Cisco IGX Installation

Release 8.5

T A B L E OF C O N T E N T S

Chapter 3   Card Installation and Node Startup   3-1

About This Guide

This section discusses the objectives, audience, organization, and conventions of the *Cisco IGX 8400 Series Installation* publication.

Cisco documentation and additional literature are available in a CD-ROM package, which ships with the product. The Documentation CD-ROM is updated monthly. Therefore, it might be more up-to-date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

Objectives

This publication provides descriptions for installing and starting up the following IGX hardware:

- Enclosures
- Power sources (AC and DC)
- Controller cards (the CPU for the node)
- Frame relay interface cards
- Voice interface cards
- Serial data interface cards
- ATM interface cards
- Trunk cards
- Alarm cards

Audience

The *Cisco IGX 8400 Series Installation* publication provides installers, operators, and network designers and managers with the necessary understanding to set up any model of an IGX node. This manual applies to the IGX 8410, IGX 8420, and IGX 8430 nodes in both rack-mount and stand-alone versions.

Organization

The major sections of this publication are as follows:

- Chapter 1, "Introduction"

- Chapter 2, "Enclosure and Power Installation"

- Chapter 3, "Card Installation and Node Startup"

- Chapter 4, "Troubleshooting"

- Chapter 5, "Repair and Replacement"

- Chapter 6, "Upgrading Rack-Mounted Nodes"

- Appendix A, "System Specifications"

- Appendix B, "Peripherals Specifications"

- Appendix C, "Cabling Summary"

- Appendix D, "Cisco Cabinet Dimensions"

Conventions

This publication uses the following conventions to convey instructions and information.

Command descriptions use these conventions:

- Commands and keywords are in **boldface**.

- Arguments for which you supply values are in *italics*.

- Required command arguments are inside angle brackets (< >).

- Optional command arguments are in square brackets ([ ]).

- Alternative keywords are separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and information the system displays are in screen font.

- Information you enter is in **boldface screen** font.

- Nonprinting characters, such as passwords, are in angle brackets (< >).

- Default responses to system prompts are in square brackets ([ ]).

Note   Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Caution   Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning This warning symbol means *danger.* You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied the product.)

Introduction

This manual describes how to install, troubleshoot, and repair an IGX 8400 series node running Release 8.5 of Cisco WAN Switching System Software. In addition to the chapters that provide these descriptions, the appendices in this manual describe system specifications for the operating environment and data transport technologies, supported peripherals, cabling, and the possible arrangements for all series of Cisco WAN switches in a Cisco rack.

The IGX 8400 series of WAN switches consist of the IGX 8410, IGX 8420, and IGX 8430. An IGX switch can reside in a rack or a stand-alone cabinet. Figure 1-1 illustrates an IGX 8410 mounted in a cabinet.

For descriptions of the hardware in an IGX 8410, IGX 8420, or IGX 8430 node, refer to the *Cisco IGX 8400 Series Reference.*

The installation and related topics in this manual consist of the following:

1 Enclosure or rack installation

This includes procedures for installing all switches in the IGX series in a cabinet or rack, using appropriate tools and mounting rails.

2 AC or DC power supply installation

Mounting procedures for the AC or DC power supplies, installation of redundant power supplies and procedures for connection to the power-entry vback cards.

3 Cooling unit installation

Installation of cooling fans in the IGX enclosure.

4 Power and ground connections

Connecting the IGX to power and ground.

5 Card installation

Procedures for installing the various front and back cards available for the IGX node.

6 Node start-up

Starting the node for the first time.

7 Troubleshooting

8 General directions for isolating a problem area and possible quick fixes.

9 Replacing system components

10 Upgrading a rack-mounted IGX 8420 to a rack-mounted IGX 8430

The remaining pages of this chapter illustrate the models in the IGX 8400 series.

Figure 1-1 illustrates an IGX 8410 switch in a stand-alone cabinet.

