

Installing

# **The Model 8000 Remote Access Concentrator**

Marketing Release 5.1

Part No. 118353-A Rev. A  
September 1997



**Bay Networks**

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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. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to take whatever measures may be necessary to correct the interference at their own expense.



## European Requirements Only

### EN 55 022 Statement

This is to certify that the Bay Networks Model 8000 Remote Access Concentrator is 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 Class A (CISPR 22).

**Warning:** This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take appropriate measures.

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This product conforms (or these products conform) to the provisions of Council Directive 89/336/EEC and 73/23/EEC. The Declaration of Conformity is available on the Bay Networks World Wide Web site at [www.baynetworks.com](http://www.baynetworks.com).

## Japan/Nippon Requirements Only

### Voluntary Control Council for Interference (VCCI) Statement

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これは、情報処理装置等電波障害自主規制協議会（VCCI）クラス A 情報技術装置です。この装置を家庭環境で使用することがあります。この場合には使用者が適切な対応を求められることがあります。

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## Australian Requirements Only

### WARNING

This customer equipment is to be installed and maintained by service personnel as defined by AS/NZS 3260 Clause 1.2.14.3. Service Personnel. Incorrect connection of connected equipment to the General Purpose Outlet could result in a hazardous situation.



## Canada Requirements Only

### Canadian Department of Communications Radio Interference Regulations

This digital apparatus (Model 8000 Remote Access Concentrator) does not exceed the Class A limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

### Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique (Model 8000 Remote Access Concentrator) respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

### Canada CS-03 Rules and Regulations

**Note:** The Canadian Department of Communications label identifies certified equipment. The certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department 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 the degradation of service in some situations.

Repairs to certified equipment should be made by a representative 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:** For equipment using loopstart lines, please note that the Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices does not exceed 5.0. The REN is located on the "FCC Rules Part 68" label located on the bracket of the module, or on the back of the unit.

### Canada CS-03 -- Règles et règlements

**Note:** L'étiquette du ministère des Communications du Canada indique que l'appareillage est certifié, c'est-à-dire qu'il respecte certaines exigences de sécurité et de fonctionnement visant les réseaux de télécommunications. Le ministère ne garantit pas que l'appareillage fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer l'appareillage, s'assurer qu'il peut être branché aux installations du service de télécommunications local. L'appareillage doit aussi être raccordé selon des méthodes acceptées. Dans certains cas, le câblage interne du service de télécommunications utilisé pour une ligne individuelle peut être allongé au moyen d'un connecteur certifié (prolongateur téléphonique). Le client doit toutefois prendre note qu'une telle installation n'assure pas un service parfait en tout temps.

Les réparations de l'appareillage certifié devraient être confiées à un service désigné par le fournisseur. En cas de réparation ou de modification effectuées par l'utilisateur ou de mauvais fonctionnement de l'appareillage, le service de télécommunications peut demander le débranchement de l'appareillage.

Pour leur propre sécurité, les utilisateurs devraient s'assurer que les mises à la terre des lignes de distribution d'électricité, des lignes téléphoniques et de la tuyauterie métallique interne sont raccordées ensemble. Cette mesure de sécurité est particulièrement importante en milieu rural.

**Attention:** Les utilisateurs ne doivent pas procéder à ces raccordements eux-mêmes mais doivent plutôt faire appel aux pouvoirs de réglementation en cause ou à un électricien, selon le cas.

**Avis:** Veuillez prendre note que pour tout appareillage supportant des lignes de type "loopstart," vous pouvez utiliser le Ringer Equivalence Number (REN) attribué à chaque terminal pour déterminer le nombre maximal de terminaux qui peuvent être branchés à votre interface de téléphones. Le raccordement à l'interface pourra se composer de toute combinaison de terminaux, pour autant que la somme des RENs ne dépasse pas cinq. Le REN figure sur l'étiquette "FCC Rules Part 68" située sur le support du module ou à l'arrière de l'unité.



## FCC Part 68 Compliance Statement

This equipment complies with Part 68 of FCC Rules. All direct connections to telephone network lines must be made using standard plugs and jacks compliant with FCC Part 68. Please note the following:

1. You are required to request service from the telephone company before you connect the unit to a network. When you request service, you must provide the telephone company with the following data:
  - When you request T1 Service, you must provide the telephone company with
    - The Facility Interface CodeProvide the telephone company with all the codes below:
    - 04DU9-BN (1.544 MB, D4 framing format)
    - 04DU9-DN (1.544 MB, D4 framing format with B8ZF coding)
    - 04DU9-IKN (1.544 MB, ESF framing format)
    - 04DU9-1SN (1.544 MB, ESF framing format with B8ZF coding)
    - 04DU9-1ZN (1.544 MB, ANSI ESF and ZBTSI without line power)The telephone company will select the code it has available.
    - The Service Order Code(s) (SOC): 6.0Y
    - The required Universal Service Order Code (USOC) jack: RJ48C
  - When you request ISDN “U” Interface Service, you must provide the telephone company with
    - The Facility Interface Code: 02IS5
    - The Service Order Code(s) (SOC): 6.0F
    - The required Universal Service Order Code (USOC) jack: RJ49C
  - When you request ISDN “S/T” Interface Service, you must provide the telephone company with
    - The Service Order Code(s) (SOC): 6.0P
    - The make, model number, and FCC Registration number of the NT1

**Note:** ISDN S/T cannot be directly connected to the network.
  - When you request Primary Rate ISDN Service, you must provide the telephone company with
    - The Facility Interface Code: 04DU9-1SN (1.544 MB, ESF framing format with B8ZF coding)
    - The Service Order Code(s) (SOC): 6.0Y
    - The required Universal Service Order Code (USOC) jack: RJ48C
2. Your telephone company may make changes to its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. The telephone company will notify you in advance of such changes to give you an opportunity to maintain uninterrupted telephone service.

3. If the unit causes harm to the telephone network, the telephone company may temporarily discontinue your service. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible and will be informed of your right to file a complaint with the FCC.
4. If you experience trouble with the unit, please contact the Bay Networks Technical Solutions Center in your area for service or repairs. Repairs should be performed only by service personnel authorized by Bay Networks, Inc.

United States	1-800-2LAN-WAN
Valbonne, France	33-4-92-96-69-68
Sydney, Australia	61-2-9927-8800
Tokyo, Japan	81-3-5402-0180

5. You are required to notify the telephone company when you disconnect the unit from the network.
  - The Service Order Code(s) (SOC): 6.0F
  - The required Universal Service Order Code (USOC) jack: RJ48C
6. Your telephone company may make changes to its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. The telephone company will notify you in advance of such changes to give you an opportunity to maintain uninterrupted telephone service.
7. If the unit causes harm to the telephone network, the telephone company may temporarily discontinue your service. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible and will be informed of your right to file a complaint with the FCC.
8. If you experience trouble with the unit, please contact the Bay Networks Technical Solutions Center in your area for service or repairs. Repairs should be performed only by service personnel authorized by Bay Networks, Inc.

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## ***Revision Level History***

Revision	Description
A	Initial release.





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## About This Guide




This manual describes how to install a Model 8000 Remote Access Concentrator. For brevity, this manual often uses the acronym *RAC* to refer to the Remote Access Concentrator.

Refer to *Installing Remote Access Concentrator Software for UNIX* or *Installing Remote Access Concentrator Software for Windows and Windows NT®* for a description of the software installation. Refer to *Managing Remote Access Concentrators Using Command Line Interfaces* for configuration information.

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An overview of the Model 8000 Remote Access Concentrator, including a description of the hardware features and firmware functions	<a href="#">Chapter 1</a>
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## Conventions

This manual uses the following printing conventions:

Convention:	Represents:
<code>special type</code>	In examples, <code>special type</code> indicates system output.
<b>special type</b>	Bold <b>special type</b> indicates user input.
<code>(Return)</code>	In command examples, this notation indicates that pressing <code>(Return)</code> enters the default value.
<b>bold</b>	Bold indicates commands, pathnames, or filenames that must be entered as displayed.
<i>italics</i>	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 <code>(Return)</code> 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.
	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.

## Acronyms

AFD	Automatic Firmware Download
ARP	Address Resolution Protocol
AUI	Attachment Unit Interface
BFS	Boot File System
BootP	Bootstrap Protocol
BRI	Basic Rate Interface
CLI	Command Line Interface
CSU	Channel Service Unit
Ercpd	Expedited remote procedure call daemon
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
LAN	Local Area Network
LAT	Local Area Transport
MAU	Media Access Unit
MLB	Main Logic Board
PPP	Point-to-Point Protocol
PRI	Primary Rate Interface
RAC	Remote Access Concentrator
RARP	Reverse Address Resolution Protocol
SLIP	Serial Line Interface Protocol
SNMP	Simple Network Management Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
Telnet	Telecommunication Network
TFTP	Trivial File Transfer Protocol
TPE	Twisted-Pair Ethernet
UDP	Unreliable Datagram Protocol
WAN	Wide Area Network

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Asia/Pacific	61-2-9927-8888	61-2-9927-8899
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Sydney, Australia	61-2-9927-8800	61-2-9927-8811
Tokyo, Japan	81-3-5402-0180	81-3-5402-0173



# Chapter 1

## Introduction

The Model 8000 Remote Access Concentrator (RAC) 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. [Figure 1-1](#) illustrates a Model 8000 Remote Access Concentrator.

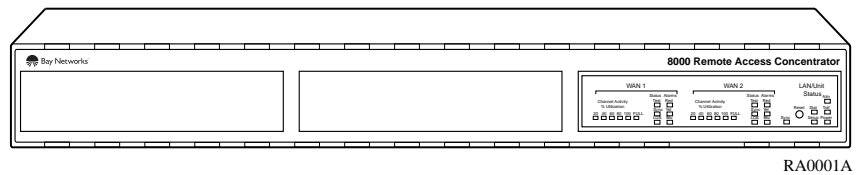


Figure 1-1. Model 8000 Remote Access Concentrator

**Remote Network Access**

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

- TCP/IP
- Novell Netware
- AppleTalk

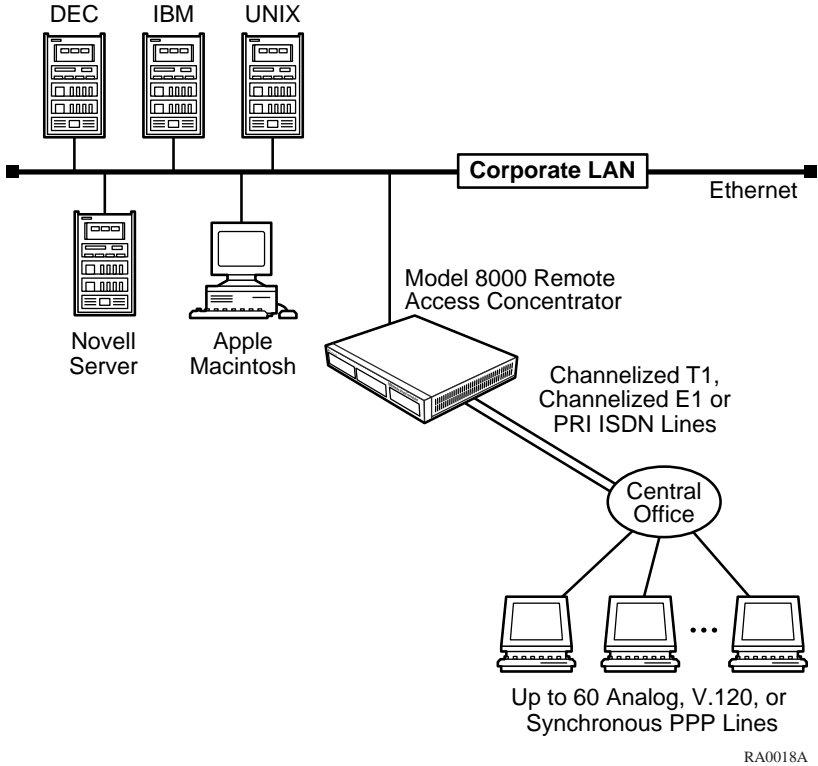


Figure 1-2. Model 8000 RAC as a Remote Access Server



The RAC also provides terminal-to-host connectivity to the following:

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



The RAC supports Windows NT<sup>®</sup> host tools. Remote Access Server Tools allow you to boot and configure the RAC on a Windows NT network. For more information, refer to *Using Remote Access Concentrator Server Tools for Windows NT<sup>®</sup>*.

