.

The supervisory module periodically polls user-installed modules in the hub across the Common Management Bus (CMB). As part of the poll, the NMM collects module configuration information and stores the information in its local nonvolatile memory for use in comparing and/or restoring a module configuration after a power cycle or reset.

What happens to a module when it is inserted in the hub depends on a combination of conditions:

- If you remove a module, change jumper settings, and reinsert the module in its original slot, the new jumper settings take effect immediately. The supervisory module records the new configuration information in its nonvolatile memory.
- If you replace a module in a slot with a different type of module, the new module is directed to use its default configuration.
- If the supervisory module is not operational, a module whose configured slot number matches its installed location can use its own stored configuration; otherwise, the module reverts to its default configuration.

To preserve the configuration parameters of the Remote Access Concentrator module you are replacing, follow the procedures in *Preparing for a Hot Swap* (below) and *Completing the Hot Swap* on page 4-22.

Verify that the backplane segment bank selector is set for the correct segment bank before installing a replacement module. For more information on jumper and switch settings, see Chapter 2.

Preparing for a Hot Swap

The Remote Access Concentrator can be inserted into or removed from a chassis without interrupting service to other modules within the System 5000 hub. This ability is referred to as “hot swapping.”

The Remote Access Concentrator holds 64KB of configuration information in EEPROM. This information is periodically sent to the host server to be saved in a file. During a hot swap, the new Remote Access Concentrator reads in this file at boot time and overwrites its EEPROM with the configuration information from the Remote Access Concentrator it is replacing. The new Remote Access Concentrator then functions as the previous Remote Access Concentrator, except for the LAT key, which needs to be reprogrammed.

If no EEPROM overwrite is desired when hot swapping, select default values for that slot from the supervisory module on the service port terminal.

There are two methods of writing the EEPROM information to the host file:

- Whenever a change is made to EEPROM, a 5 minute timer is started. When the timer expires, the contents of the EEPROM memory are copied to an internal buffer in the Remote Access Concentrator RAM and encrypted. The file is then transferred to the host specified in the configuration parameter **pref_dump_addr**. The filename used to store the EEPROM information on the host is **params.*n.n.n.n*** (where ***n.n.n.n*** is the IP address of the Remote Access Concentrator).
- In addition, writing the EEPROM information to the host can be forced (bypassing the 5 minute timer) by using the Remote Access Concentrator's superuser **cp -e** command. This can be done at any time and typically is done if you have just completed making changes to one of the configuration files or some of the configuration parameters.

It will be necessary to configure the replacement Remote Access Concentrator to define the LAT key, because it isn't restored during a hot swap.

For the hot swap to be successful, the module being replaced and the new module must both be registered for the same software options.

Removing a Module

To remove a Remote Access Concentrator, follow these steps:

1. **Using the flat-tip screwdriver, loosen the two captive retaining screws on the module until they pop free of the chassis.**
2. **Push the top and bottom inserter/extractor levers away from the center of the Remote Access Concentrator front panel to release the module from the backplane connector.**
3. **Slide the module out of the chassis.**

   Grip the front panel with one hand while supporting the bottom of the module with the other hand.
4. **Place the module on an antistatic mat.**

If a module is removed from the chassis permanently or for more than a few minutes, you should install a filler panel on the empty chassis slots to maintain the cooling air flow within the chassis.

The removed Remote Access Concentrator retains all of its set parameters, including the IP address. If you reuse this module elsewhere without removing this IP address, you will have duplicate IP addresses on your network.