## Model 8000 Remote Access Concentrator Description

The Model 8000 RAC is a wide area network server capable of supporting domestic ISDN, European ISDN, channelized T1, and channelized E1. The Model 8000 RAC can house up to 62 modems to provide the flexibility of terminating calls originated by analog modems, terminal adapters, and routers.

The RAC consists of the following:

- Main logic board
- Digital modem cards
- Compression/decompression daughter card (optional)

## Main Logic Board

<b>Processors</b>	The Model 8000 RAC uses three 80486 DX2 clock-doubled processors, operating at 64 MHz.
<b>WAN Interfaces</b>	Two WAN interfaces reside on the MLB and are accessible via RJ-48C connectors on the rear 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.
<b>Ethernet Interfaces</b>	The MLB provides AUI (for thick or thin Ethernet) and 10BASE-T (for twisted pair) autosensed Ethernet interfaces, accessible via connectors on the rear panel.
<b>Sync Port</b>	The MLB provides one synchronous port that can support V.35, X.21, RS-422, and RS-232 physical interfaces, which are accessible through a connector on the rear panel.
<b>Memory</b>	The MLB is equipped with 8 megabytes (MB) of main DRAM. An additional 4 MB of DRAM is provided for each WAN interface controller.
<b>Flash Memory</b>	The MLB is equipped with 4 MB of flash memory for image storage.

## Modem Cards

<b>Digital Modems</b>	The RAC can be configured with up to 62 internal DSP-based digital modems. The modems are dynamically downloaded with images to configure them for the appropriate protocol. The modems are located on plug-in modem cards installed on the main logic board.
-----------------------	---

## Compression Controller

### **Stac 9711 Coprocessor**

The Model 8000 RAC supports an optional compression/decompression daughter card that utilizes the Stac 9711 coprocessor to implement high-speed LZS and MPPC.

## Firmware and Software

### **Firmware**

The RAC ROM contains firmware for performing power-up self-tests and loading operational code. A nonvolatile EEPROM stores the configuration parameters.

The RAC 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. You define the information that the Model 8000 RAC needs to boot an operational image using the ROM monitor and its command set. ROM monitor commands are issued from a terminal connected to the console port on the rear panel. When the RAC completes its self-tests, the console 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 RAC manually.

After the RAC obtains a boot image and is booted, it displays the Console monitor (for more details, see Chapter 2).

### **Supported Configurations**

The Model 8000 RAC can self-boot from the image contained in its flash memory. The RAC can also obtain full operational code over the network from one of the following devices:

- UNIX host
- Another Model 8000 Remote Access Concentrator configured as a load server
- NT host

### **Watchdog Timer**

The Model 8000 RAC uses a watchdog timer that is reset by the software at regular intervals. The watchdog timer reboots the RAC in the unlikely event of an internal software error. This feature enables the RAC to run for long periods of time without intervention.

## Front Panel

The Model 8000 RAC front panel consists of:

- LAN/Unit Status LEDs
- Sync LED
- Reset button
- WAN 1 Status and Alarm LEDs
- WAN 1 Channel Activity LEDs
- WAN 2 Status and Alarm LEDs
- WAN 2 Channel Activity LEDs

[Figure 1-3](#) illustrates the Model 8000 RAC front panel. The front panel components are described in the following paragraphs.

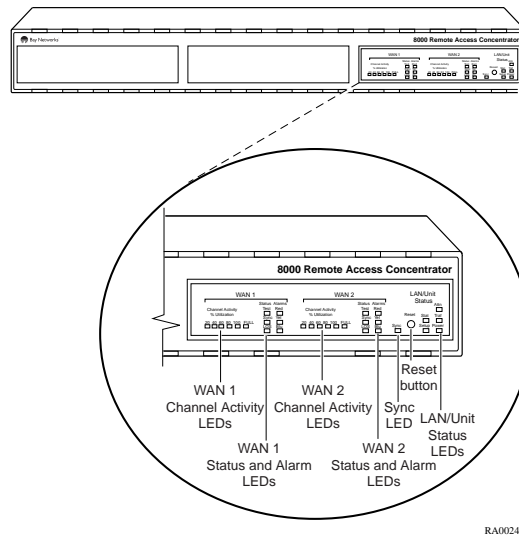


Figure 1-3. Model 8000 Remote Access Concentrator Front Panel

## Front Panel Components

### LAN/Unit Status LEDs

The LAN/Unit Status LEDs display the status of the activity of the Model 8000 RAC ([Table 1-1](#)).

Table 1-1. LAN Status LEDs

LED	Description
Attn	Turns amber when the RAC requires operator attention, for example, in Monitor mode. Flashes when the diagnostic tests fail.
Stat	Turns green after the RAC passes power-up diagnostics. Flashes if power-up diagnostics fail.
Traf	Flashes to indicate that data is being successfully transmitted or received on the Ethernet connection.
Setup	Normally off. When the Reset button is pressed a first time and held for more than 3 seconds, it flashes (Reset Mode). When pressed a second time and held momentarily, the LED stays on (Setup Mode).
Power	Lit when the RAC is connected to an AC power outlet and turned on.

### Sync LED

The Sync LED turns on and off corresponding to data activity on the rear-panel Sync port.

## Reset Button

You use the Reset button to:

- **Enter Setup mode**

When you press the Reset button, the RAC enters Setup mode and lights the amber Setup LED. In this mode, you can enter configuration data at the monitor:: prompt using the Console terminal, before booting the operational software.

- **Reset the RAC**

When you press the Reset button and hold it for 3 seconds, the Stat LED flashes and the RAC begins to execute its power-up diagnostics. If you press the Reset button again within 5 to 10 seconds, the RAC enters Setup mode and waits for configuration information to be entered.

## Status and Alarm LEDs

Two sets of Status and Alarm LEDs (one set for each WAN port) display network activity during system operation ([Table 1-2](#)). Technical Support personnel can use this information to diagnose problems.

Table 1-2. Status and Alarm LEDs

Alarm	Description
TEST	The network TEST indicator is on when the WAN Interface is looped back. Loopback tests are activated either locally by the user during diagnostics or by the telephone company.
SYNC	The SYNC indicator is on when the WAN interface is properly synchronized with the received network signal and is receiving proper framing information. The absence of sync causes the RAC to transmit a YELLOW alarm across the telephone network.
LOS	The LOS indicator is on when the WAN interface is detecting no signal on the network interface receiver. When an LOS condition exists, the RAC transmits a YELLOW alarm to the remote system.
RED	The RED alarm indicator is on during a locally detected carrier failure such as loss of signal or loss of frame sync. During the RED alarm condition, a YELLOW alarm is transmitted across the telephone network.
YELLOW	The YELLOW alarm indicator is on 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 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.

**Channel Activity LEDs**

The green Channel Activity LEDs labelled 20, 40, 60, 80, and 100, indicate the approximate percentage of B channels that are being used. The amber Channel Activity LED labelled Full indicates that all available B channels are in use. The Full LED stays on until at least one call disconnects. (By contrast, the LED labelled 100 indicates that between 80% and 100% of the channels are active.) There are two sets of Channel Activity LEDs, one set for each WAN port.



## Rear Panel

[Figure 1-4](#) shows the Model 8000 RAC rear panel, which consists of:

- WAN 1 and WAN 2 interface ports
- AUI Ethernet interface port
- 10BASE-T Ethernet interface port
- Link LED
- Sync Port
- Console port
- Power switch
- AC line socket

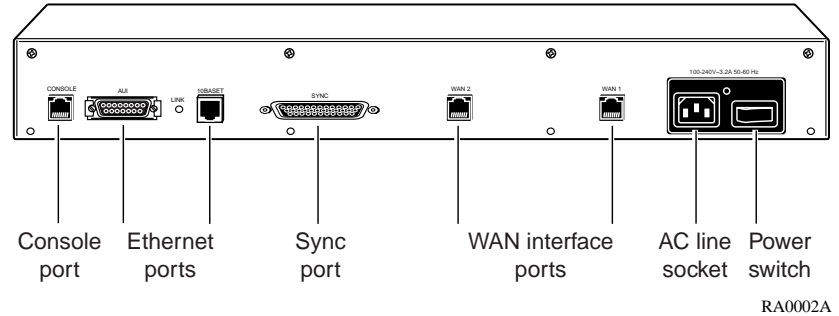


Figure 1-4. Model 8000 Remote Access Concentrator Rear Panel

- WAN Interface Ports** The two WAN interface ports provide access to channelized T1, channelized E1, and ISDN PRI lines. The WAN Interface ports come with 8-pin, RJ-48C jacks for attaching T1, E1 or ISDN cable connectors.
- Ethernet Ports** The Model 8000 RAC provides autosensed AUI (Attachment Unit Interface) and 10BASE-T Ethernet ports to connect the unit to the LAN. The AUI port allows connection of either 10BASE5 (thick Ethernet) or 10BASE2 (thin Ethernet), if you supply the appropriate transceiver. The AUI port accommodates most standard transceivers, also known as Media Access Units (MAUs).
- Link LED** The Link LED is an Ethernet link layer integrity indicator. The LED is on when an active 10BASE-T segment is attached, and off when an AUI segment is attached.
- Sync Port** The Sync port is used for trafficking data over several physical interface types such as X.21, V.35, RS-422, and synchronous RS-232.
- Console Port** The Model 8000 RAC has a 9600-baud console port with an 8-pin, modular jack for attaching the console. The console port provides access to the ROM monitor commands when the Model 8000 is in Setup mode and provides access to the console commands when the unit is running.

## Physical Characteristics

The Model 8000 RAC has the following characteristics:

- **Dimensions:**

Height: 2.6 in. (6.5 cm)

Width: 19 in. (47.5 cm)

Depth: 16.75 in. (41.9 cm)

- **Weight:**

20 lbs (9 kg)

- **Electrical Specifications:**

- Power consumption: 125 W

- Thermal rating: 427 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: 10 G 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 m

- Storage altitude: 0 to 15,000 m

- 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 EN 55 022 Class A with shielded and unshielded cables
  - Meets US and Canadian Telecom requirements per FCC Part 68 and IC CS-03
- **MTBF:**  
84,000 hrs. (estimated), calculated @ 25°C (Mil Std 217)
- **Front clearance requirement (for connectors and cables):**  
6 in. (15 cm)



## **Chapter 2**

# ***Installing the Model 8000 Remote Access Concentrator***

**T**his chapter describes how to install your Model 8000 Remote Access Concentrator hardware and software. It provides the following information:

- Before you begin
- Installing the Remote Access Concentrator in a rack (optional)
- Connecting a LAN using Ethernet
- Connecting a console terminal
- Connecting WAN interfaces
- Initial setup and using the ROM monitor
- Booting the Remote Access Concentrator
- Invoking the console monitor

## **Before You Begin**

Before you begin the installation you should:

- Verify that your RAC shipment is complete
- Make sure that you have any additional hardware and software you need to complete the installation

The following sections describe these tasks.

## Verifying Shipment Contents

The standard contents of every Model 8000 RAC shipment include:

- A power cable
- An RJ-45 cable with DTE adapter
- Two rackmount brackets
- Twelve #6 flathead screws
- Four #10 rackmount screws and washers
- Six rubber feet

[Figure 2-1](#) illustrates the standard contents of your Model 8000 RAC shipment.

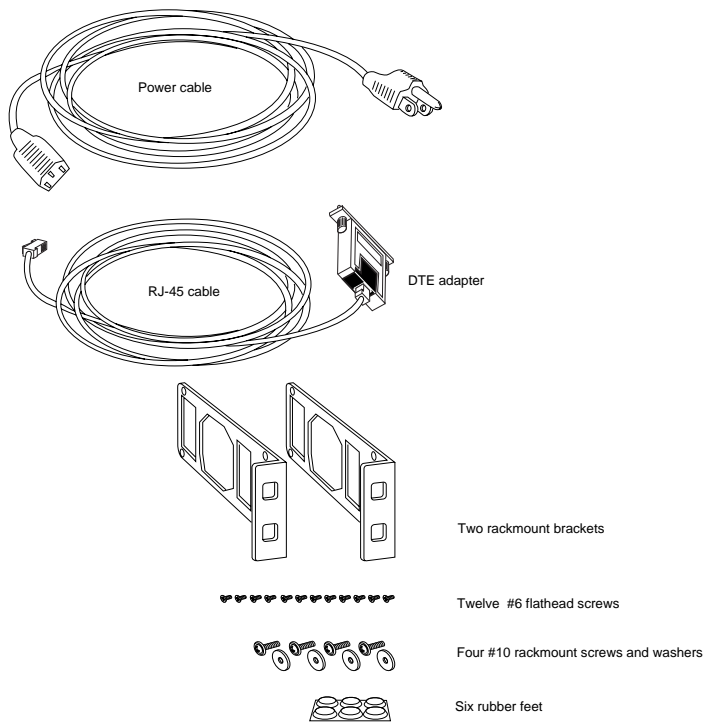


Figure 2-1. Standard Shipment Contents

## Preparing for Installation

To install the Model 8000 Remote Access Concentrator, you need:

- A console terminal
- A valid IP address
- An appropriate subnet mask
- A host with Model 8000 RAC software installed (if not booting from flash memory)

The RAC can obtain its operational image from any one of these sources:

- A UNIX host running erpcd
- A Windows NT host running erpcd
- Flash memory (self-boot)
- Another Model 8000 RAC configured as a boot host
- Any host supporting TFTP

The RAC must be connected to the network to receive its operational image, except when self booting. When self booting, the operational image is contained within the Flash memory of the RAC. A console terminal (connected to the console port on the rear panel) is the input device used to enter basic configuration parameter values for the RAC.

### Booting from a UNIX Host

If you plan to download the image from a UNIX host to the RAC, you must first install the RAC operational software and image on the UNIX host. Refer to *Installing Remote Access Concentrator Software for UNIX* for instructions and detailed information.

## Booting from a Windows NT Host

If you plan to download the image from a Windows NT host to the RAC, you must first install the RAC operational software and image on the Windows NT host. Refer to *Installing Remote Access Concentrator Software for Windows and Windows NT* for instructions and detailed information.

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

## Booting from Flash Memory

For more information on booting the RAC from Flash memory, see [Self-Booting the Remote Access Concentrator on page -27](#).

## Booting from Another Model 8000 Remote Access Concentrator

You can boot from another Model 8000 Remote Access Concentrator, if the Model 8000 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** parameter to **image**. Refer to *Managing Remote Access Concentrators Using Command Line Interfaces* for additional information.

## Booting from a TFTP Host

For more information on booting the RAC from a TFTP host, see [Booting Using TFTP on page -24](#).



## Installing the Remote Access Concentrator in a Rack

If you wish, you can install the RAC in an equipment rack. To do this, you need the following equipment:

- Two mounting brackets shipped with the RAC
- Twelve #6 flathead screws shipped with the RAC
- Four #10 rackmount screws and washers shipped with the RAC
- Phillips screwdriver

You install the RAC in a rack by attaching mounting brackets to the sides of the device and then attaching the device to the rack.

### Attaching the Mounting Brackets

To attach the mounting brackets to the RAC:

- 1. Remove the two mounting brackets and the 12 #6 flathead screws from the package.**
- 2. Line up the six holes in one mounting bracket with the six holes on the RAC ([Figure 2-2](#)).**
- 3. Insert and tighten the six screws to secure the bracket to the device.**

4. Attach the other mounting bracket in the same manner.

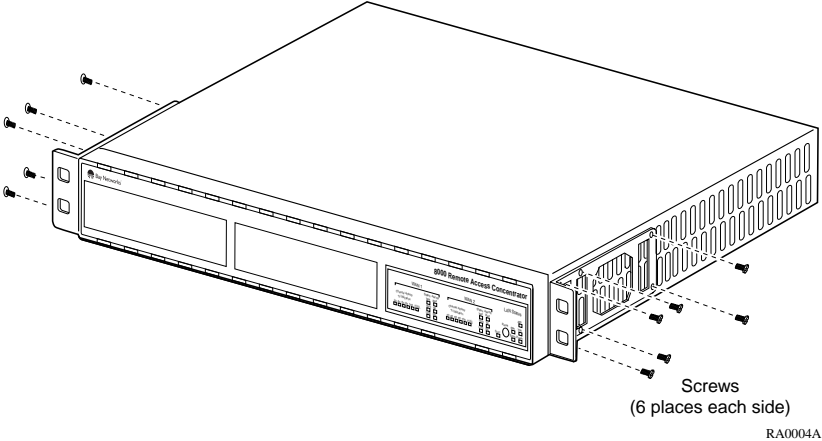
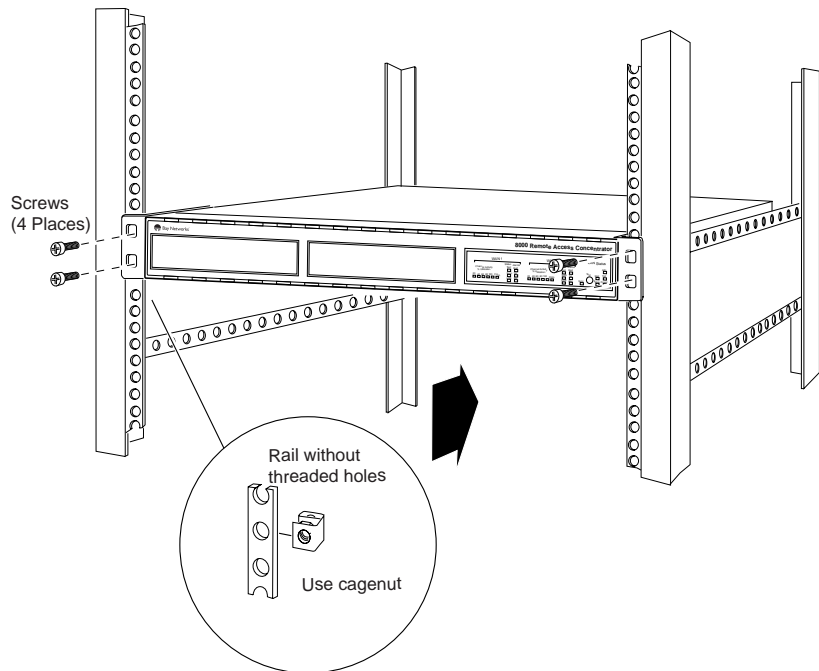


Figure 2-2. Attaching the Mounting Brackets to the RAC

## Attaching the Device to the Rack

To attach the device to the rack:

1. **Position the unit horizontally, facing forward in the rack.**
2. **Align the holes in the mounting brackets with the holes in the rack.**
3. **Insert the four #10 rackmount screws (with washers) and tighten the screws to attach the front of the RAC to the rack (see [Figure 2-3](#)).**



RA0006A

Figure 2-3. Attaching the Device to the Rack

## Connecting a LAN Using Ethernet

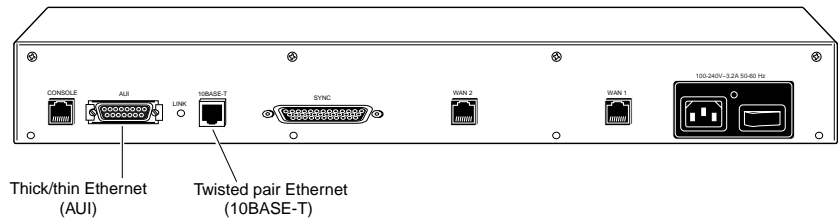
The RAC supplies AUI and 10BASE-T Ethernet ports on the rear panel for connecting a LAN (Figure 2-4). Appendix A describes the signal/pin allocations for the AUI and 10BASE-T Ethernet ports.

The 10BASE-T port is for connecting twisted pair cabling. The AUI port allows connection of either 10BASE5 (thick Ethernet) or 10BASE2 (thin Ethernet), if you supply the appropriate transceiver. The AUI port accommodates most standard transceivers, also known as Media Access Units (MAUs).

Each connection type requires a different connection procedure (described in the following sections). Connect only one type of Ethernet cabling at a time.



Make sure the RAC is turned off before connecting or disconnecting the Ethernet cabling.



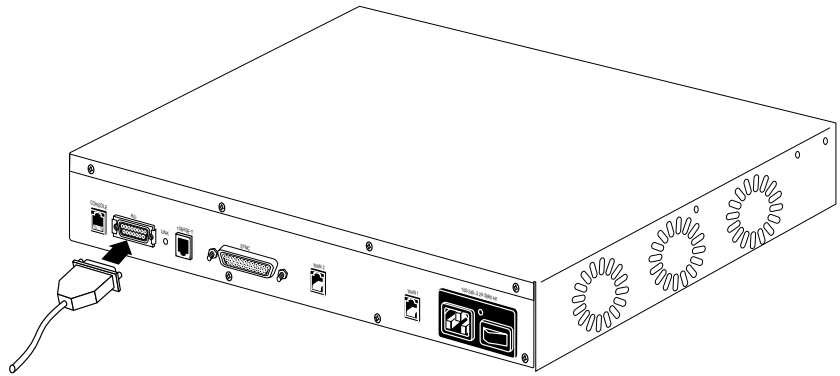
RA0007A

Figure 2-4. Remote Access Concentrator Ethernet Connections

## Connecting AUI Cable

To connect an AUI cable to the RAC ([Figure 2-5](#)):

1. **Make sure the transceiver cable is plugged into the Ethernet network.**
2. **Push the slide mechanism on the RAC's Ethernet connector to the right and plug in the transceiver cable.**
3. **Push the slide mechanism to the left to secure the connection.**



RA0008A

Figure 2-5. Connecting an AUI Cable

## Connecting Twisted Pair Ethernet (10BASE-T) Cable

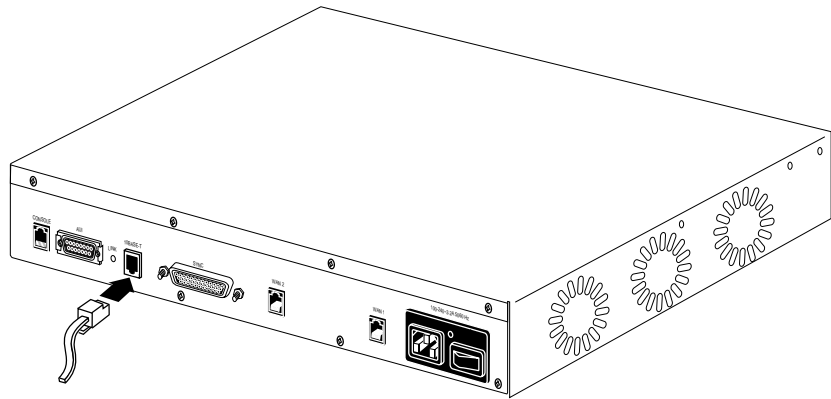
To connect twisted pair (10BASE-T) Ethernet cable to the RAC ([Figure 2-6](#)):

1. **Insert the connector located on the twisted pair Ethernet cable into the 10BASE-T connector on the rear panel of the RAC.**

When the connector clicks into place, the connection is secure.