Completing the Hot Swap

To complete the hot swap of the Remote Access Concentrator:

1. **Verify that the jumper settings on the replacement module are the same as the settings on the original module.**
2. **Use the procedures outlined in Chapter 2 to insert the replacement module into the System 5000 chassis.**
3. **Boot the replacement Remote Access Concentrator.**

   The saved EEPROM information is read by the Remote Access Concentrator at boot time only in a hot swap situation. The Remote Access Concentrator compares the “board serial number” field (in the supervisory module nonvolatile memory) against its internal serial number. After loading the operational image, the initialization process sets up the network interface and then reads the **params.*n.n.n.n*** file from the host server, and places it in local memory. The EEPROM file contents are decrypted and written to the EEPROM. The buffer containing the files is then discarded. This process may take several minutes to complete.
4. **If applicable, obtain a new LAT key and enter it.**

Appendix A
Port Pins and Signals

This appendix identifies the signals and the associated pins used by the Remote Access Concentrator's WAN Interface ports.

WAN Interface Ports

The Model 5399 Remote Access Concentrator is equipped with two WAN Interface ports. Figure A-1 illustrates a WAN Interface port connector. Table A-1 lists the port's pin/signal allocations.

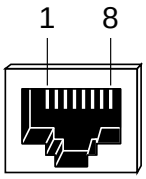


Figure A-1. WAN Interface Port Connector

Table A-1. WAN Interface Port/Pin Signal Allocations

Pin Number	Signal
1	Receive data from Network (RECEIVE RING)
2	Receive data from Network (RECEIVE TIP)
3	Unused
4	Transmit data to Network (TRANSMIT RING)
5	Transmit data to Network (TRANSMIT TIP)
6	Unused
7	Unused
8	Unused

Appendix B
Modem Upgrade Instructions

The Model 5399 supports up to 62 internal digital modems. The modems are located on plug-in cards that reside on the module. This chapter describes how to install digital modem cards to upgrade the number of modems on the module. This chapter also describes how to remove modem cards from the module.

These installation instructions contain a description of the following:

- *Contents of the Kit*
- *Module Removal Instructions*
- *Modem Card Installation Instructions*
- *Removing Modem Cards*

Contents of the Kit

The modem upgrade kit contains:

- Two digital modem cards
- One hardware kit containing two screws per modem card

Required Tools

- A flat-tip screwdriver
- A Phillips screwdriver
- A pair of needle-nose pliers

Module Removal Instructions

Observe handling precautions: digital telecommunications cable(s).

The following instructions describe how to remove the Remote Access Concentrator module from the hub. Figure B-1 illustrates the instructions.

1. **Disconnect the WAN cables.**
2. **Loosen the two captive screws.**
3. **Disengage the module from the backplane by simultaneously pushing the inserter/extractor levers towards the outside of the module front panel (see Figure B-1).**
4. **Remove the module.**

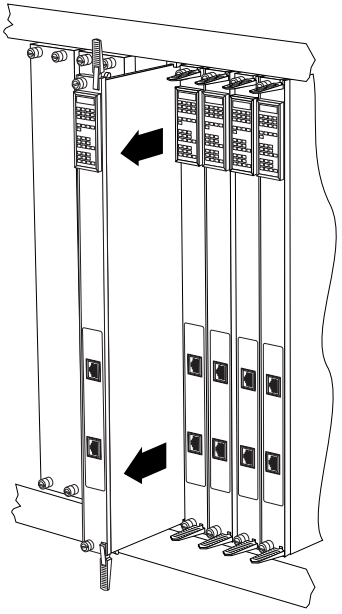


Figure B-1. Removing the Module from the System 5000 Hub

Modem Card Installation Instructions

Observe handling precautions: electrostatic-sensitive devices.

The following instructions describe how to install the modem cards onto the Remote Access Concentrator module (see Figure B-2).