2. **Verify that the Link indicator is green.**

The green Link indicator LED next to the 10BASE-T connector goes on when power is applied and an active 10BASE-T network segment is plugged in.



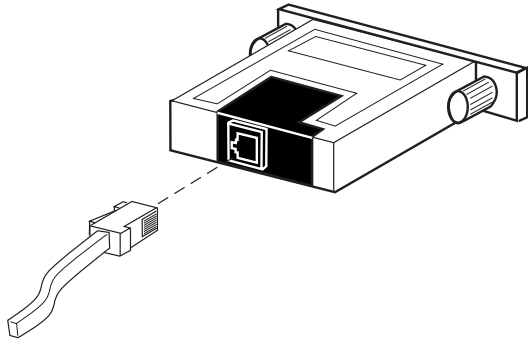
RA0009A

Figure 2-6. Connecting Twisted Pair Ethernet Cable

## Connecting a Console Terminal

You use a console terminal to access the ROM monitor and boot the RAC for the first time. To connect a console terminal to the console port located on the rear panel of the RAC:

1. **Connect one end of the cable (provided in the accessory kit) to the console terminal's I/O connector, using a DB-25 DTE drop adapter (Figure 2-7).**

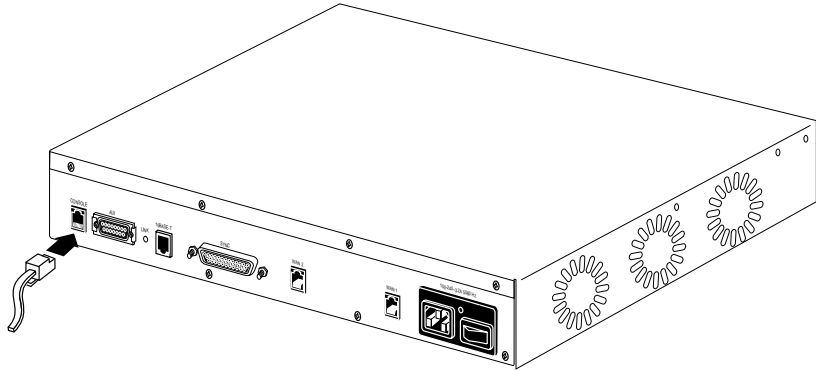


RA0012A

Figure 2-7. Connecting the Cable to the DB-25 DTE Drop Adapter

2. **Plug the 8-pin connector into the console port located on the back panel of the RAC (Figure 2-8).**

When the connector clicks into place, the connection is secure. [Appendix A](#) describes the console port's signal/pin allocation.



RA0011A

Figure 2-8. Connecting a Console Terminal

3. **Turn on the console terminal and set the terminal to 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.**

The ROM monitor assumes that this terminal is CRT-based and displays the backspace (BS) character accordingly. See [Powering Up and Testing the Remote Access Concentrator on page 2-17](#) for information about invoking the ROM monitor.



## Connecting WAN Interfaces

The WAN Interfaces connect the RAC to channelized T1, channelized E1, and ISDN PRI lines. To connect the lines to the WAN Interface ports:

- 1. Configure the WAN interface using any of these tools:**

- The **admin** CLI command (refer to *Managing Remote Access Concentrators Using Command Line Interfaces* for details)
- Annex Manager (refer to *Managing Remote Access Concentrators Using Annex Manager* for details)
- Quick2Config Annex (if you are using a PC; see the online help for Quick2Config Annex for details)



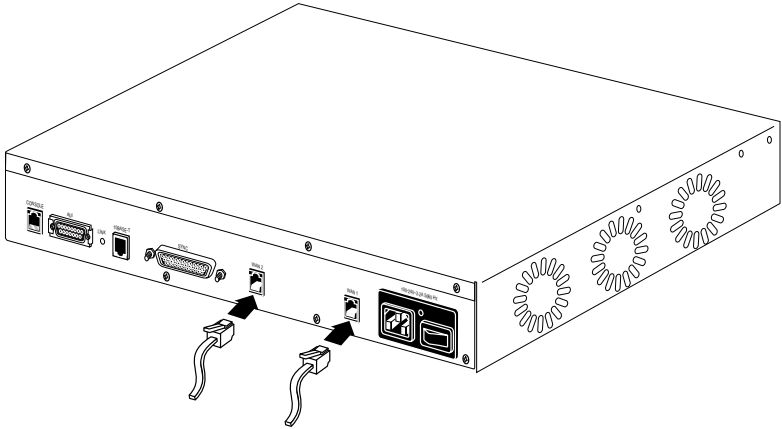
The switch type and other WAN parameters must be configured properly to be compatible with those provided by the telco. The telco may disable lines connected to an improperly configured device.

- 2. Plug the RJ-48C connectors located on the WAN interface cable into the WAN interface ports located on the rear panel of the RAC (see [Figure 2-9](#)).**



Observe handling precautions for digital telecommunications cables.

When the connector clicks into place, the connection is secure. Appendix A describes WAN interface port signal/pin allocations.



RA0010A

Figure 2-9. Connecting the WAN Interfaces



The RAC uses an internal Channel Service Unit (CSU) for T1 applications. An internal CSU is not used in E1 applications.

## Initial Setup Using the ROM Monitor

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

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

You need this information 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 console terminal. See [Chapter 3](#) for more information about these commands.

The RAC 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, the server will boot without user intervention. For more information about using these protocols, see [Autoinitializing the IP Address Parameters on page 2-19](#).



The RAC supports Windows NT host tools. Remote Access Server Tools allows you to boot and configure the RAC on a Windows NT network. For more information, refer to *Using Remote Access Concentrator Server Tools for Windows NT*<sup>®</sup>.

## Remote Access Concentrator Parameters

You must set certain parameters from the ROM monitor before booting the RAC from a host ([Table 2-1](#)). After the RAC boots, you can change these parameters using the **na** utility. If you make any changes to these parameters, you must reboot the RAC for the changes to take effect.

Table 2-1. Server Parameters

Parameter	Description
Internet address	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).
Preferred load host address	Internet address of the host from which you want to boot.
Load/dump gateway Internet address	Internet address of the router, for which you will be prompted, if the preferred load host is on a different network.
Broadcast address	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 link layers of the LAN. 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 RAC will broadcast for a load host if it doesn't have a load host.



If you plan to use Annex Manager or Quick2Config Annex to manage or configure the RAC, you must enable SNMP sets using the **allow\_snmp\_sets** ROM Monitor command. See [allow\\_snmp\\_sets on page 3-7](#) for details.

## Powering Up and Testing the Remote Access Concentrator

This section describes how to power up and test the RAC, and enter monitor mode to configure the unit.

To power up and test the RAC:

- 1. If you have not already done so, connect a terminal to the console port as described [on page 2-11](#).**
- 2. Plug the unit into an AC power outlet and turn on the power switch. The Power LED lights.**
- 3. Press the Reset button momentarily. The amber Setup LED lights.**

The unit now runs its ROM-resident power-up diagnostics. The LEDs light and then turn off, except for some status LEDs. The diagnostics take about a minute to complete.

If the diagnostics complete successfully, the RAC either enters Setup mode and waits for configuration data to be entered or boots its operational image from flash memory.

You can enter configuration information through the terminal connected to the console port. The ROM monitor prompt (`monitor::`) appears on the terminal.

If the ATTN LED is ON or flashing, one of the following failures has occurred (see Chapter 4 for more details):

- Hardware failure; contact technical support.
- Network or network interface failure; error message appears on the console.

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 3-23.

#### 4. Verify the RAC hardware configuration.

At the `monitor::` prompt, type **config** and press Return. The screen displays information similar to this:

```

                                REVISION/CONFIGURATION INFORMATION

ROM Software Rev: 1122
Board ID: 64                      Board Type: 8000
CPU Type: 486DX2                  Ethernet Address: 00-80-2d-xx-xx-xx
Memory size: 8 Meg                EEPROM size: 65504
Flash size: 4 Meg                 Flash ID:0089
Available Interfaces (* = selected): ThickNet *Twisted Pair

WAN 1: CAS E1                      Revision: VERSION CAS MGR=2.1
WAN 2: CAS E1                      Revision: VERSION CAS MGR=2.1

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

```

#### 5. Verify and record the RAC's Ethernet address for future reference.

At the monitor prompt, type **addr -d** and press Return. The screen displays information 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

```

## Booting the Remote Access Concentrator

You can boot the RAC by downloading the image from a host system or another Model 8000 Remote Access Concentrator, or by using the image contained in flash memory (self-boot). However, before you actually boot the RAC, you must first initialize the IP address parameters manually or by using the autoinitialize feature. The following sections describes the two methods of initializing the IP address parameters, and the various boot methods.

### Autoinitializing the IP Address Parameters

The RAC is distributed without an IP address or preferred load host defined in ROM. When you boot RAC, it attempts to initialize itself (autoinitialize) 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 RAC supports the BootP and RARP protocols. These protocols obtain boot information from a UNIX host without requiring any manual setup on the RAC.

- 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 ROM invokes this system of acquiring boot information when a boot is initiated and the RAC is not initialized. Under this condition, the RAC first tries to get boot information via BootP or RARP.

If all requests fail, the RAC returns to the ROM monitor (if in Setup mode) or continues the autoinitializing procedure indefinitely (if in normal mode).

## BootP

For a successful BootP retrieval, you must be running a **bootpd** daemon on a host on the same subnet as the RAC (or have a router on the same subnet that supports BootP forwarding) and must have the appropriate information in the **bootptab** file. The BootP implementation for the RAC adheres to RFC 951, RFC 1048, and RFC 1084. A sample **bootptab** file entry used to initialize the RAC 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 this example:

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



When the RAC 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 8000 Remote Access Concentrator, in this case) with whatever format the client requests. The Model 8000 Remote Access Concentrator (client) always makes requests with the Vendor Magic Cookie set to 99.130.83.99.

The **bootpd** daemon adds the address of the host on which it is running as the *Server Address* in the **bootp** response message. The ROM uses the *Server Address* as the preferred load host and stores 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 RAC 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 RAC, and the host's ARP table must be initialized with the RAC's IP and Ethernet addresses (see the **arp** man page for **arp -s**).

The only boot information that RARP provides is the RAC's IP address. The ROM saves this information in the **inet\_addr** parameter. The ROMs use default information for the subnet mask and preferred load host. This means the ROM will broadcast its requests.

The host providing the RAC with boot information must be running on the same subnet as the RAC because the RAC broadcasts BootP and RARP queries using the “this network” IP address, 255.255.255.255.

If BootP and RARP fail, the RAC transmits an IPX Advertisement Request for Service.

If all requests fail, the RAC returns to the ROM monitor (if in Setup mode) or continues the autoinitialization procedure indefinitely (if in Normal mode).

After the RAC has successfully initialized, it is ready to be booted. See [Booting Using BFS on page -23](#), [Booting Using TFTP on page -24](#), or [Self-Booting the Remote Access Concentrator on page -27](#) for detailed information about booting the RAC.

## Manually Initializing the IP Address Parameters

To configure the RAC 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 RAC.**

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 Return to retain the current setting.**

After the RAC has successfully initialized, it is ready to be booted. See [Booting Using BFS on page -23](#), [Booting Using TFTP on page -24](#), or [Self-Booting the Remote Access Concentrator on page -27](#) for detailed information about booting the RAC.

## Booting Using BFS

To boot the RAC using the block file server (BFS):

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

The autoinitialization method is described in [Autoinitializing the IP Address Parameters on page 2-19](#). The manual initialization method is described in [Manually Initializing the IP Address Parameters on page 2-22](#).

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 Return 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]::
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 from 30 to 60 seconds for a Model 8000 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 RAC is booted, Monitor mode is no longer operational. The RAC is up and running, and the following message is displayed:

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

## Booting Using TFTP

To boot using TFTP, your TFTP daemon (tftpd) must be started in `/etc/inetd.conf` (or another 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 omit the `-s /tftpboot`, a chroot will not be done, and your system will be not be secure.

To set up directories and files and use TFTP to boot the RAC:

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

The auto-initialization method is described in [Autoinitializing the IP Address Parameters on page 2-19](#). The manual initialization method is described in [Manually Initializing the IP Address Parameters on page 2-22](#).

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

When prompted, enter the following information:

- Boot image name
- Boot directory
- Dump file name

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

The following example shows how the image command is used to set up a RAC boot from the `/tftpboot/annex/` directory. When you enter the load directory name, make sure you end the path name 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. Execute the following commands to prepare the tftp dump file.

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



## Self-Booting the Remote Access Concentrator

The RAC comes equipped with Flash memory that contains an operational image you can use to self-boot the unit. To self-boot your RAC:

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 2-22](#).

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
```

```
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. After the RAC boots, Monitor mode is no longer active.

## Invoking the Console Monitor

After the image boots, you can invoke the Console monitor by pressing Return on the console 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 RAC to the host and reboots)
- **help** or **?** (displays the available options)
- **info** (displays configuration information for the unit)
- **leds** (displays the current front panel LED status)
- **quit** (quits and returns to quiet console)
- **reboot** *filename* (reboots the unit)
- **rom** (returns the RAC 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 console port.

The ROM Monitor commands allow you to set a subset of the configuration (EEPROM) parameters. Some of these parameters, such as the unit's IP address, are required for booting the Model 8000 Remote Access Concentrator; some parameters, such as 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 RAC'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 RAC to load by requesting assistance from a specific host, rather than by broadcasting that request to all hosts on the subnet.

After the RAC boots, 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. *Managing Remote Access Concentrators Using Command Line Interfaces* describes the **na** utility in detail. See [Chapter 2](#) for information about 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 you 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 is displayed on the console terminal.

## Command Descriptions

[Table 3-1](#) lists the ROM Monitor commands; the following sections describe them.

Table 3-1. ROM Monitor Commands

Command	Description	Use
<b>addr [-d]</b>	Displays and sets EEPROM values relevant to IP network addressing, including the unit's IP address.	Changing IP configuration parameters.
<b>allow_snmp_sets [-d]</b>	Enables/disables the RAC's ability to accept SNMP sets.	Allowing or not allowing the RAC to be configured using SNMP sets.
<b>boot [-v] [&lt;file&gt;]</b>	Manually boots and loads the unit's operating code.	Changing the address of the boot image.
<b>boot [-l] [&lt;file&gt;]</b>	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
<b>config</b>	Displays the current hardware configuration and revision levels.	Identifying your hardware, memory, and ROM versions.
<b>erase</b>	Erases nonvolatile memory.	Clearing out old parameters.
<b>help</b>	Displays the list of ROM Monitor commands.	Referencing the ROM monitor commands.
<b>image [-d   &lt;file&gt;]</b>	Displays and/or sets the load image and <b>tftp</b> load dump names.	Loading an image that differs from the default.
<b>lat_key [-d]</b>	Sets the LAT key.	Connecting to a VMS host.
<b>net</b>	Executes an Ethernet transceiver loopback test.	Checking your Ethernet connection.
<b>ping</b>	Sends ICMP ECHO_REQUEST datagram to a host or gateway.	Checking to see whether a host or gateway can be reached.
<b>ports [-d]</b>	Shows the current status of a WAN interface port.	Testing a WAN interface port or modem hardware.
<b>sequence [-d   &lt;list&gt;]</b>	Displays and edits the load/dump interface list.	Checking or changing the load/dump interface list.
<b>stats</b>	Displays current network statistics gathered by the ROM.	Checking network resources.

## addr

The **addr** command sets and displays several RAC 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 RAC's ROM-resident Ethernet address in hexadecimal notation. (For a description of IP addresses, refer to *Managing Remote Access Concentrators Using Command Line Interfaces*.) The command syntax is:

**addr [-d]**

If you enter the **addr** command without the **-d** argument, you will be prompted for each IP address. Enter IP addresses using standard dotted-decimal notation.

The **addr -d** command displays the RAC'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 RAC 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 RAC from a UNIX load host. If you do not define a subnet mask, the RAC 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 RAC tries to boot from a preferred UNIX load host. If you do not define a preferred load host, the RAC 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 (router). The **addr** command prompts you for this gateway's IP address.

The RAC uses the broadcast address parameter when loading a file. If this parameter contains a specific address (for example, 132.245.6.255), the RAC uses only that address for broadcasting. If the value is all zeros (0.0.0.0), the ROM Monitor tries various combinations of broadcast addresses and subnet or network broadcasts. The RAC 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 use 802.3 packet encapsulation.



Do not change this parameter unless you know for certain that your Ethernet hosts are using IEEE 802.2/802.3 packet encapsulation. An incorrect encapsulation type prevents your RAC from booting.

## allow\_snmp\_sets

This command enables or disables the RAC's ability to accept and process SNMP **set** commands.

The command syntax is:

### **allow\_snmp\_sets [-d]**

If you enter the **allow\_snmp\_sets** command without the **-d** argument, you will be prompted to change the current setting of the parameter. The **allow\_snmp\_sets -d** command displays the current setting.

When disabled (the default), the RAC rejects all SNMP **set** commands; the RAC SNMP agent returns the error "no such name" for the first object in the **set** command.

Enabling **allow\_snmp\_sets** configures the RAC to accept SNMP set commands from any source. SNMP Version 1 is inherently a non-secure protocol. SNMP bypasses the RAC's security measures. If security is a concern, you should consider taking the following security measures:

Use the **na** utility or **admin** to change the community string default to a less common string name. Institute a filter on any firewall router to block SNMP traffic from outside the local network. Refer to *Managing Remote Access Concentrators Using Command Line Interfaces* for more information.

## boot

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



For more information about the **image** command, see [image on page 3-17](#).

To set the interface used for booting, use the **sequence** command. When **SELF** is selected, the RAC checks 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 does not match, the RAC uses the next interface specified by the **sequence** command.



For more information about the **sequence** command, see [sequence on page 3-22](#).



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

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

When the RAC begins to boot, it displays the load server host's IP address. If the unit does not boot successfully after several attempts, it displays the message *boot attempt failed*; if the RAC opens the boot file and an error occurs during the boot process, it displays a boot error report on the console 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 4-11](#)).

During a boot, the console 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 RAC indicating a serious problem with the Ethernet connection (if this symbol appears in your **boot** command display, contact the Technical Solutions Center).

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
- 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"]::

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 RAC always tries to open a file using **bfs** first. If unsuccessful, the RAC uses **tftp** to open the file.

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

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

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 you execute a **boot -l** command, 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"]::

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...

```



## config

The **config** command displays the current configuration information and revision levels for the RAC. 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 RAC with 31 modems (E1) looks similar to this:

```

                                REVISION/CONFIGURATION INFORMATION

ROM Software Rev: 1122
Board ID: 64                      Board Type: 8000
CPU Type: 486DX2                  Ethernet Address: 00-80-2d-xx-xx-xx
Memory size: 8 Meg                EEPROM size: 65504
Flash size: 4 Meg                 Flash ID: 0089
Available Interfaces (* = selected): Thicknet *Twisted Pair

General Purpose Sync Port Interface: Loopback

WAN 1: CAS E1                      Revision: VERSION CAS MGR=2.1
WAN 2: CAS E1                      Revision: VERSION CAS MGR=2.1

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

```



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

## erase

The **erase** command erases the contents of nonvolatile memory (EEPROM memory). Erasing EEPROM restores all parameters to factory default values. The **erase** command does not erase the Ethernet address. The syntax is:

### erase

The **erase** command prompts for confirmation before erasing the nonvolatile (EEPROM) memory.



Because the **erase** command erases the IP address, you may need to use the **addr** command to reenter the RAC'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 similar to 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 RAC software. The syntax is:

**image** [-d | *filename*]

The *filename* argument can have up to 100 characters. To return the image name to its default, enter a pair of quotation marks (""). 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 displays the current image file name:

```
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 and display 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 as shown in the following example:

```
monitor:: net  
Is a loopback plug being used ? (y/n) [n]: n
```

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

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

```
monitor:: net  
Is a loopback plug being used ? (y/n) [n]: n  
Network test - PASSED
```

If the RAC fails, the console terminal displays an error message. Failing this test indicates that either the RAC 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* argument is the IP address of the host or gateway from which you wish to elicit a response.
- The optional *data\_size* argument is the number of bytes sent in a datagram packet. The default value is 64 and the maximum value is 1024.
- The optional *npackets* argument 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
        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
        IP address required, ie: ping 132.245.33.69\
        [data bytes] [npackets]
```

To exit the **ping** command 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 RAC.

```
monitor:: ports
WAN Port Tests
Some Important Notes:
- These tests require the WAN port to have a loopback
  plug installed.
  1) Digital Ports
  2) Modem Ports
  3) Sync Ports
Selection (Return to exit)::
```

The following is a sample screen display for a modemless version of the RAC.

```
monitor:: ports
WAN Port Tests
Some Important Notes:
- These tests require the WAN port to have a loopback
  plug installed.
  1) Digital Ports
  2) Sync Ports
Selection (Return to exit)::
```

## sequence

The **sequence** command edits the load/dump interface list. This list determines the order of the network interfaces the RAC uses for loading and dumping. The default, **net**, uses the LAN interface. If the RAC 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 the interfaces with a comma or a space. Enter the interface list as an argument to the command, or the console 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 the 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 an interface list at the same time. 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 that 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 RAC 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 RAC lost the Carrier Sense signal; this is usually the result of excessive traffic on the Ethernet.
Clear to Send Losses	The number of times packets could not be transmitted because the RAC lost the Clear to Send signal – usually the result of a serious hardware failure or incompatibility.
Collisions Detected	The number of times the RAC had to retry transmissions automatically; this is usually the result of normal Ethernet traffic. These retries do not cause the <b>boot</b> command to display “*.”
Excessive Collision Losses	The number of times the RAC could not transmit packets because there were too many collisions; this is usually the result of excessive traffic on the Ethernet, but can be due to wiring errors or hardware failure. The <b>boot</b> 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 8000 RAC 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 8000 RAC front-panel LEDs.

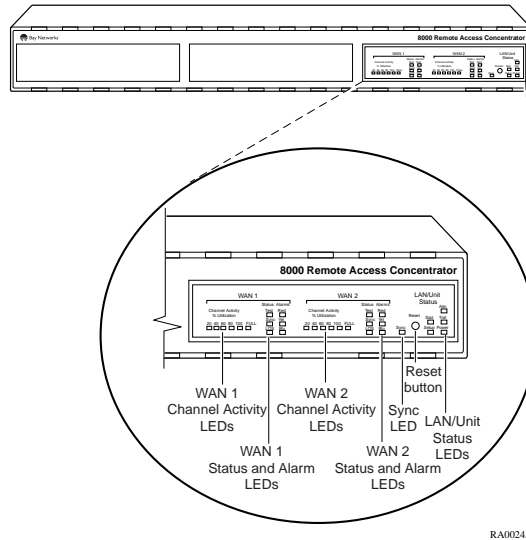


Figure 4-1. Model 8000 RAC Front-Panel LEDs

[Figure 4-1](#) describes the LEDs located on the front panel of the Model 8000 RAC.