1. **Find the locations on the module in which the modem cards are installed.**
2. **On the modem cards, find the blank connector position labeled JP1.**
3. **Orient the modem card so that JP1 is closest to the rear edge of the module and carefully press it into the card connector, making sure not to bend or damage any pins. Make sure that the connector is fully seated.**
4. **Push the corners of the modem card down onto the nylon standoffs until the locking detents engage.**
5. **Insert and tighten the two screws to secure the modem card.**
6. **Follow the installation instructions detailed in Chapter 2 to reinstall the upgraded Remote Access Concentrator into the System 5000 Hub.**

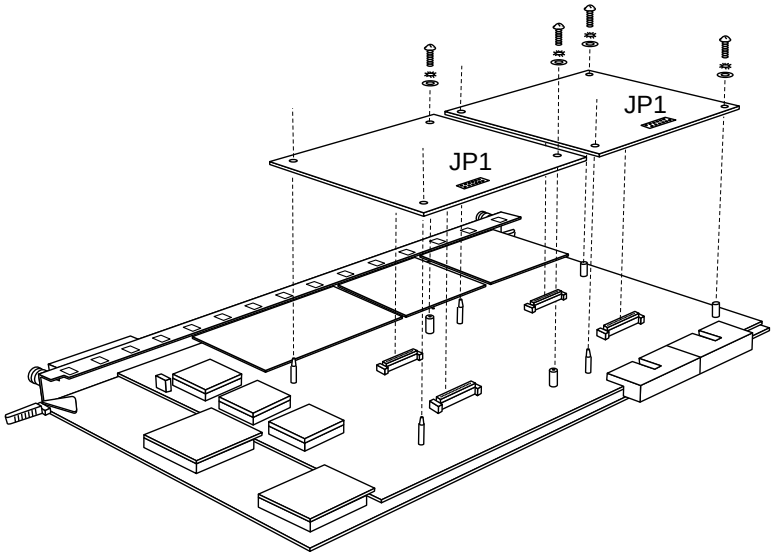


Figure B-2. Adding Modem Cards to the Module

Removing Modem Cards

Occasionally it may be necessary to remove modem cards from the Remote Access Concentrator module (for example, if a modem card fails and needs to be replaced). On the Remote Access Concentrator module, there are two locations that can accommodate modem cards (up to 62 modems total).

The following instructions detail how to remove a modem card from the Remote Access Concentrator. Figure B-3 illustrates the instructions.

1. **Locate the modem card that you want to remove.**
2. **Remove the two screws that secure the modem card to the module.**
3. **Push in the locking detent on the nylon standoff that secures a corner of the modem card to the module, and gently work that corner of the card off the nylon standoff (see Figure B-3).**
4. **Repeat the procedure for the other corner of the modem card that is secured by a nylon standoff.**
5. **Lift the modem card straight out of its connector, making sure not to damage any pins.**

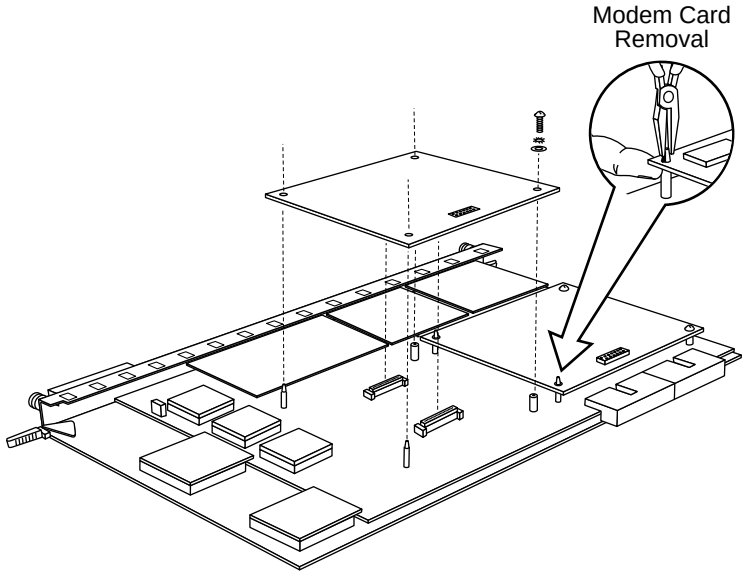


Figure B-3. Removing Modem Cards from the Module

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