Table 4-1. Model 8000 RAC Front-Panel LEDs

LED	Description
LAN/Unit Status LEDs	<p>Attn - Turns on when the RAC requires operator attention, that is, in Monitor mode or when the diagnostic tests fail.</p> <p>Stat - Turns green after the RAC passes power-up diagnostics. Turns amber if power-up diagnostics fail.</p> <p>Traf - Flashes to indicate that data is being successfully transmitted or received on the Ethernet connection.</p> <p>Setup - Normally off. When the Reset button is pressed a first time and held for more than 3 seconds, it flashes (Reset Mode). When pressed a second time and held momentarily, the LED stays on (Setup mode).</p> <p>Power - Lit when the RAC is connected to an AC power source and switched on.</p>
Sync LED	The Sync LED turns on and off depending on the data activity of the rear-panel Sync port.
Channel Activity LEDs	The Channel Activity LEDs labeled 20, 40, 60, 80, and 100 indicate the approximate percentage of B channels that are being utilized. The amber Channel Activity LED labeled Full indicates that all available B channels are in use. The Full indicator stays on until at least one call disconnects. (By contrast, the LED labelled 100 indicates that between 80% and 100% of the channels are active.) There are two sets of Channel Activity LEDs, one set for each WAN port.

*(continued on next page)*

Table 4-1. Model 8000 RAC Front-Panel LEDs (continued)

LED	Description
Status and Alarm LEDs	<p>TEST- The network Test indicator is on when the WAN Interface is looped back. Loopback tests are activated either locally by the user or by the telephone company.</p> <p>SYNC - The Sync indicator is on when the WAN interface is synchronized with the received network signal and is receiving proper framing information. The absence of sync causes the RAC to transmit a YELLOW alarm across the telephone network.</p> <p>LOS - The LOS indicator is on when the WAN interface is detecting no signal on the network interface receiver. When an LOS condition exists, the WAN interface transmits a YELLOW alarm to the remote system.</p> <p>RED - The RED alarm indicator is on during a locally detected carrier failure such as loss of signal or loss of frame sync. During the RED alarm condition, a YELLOW alarm is transmitted across the telephone network.</p> <p>YELLOW - The YELLOW alarm indicator is on 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).</p> <p>BLUE - The BLUE alarm indicator is on 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.</p>

During power-up and booting, it is more difficult to diagnose problems because they can originate in the RAC, 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 the LEDs. Technical Support personnel can use this information to diagnose problems.

## Power-Up and Boot Procedures

The RAC 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 RAC runs a set of diagnostics. The system LEDs display the status of the diagnostics. The pattern of the system LEDs identifies the error condition.

### Normal Mode Diagnostics

Following power-up or reset, the RAC enters Normal mode. The following sections describe possible error and error-free conditions that can occur during power-up and booting in Normal mode.

### Normal Mode Error-Free Sequence

[Table 4-2](#) summarizes the LED display states during an error-free power-up sequence in Normal mode.

Table 4-2. Normal Mode Error-free LED States

Activity	STAT Green	ATTN Amber	TRAF Green
N1: LEDs OK	●	●	●
N2: Hardware OK	●	×	●

Key:

● On continuously

× Off

### Activity N1: Testing LEDs

All front-panel LEDs (and the Link LED on the rear panel) light for a few seconds, then all turn off, confirming that all LEDs are operational.

### Activity N2: Testing the Hardware

During the power-up sequence, the RAC runs a series of self-test diagnostics. These diagnostics test internal hardware functions. If a test fails, the ATTN and STAT LEDs flash and an error message is displayed on the console port. The TRAF LED flashes during the power-up self-tests. After the self-tests complete, only the STAT and TRAF LEDs remain on.

## Normal Mode Error Sequence

[Table 4-3](#) shows the state of the LEDs when an error occurs at various stages of the start-up process. If the RAC fails during the hardware-test state (N2), the error condition is hardware failure NE2. A description of possible causes and solutions for each error condition follows.

Table 4-3. Normal Mode Error LED States

Activity	STAT Green	ATTN Amber	TRAF Green
NE2: Hardware Failure	◆	◆	×
NE5: Booted wrong image	●	◆	●

Key:

- On continuously
- × Off
- ◆ Flashing regularly (about 1Hz)

#### Activity NE2: Hardware Failure

The ROM diagnostics detected a hardware problem requiring service; call the Technical Solutions Center.

#### Activity NE5: Booted Wrong Image

The RAC loaded the wrong image. Press the Reset button for 3 seconds to reset the device. To prevent this problem in the future:

- Make sure that you configure the RAC with the appropriate information about the location of the image. See [Booting the Remote Access Concentrator on page 2-19](#) for more information.
- Be sure that the image you are booting has the correct name. Do not rename the image file unless you are making a copy for backup.
- If you used an **na**, **admin**, or cli **boot** command, specify the correct image and a valid file name.

If you do not know why the RAC booted the wrong image, enter Setup mode and issue an **image -d** command. The command displays the image file the RAC is trying to load.



## Setup Mode

Enter Setup mode by pressing the Reset button located on the front panel. Press this button within 30 seconds of resetting or turning on the device.

### Setup Mode Error-Free Sequence

[Table 4-4](#) summarizes the LED sequences that display in Setup mode during an error-free startup. A description of each sequence follows [Table 4-4](#).

Table 4-4. Setup Mode Error LED States

Activity	STAT Green	ATTN Amber	TRAF Green
T1: Testing LEDs	●	●	●
T2: Testing Hardware	●	×	■
T3: At Monitor Prompt	●	●	■

Key:

- On continuously
- × Off
- Flashing irregularly

#### Activity T1: Testing LEDs

All front-panel LEDs (and the Link LED on the rear panel) light for a few seconds, then all but the TRAF LED turn off. This sequence confirms that all LEDs are operational. At this point, the RAC is in Normal mode. Press the Reset button to put the RAC into ROM monitor mode.

#### Activity T2: Testing the Hardware

During the power-up sequence, the RAC runs self-tests that execute diagnostics for the CPU, ROM, EEPROM, flash, and so on. The TRAF LED flashes during the tests. After the power-up self-tests finish, the STAT and TRAF LEDs remain on.

**Activity T3: At the Monitor Prompt**

When the STAT and ATTN LEDs are on, the ROM monitor prompt is displayed on the console terminal. Enter the boot command at the prompt. If you do not enter a file name with the command, you are prompted to do so.

**Setup Mode Error States**

[Table 4-5](#) describes the LEDs that are used to indicate errors at different stages of the system startup process. If the RAC fails while testing the hardware (state T2), the error condition is hardware failure TE2. A description of each error condition follows [Table 4-5](#).

Table 4-5. Setup Mode Error LED States

Activity	STAT Green	ATTN Amber	TRAF Green
TE2: Hardware Failure	◆	◆	×
TE7: Booted Wrong Image	●	◆	×

Key:

- On continuously
- × Off
- ◆ Flashing regularly (about 1Hz)

**Activity TE2: Hardware Failure**

The ROM diagnostics detected a RAC hardware problem requiring service. Call the Technical Solutions Center.

### Activity TE7: Booted Wrong Image

The RAC loaded an inappropriate image. Press the Reset button for 3 seconds to reset the device. To prevent this problem in the future:

- Make sure that you configure the RAC with the appropriate information about the location of the image. See [Booting the Remote Access Concentrator on page 2-19](#) for more information.
- Make sure that the image you are booting has the correct name. Do not rename the image file unless you are making a copy for backup.
- If you used an **na**, **admin**, or **cli** boot command, specify the correct image and a valid file name.

### Power-Up Diagnostic Messages

Power-up diagnostics run when the RAC is turned up or reset. During the power-up sequence the following message is displayed on the console terminal:

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

If you press the spacebar within 10 seconds, the following message is displayed:

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

If you do not press the spacebar within 10 seconds, the following message 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 troubleshooting a power-up failure established that:

- The hardware is functional.
- The Ethernet interface is functional.
- The RAC can communicate with the Ethernet.

If the RAC still does not boot, you must locate the problem. The boot error report can help in this process.



The RAC 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 RAC is not configured properly.
- The load server host is not responding.

The RAC requests a boot image from a predefined load host or by broadcasting a boot request. When a host responds, the RAC loads its operational image.

You must set certain configuration parameters for the RAC. Enter these parameters using Monitor mode commands for the initial boot sequence. See [Chapter 3](#) for more information about these commands.

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

## Boot Error Report

If a boot error occurs, a RAC *boot error report* is generated *only* if the RAC opened the boot file. The report looks similar to this:

```
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 RAC generates a boot error report for the IP address from which it tried to boot. [Table 4-6](#) contains a description of the errors from the last ERPC layer invocation field; [Table 4-7](#) contains a description of the errors from the last read request field.

The error count indicates 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 the last ERPC layer invocation field lists only errors that occurred during the failed read request ([Table 4-6](#)). The report does not list errors that occurred during any other read request ([Table 4-7](#)) or during the open request ([Table 4-8](#)).

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 4-6. Errors from Last ERPC Layer Invocation

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

Table 4-7. 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 <a href="#">Table 4-6</a> .
Aborts rx'd	The host's BFS transmitted an abort in response to the RAC's read request. Run <b>erpcd -D</b> on the host to obtain more information.

Table 4-8. Errors from Last Open Request

Error	Description
ARP errors	Address Resolution Protocol (ARP) errors indicate that the RAC is configured to boot from a specified host, but the host would not transmit its Ethernet address to the RAC. Possibly, the RAC configuration includes the wrong IP encapsulation, or the subnet mask is misconfigured on the host or the RAC.
ERPC layer errors	See <a href="#">Table 4-6</a> .
Aborts rx'd	The host's BFS transmitted an abort in response to the RAC'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 <b>erpcd -D</b> on the host to obtain more information.

## Correcting Remote Access Concentrator Parameters

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

Verify the RAC'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:

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

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

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

Confirm that the RAC's boot parameters are correct by using the appropriate ROM Monitor commands. Modify any boot parameters that are incorrect or missing. Boot the RAC by entering the **boot** command at the console terminal, or by resetting the unit.

## Load Server Host Not Responding

The RAC 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 other) 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 RAC software is installed properly on the host. Refer to *Installing Remote Access Concentrator Software for UNIX* for procedures to properly install the software.
- The **erpcd** daemon or **tftp** server (which loads the operational image to the RAC) is running.

In Test mode, **erpcd** on the load server host displays boot progress reports. In Monitor mode, the RAC displays boot progress reports. The RAC displays its reports on the console terminal that invokes its Monitor mode; **erpcd** displays its reports on the UNIX workstation 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 the default path name and can be changed.

To trouble shoot a UNIX host on the LAN:

1. **Place erpcd on the load server host into Test mode by killing the erpcd program (requires superuser privileges) and restarting it using the -D5 option:**

```
# /usr/annex/erpcd -D5
```



Running **erpcd** with the **-D5** option invokes a very thorough debug mode that can take a considerable amount of time to complete.

2. **Put the RAC into Monitor mode. (This resets the RAC, so warn users before you do this.)**
3. **At the monitor prompt, enter:**

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

When the RAC boots in Monitor mode, the console terminal displays the load server host's IP 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 the message *erpc\_return 0* if it successfully receives a request and is sending out an affirmative response. If any RAC-related files are missing or cannot be installed, contact the Technical Solutions Center.

### 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 RAC software is installed properly on the host. Refer to *Installing Remote Access Concentrator Software for Windows and Windows NT®* for procedures to properly install the software.
- The **erpcd** daemon or **tftp** server (which loads the operational image to the RAC) is running.

In Test mode, **erpcd** on the load server host displays boot progress reports. In Monitor mode, the RAC displays boot progress reports. The RAC displays its reports on the console terminal that invokes its Monitor mode; **erpcd** displays its reports on the terminal that invokes its Test mode.

To troubleshoot a Windows NT host on the LAN:

1. **Stop the `erpcd` service from the Control Panel. Then open a DOS command shell and manually start `erpcd` with the `-D5` option.**



Running `erpcd` with the `-D5` option invokes a very thorough debug mode that can take a considerable amount of time to complete.

2. **Put the RAC into Monitor mode. (This resets the RAC, so warn users before you do this.)**
3. **At the monitor prompt, enter:**

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

When the RAC boots in Monitor mode, the console terminal displays the load server host's IP 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 the message `erpc_return 0` if it successfully receives a request and is sending out an affirmative response. If any RAC-related files are missing or cannot be installed, contact the Technical Solutions Center.

## Another Model 8000 Remote Access Concentrator

To troubleshoot a Model 8000 RAC configured as a load server host:

1. **Use the ping command from any host on your network to make sure the Model 8000 RAC can be reached.**
2. **Either use telnet or na to verify the unit's configuration.**

Refer to *Managing Remote Access Concentrators Using Command Line Interfaces* for more information about these commands.

A Model 8000 RAC that has been reconfigured as a load server host, but has not been rebooted, cannot boot another Model 8000 RAC on the network. Rebooting the Model 8000 RAC load server host ensures that the parameters are set.

Do not set the preferred dump address to point to another Model 8000 Remote Access Concentrator. Set it to a host address, or to 127.0.0.1 to disable dumping.

## Remote Access Concentrator Dumps

The RAC dumps its memory image to a host running load server software when certain software or hardware events occur. [Table 4-9](#) shows the LED states during a dump.



Dump files are generated for use by Technical Solutions Center personnel only.

Events that trigger RAC dumps are:

- Nonrecoverable hardware or software errors.
- Software fails to reset the RAC's watchdog timer.
- Software fails one or more internal consistency checks.
- Hardware detects an internal fault.

Table 4-9. Remote Access Concentrator LED States During a Dump

Activity	STAT Green	ATTN Amber	TRAF Green
Dump	●	●	■

Key:

- On continuously
- Flashing irregularly

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

The RAC sends a dump to the **/usr/spool/erpcd/bfs** directory on the dump host. The **/usr/spool/erpcd/bfs** directory is the default path name and can be changed. The receiving RAC 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 RAC 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 (for example, most UNIX hosts), dump files are named **dump.<addr>**. The file extension **<addr>** is the RAC's IP address.

For hosts that may limit file names to 14 characters (for example, 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 RAC's IP network address as its name. The dump file uses the RAC'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 RAC uses the **bfs** convention.

Each dump file contains a complete image of the RAC 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 RAC.

[Table 4-10](#) shows sample dump file names. All path names are relative to the directory **/usr/spool/erpcd/bfs**.

Table 4-10. Remote Access Concentrator Dump File Naming Conventions

RAC Address	Network Address	BSD File name	System V Path Name
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





# Appendix A

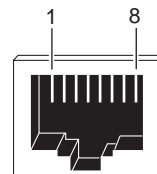
## Port Pins and Signals

This appendix identifies the signals and the associated pins used by the following Remote Access Concentrator ports:

- Console Port
- WAN Interface Ports
- AUI Ethernet Port
- 10BASE-T Ethernet Port
- Sync Port

### Console Port

The console port uses a dedicated RJ-45 connector ([Figure A-1](#)). [Table A-1](#) lists the console port pin/signal allocations.



RA0014A

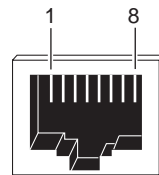
Figure A-1. Console Port

Table A-1. Console Port Pin/Signal Allocations

Pin Number	Signal
1	RTS
2	DTR
3	TXD
4	DCD
5	RXD
6	GND
7	DSR
8	CTS

## WAN Interface Ports

The Model 8000 RAC is equipped with two WAN Interface ports ([Figure A-2](#)). [Table A-2](#) lists the port's pin/signal allocations.



RA0014A

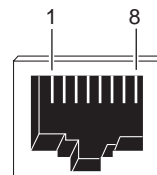
Figure A-2. WAN Interface Port Connector

Table A-2. 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

## 10BASE-T Ethernet Port

[Figure A-3](#) illustrates a 10BASE-T Ethernet port receptacle. [Table A-3](#) lists the receptacle's pin/signal allocations.



RA0014A

Figure A-3. 10BASE-T Ethernet Port

Table A-3. 10BASE-T Ethernet Port Pin/Signal Allocations

RJ-45 Pin	Signal
1	TXD +
2	TXD -
3	RXD +
4	NC
5	NC
6	RXD -
7	NC
8	NC

## AUI Ethernet Port

[Figure A-4](#) illustrates an AUI Ethernet port. [Table A-4](#) lists the port's pin/signal allocations.

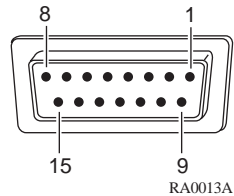


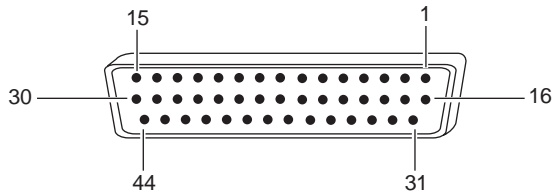
Figure A-4. AUI Ethernet Port

Table A-4. AUI Ethernet Port Pin/Signal Allocations

Pin	Signal
1	Ground (for transceiver power)
2	Collision +
3	Transmit +
4	Ground
5	Receive +
6	Ground (for transceiver power)
7	Unused
8	Ground
9	Collision –
10	Transmit –
11	Ground
12	Receive –
13	+ 12 volts (for transceiver power)
14	Ground
15	Unused

## Sync Port

The connector used for the sync port is a high-density 44-pin DB-25 connector ([Figure A-5](#)). [Table A-5](#) lists the port's pin/signal allocations.



RA0019A

Figure A-5. Sync Port

Table A-5. Sync Port Pin/Signal Allocations

Pin	Signal	Description
1	FGND	Frame (Chassis) Ground
2	SD+	non-V.35 Send Data
16	SD-	
3	RD+	non-V.35 Receive Data
17	RD-	
4	RTS+	non-V.35 Request To Send
18	RTS-	
5	CTS+	non-V.35 Clear To Send
19	CTS-	
6	DSR+	non-V.35 Data Set Ready
20	DSR-	
7	SGND	Shield Ground

*(continued on next page)*

Table A-5. Sync Port Pin/Signal Allocations (*continued*)

Pin	Signal	Description
8	DTR+	non-V.35 Data Terminal Ready
22	DTR-	
9	DCD+	non-V.35 Data Carrier Detect
23	DCD-	
10	ST+	non-V.35 Send Timing
24	ST-	
11	RT+	non-V.35 Receive Timing
25	RT-	
12	TT+	non-V.35 Terminal Timing
26	TT-	
13	RTIN#	Buffered Receive Timing from transceiver
28	RTIN#B	Receive Timing to SCC
30	ST#	Buffered Send Timing from transceiver
14	CABLE	Cable type - normally 1 (X.21=1, others =0)
29	non_X.21	non-X.21 cable (active low)
15	X.21_cab	X.21 cable present signal (n/c)
21	Unused	Unused
27	Unused	Unused
31	VST-	V.35 Send Timing
32	VST+	
33	VRT-	V.35 Receive Timing
34	VRT+	
35	VRD-	V.35 Receive Data
37	VRD+	
36	VSD-	V.35 Send Data
38	VSD+	
39	VTT-	V.35 Terminal Timing
40	VTT+	

*(continued on next page)*







# Appendix B

## Modem Upgrade Instructions

**T**he Model 8000 RAC supports up to 62 internal digital modems. The modems are located on plug-in cards that reside on the main logic board. This chapter describes how to install digital modem cards to upgrade the number of modems on the RAC. This chapter also describes how to remove and replace faulty modem cards.

This appendix describes:

- Contents of the kit
- Removing the RAC cover
- Modem card installation instructions
- Removing modem cards
- Assembly instructions
- Power-up and test

### 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 Phillips screwdriver
- A pair of pliers

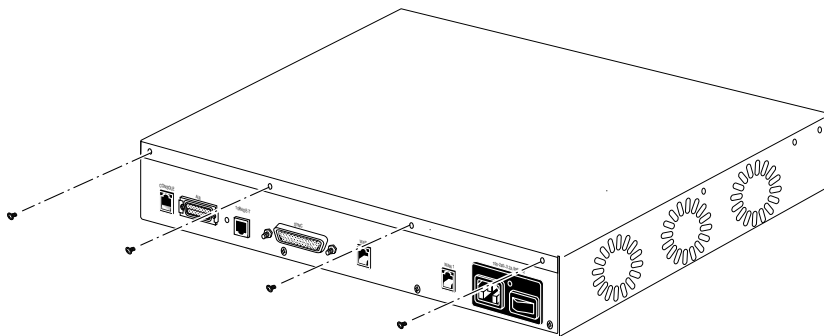
## Removing the RAC Cover



Observe handling precautions for digital telecommunications cables.

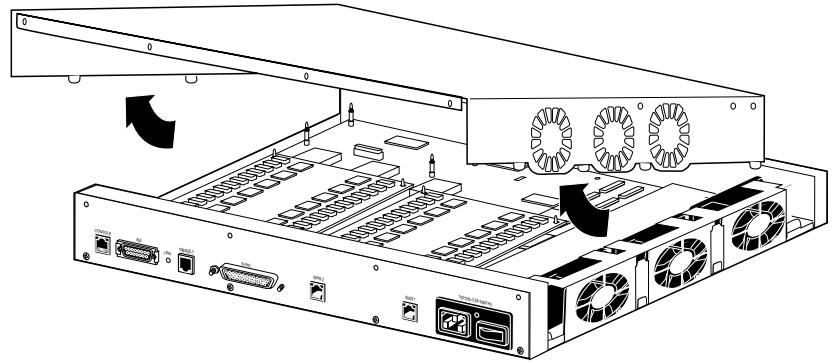
To remove the cover from the RAC:

1. **Unplug the RAC and disconnect all cables.**
2. **Remove the four screws from the back of the unit** ([Figure B-1](#)).
3. **Lift the cover up from the back of the unit and off** ([Figure B-2](#)).



RA0023A

Figure B-1. Removing the Screws from the Model 8000 RAC Cover



RA0022A

Figure B-2. Removing the Model 8000 RAC Cover

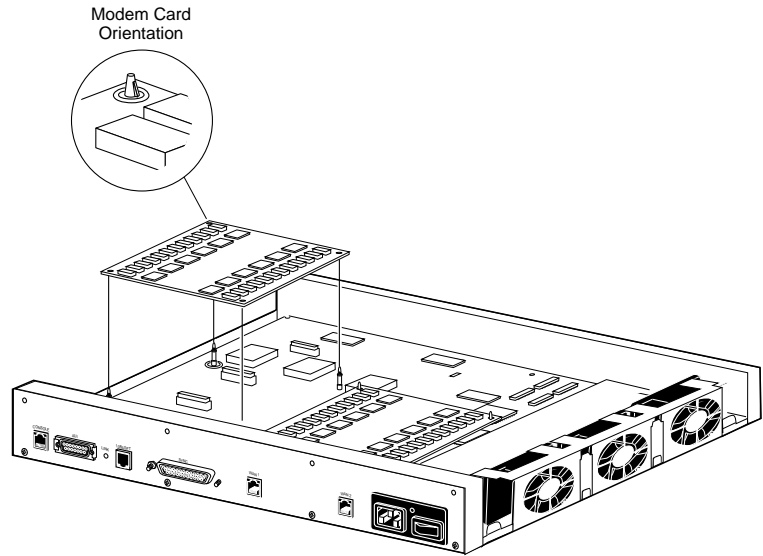
## Installing Modem Cards



Observe handling precautions for electrostatic-sensitive devices.

On the RAC, there are two locations that can accommodate modem cards (up to 62 modems total). To install the modem cards into the RAC ([Figure B-3](#)):

- 1. Find the locations in which you plan to install the modem cards.**
- 2. On the modem cards, find the mounting hole that is silk-screened with a ring.**
- 3. Orient the modem card so that the ring on the modem card's mounting hole lines up with the ring on the main logic board ([Figure B-3](#)).**
- 4. Carefully press the modem card into the card connector. Make sure that the connector is fully seated.**
- 5. Push the corners of the modem card down onto the nylon standoffs until the locking tabs engage.**



RA0016A

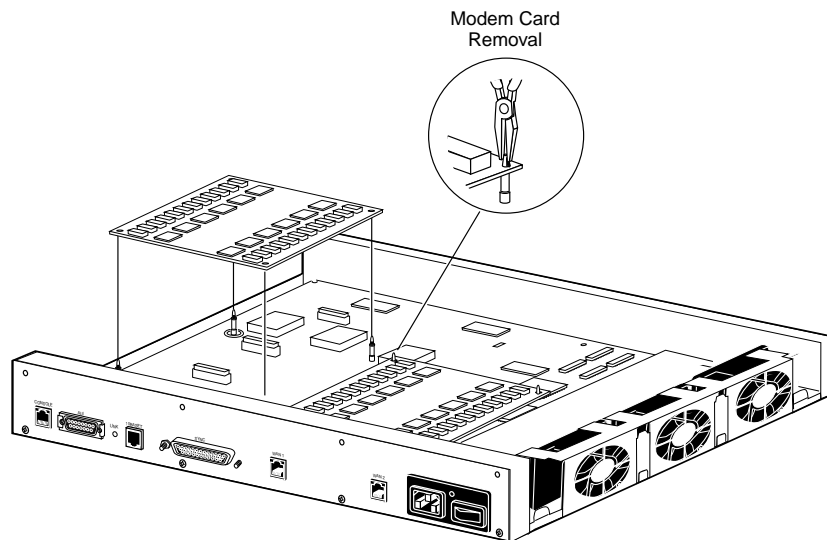
Figure B-3. Adding Modem Cards to the Model 8000 RAC

## Removing Modem Cards

Occasionally you may need to remove modem cards from the RAC (for example, if a modem card fails and needs to be replaced). On the RAC, there are two locations that can accommodate modem cards (up to 62 modems total).

To remove a modem card from the RAC ([Figure B-4](#)):

1. **Locate the modem card that you want to remove.**
2. **Push in the locking tab on the nylon standoff that secures a corner of the modem card to the main logic board, and gently work that corner of the card off the nylon standoff ([Figure B-4](#)).**
3. **Repeat the procedure for the other three corners of the modem card.**
4. **Lift the modem card straight out of its connector.**



RA0016B

Figure B-4. Removing Modem Cards from the Model 8000 RAC

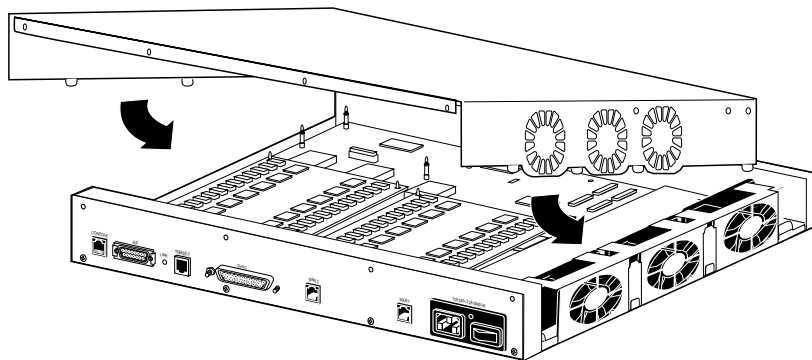
## Replacing the RAC Cover

To replace the RAC cover:

1. Lower the cover onto the unit at an angle, and insert the five tabs on the cover into the corresponding slots on the chassis ([Figure B-5](#)).
2. Swing the cover down into place, making sure the tabs on the sides of the cover fit inside the corresponding slots in the chassis.
3. Secure the cover by installing the four screws in the back of the cover.



Do not overtighten these screws.



RA0021A

Figure B-5. Replacing the Model 8000 RAC Cover



## Power-up and Test

To run the Model 8000 RAC power-up and test sequence:

1. **Reconnect all the cables, including:**
  - The Ethernet cable
  - The WAN interface cables
  - The console terminal cable
  - Sync port cable (V.35, X.21, RS-422, or RS-232)
  - The power cord
2. **Turn on the unit's power.**
3. **Set the Model 8000 RAC to Setup mode by pressing the Reset button momentarily ([Figure B-6](#)).**

The RAC runs its ROM-resident power-up diagnostics.
4. **At the `monitor::` prompt, issue the `config` command to verify the new hardware and modem configuration.**
5. **Issue the `ports` command and enter the number of ports to be tested, as a range, at the prompt requesting the port list.**

If the ports tests complete successfully, and the `config` command indicates that the RAC recognizes the new modems, the installation is complete.

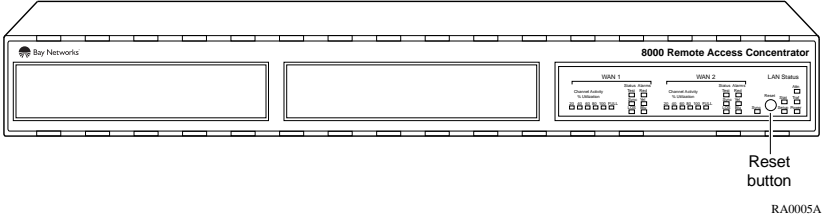


Figure B-6. Setting the Model 8000 RAC to Setup Mode



# **Appendix C**

## **Data Compression Upgrade Instructions**

**T**he Model 8000 supports data compression. The compression is performed by a plug-in card that is installed on the main logic board. This chapter describes how to install the data compression card on the main logic board.

These installation instructions contain a description of the following:

- Contents of the kit
- Removing the RAC cover
- Installing the compression card
- Replacing the RAC cover

## **Contents of the Kit**

The modem upgrade kit contains:

- One data compression card
- Hardware kit

## **Required Tools**

The only required tool is a Phillips screwdriver.

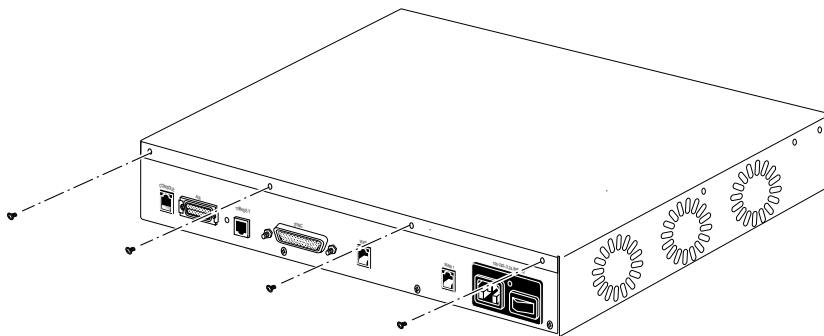
## Removing the RAC Cover



Observe handling precautions for digital telecommunications cables.

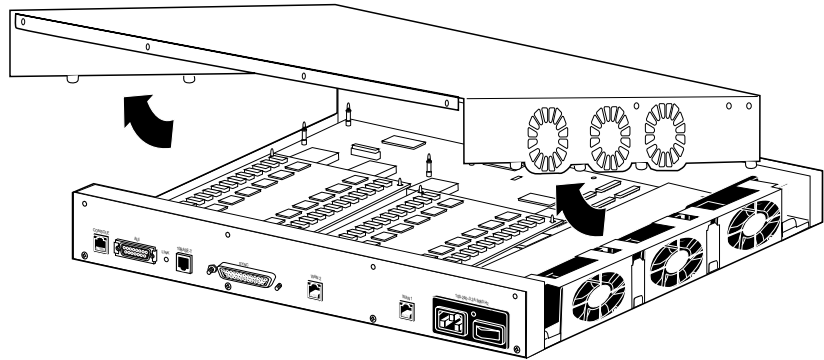
To remove the RAC cover:

1. **Unplug the RAC and disconnect all cables.**
2. **Remove the four screws from the back of the unit** ([Figure C-1](#)).
3. **Lift the cover up from the back of the unit and off** ([Figure C-2](#)).



RA0023A

Figure C-1. Removing the Screws from the Model 8000 RAC Cover



RA0022A

Figure C-2. Removing the Model 8000 RAC Cover

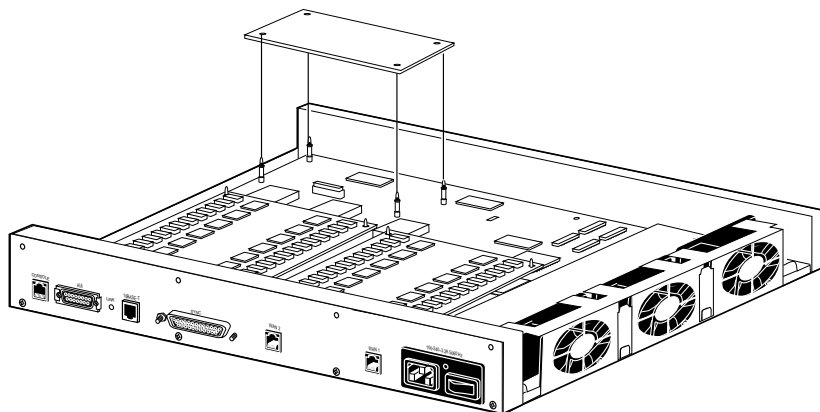
## Installing the Compression Card



Observe handling precautions for electrostatic-sensitive devices.

To install the compression card on the main logic board ([Figure C-3](#)):

1. Find the location in which you plan to install the compression card.
2. Orient the compression card and carefully press it into the card connector ([Figure C-3](#)). Make sure that the connector is fully seated.
3. Push the corners of the compression card down onto the nylon standoffs until the locking tabs engage.



RA0015A

Figure C-3. Installing the Compression Card

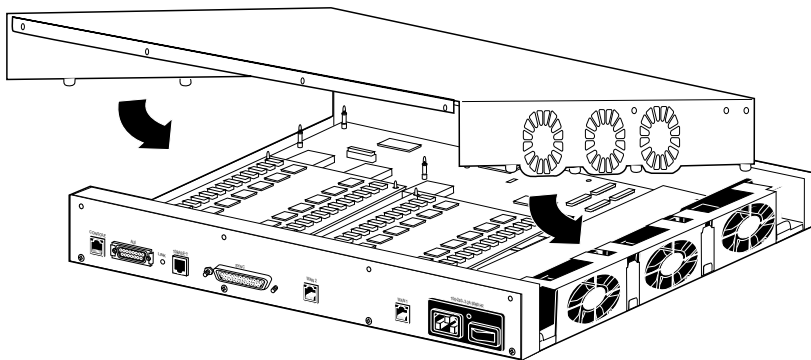
## Replacing the RAC Cover

To replace the RAC cover ([Figure C-4](#)):

1. Lower the cover onto the unit at an angle, and insert the five tabs on the cover into the corresponding slots on the chassis ([Figure C-4](#)).
2. Swing the cover down into place, making sure the tabs on the sides of the cover fit inside the corresponding slots in the chassis.
3. Secure the cover by installing the four screws in the back of the cover.



Do not overtighten these screws.



RA0021A

Figure C-4. Replacing the Model 8000 RAC Cover





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