Figure 1-1   IGX 8410 Node
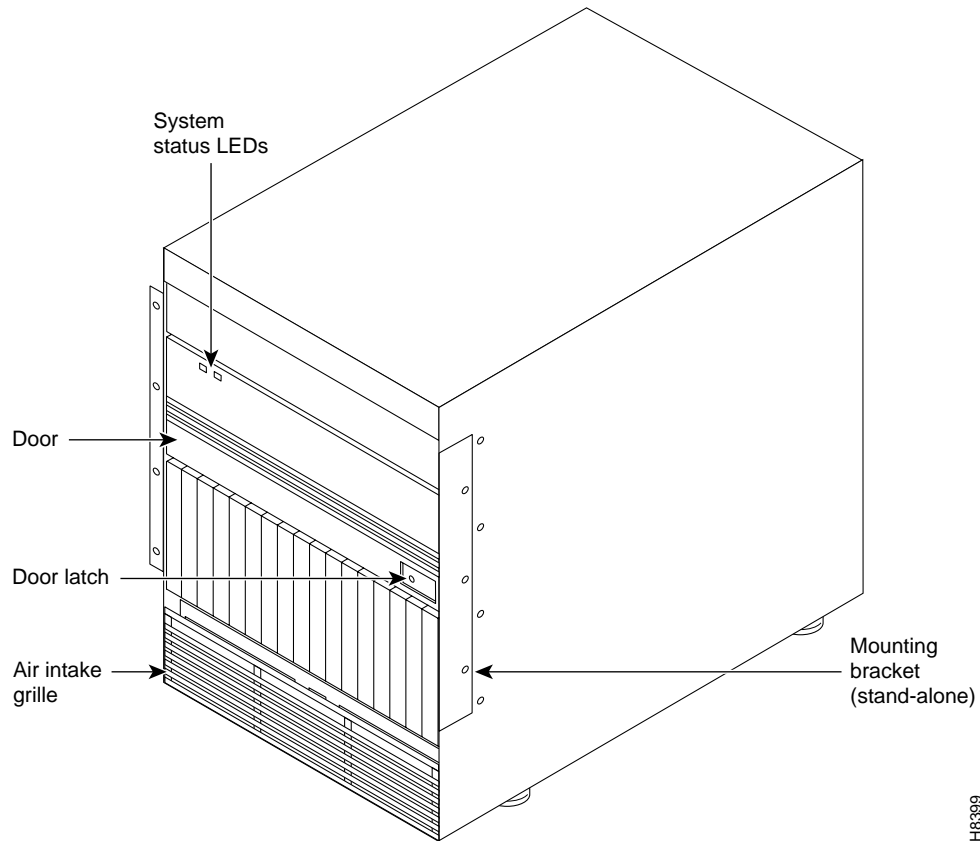
Figure 1-2 illustrates an IGX 8420 switch in a stand-alone cabinet.

Figure 1-2   IGX 8420 Switch
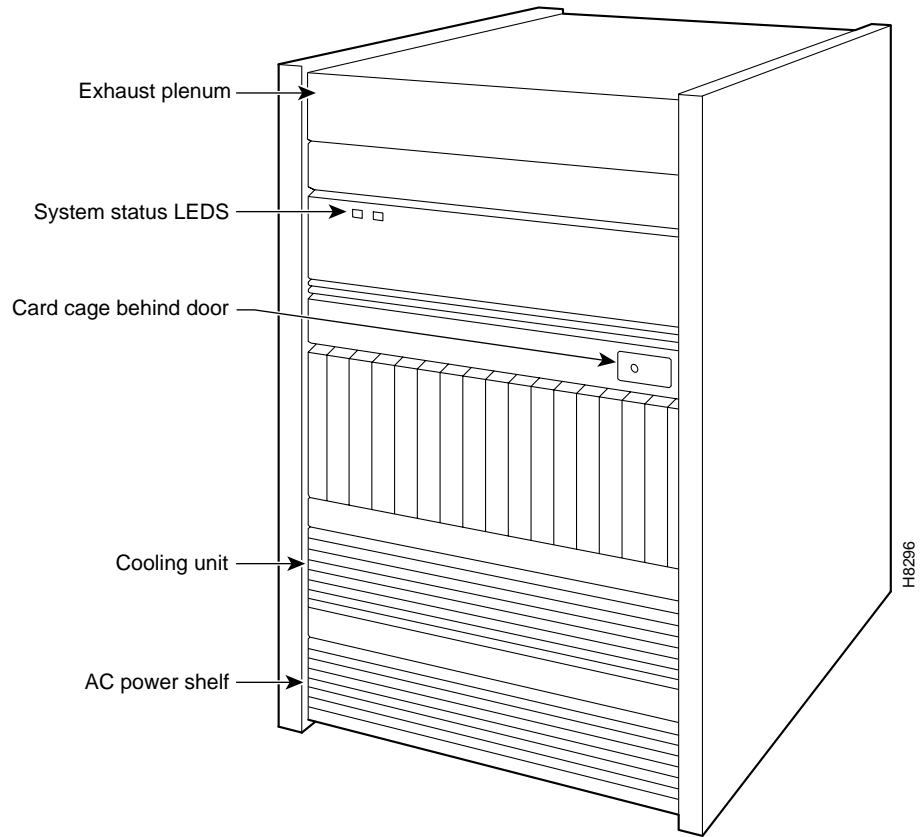
Figure 1-3 illustrates the IGX 8430 mounted in a cabinet.

Figure 1-3   IGX 8430 Node
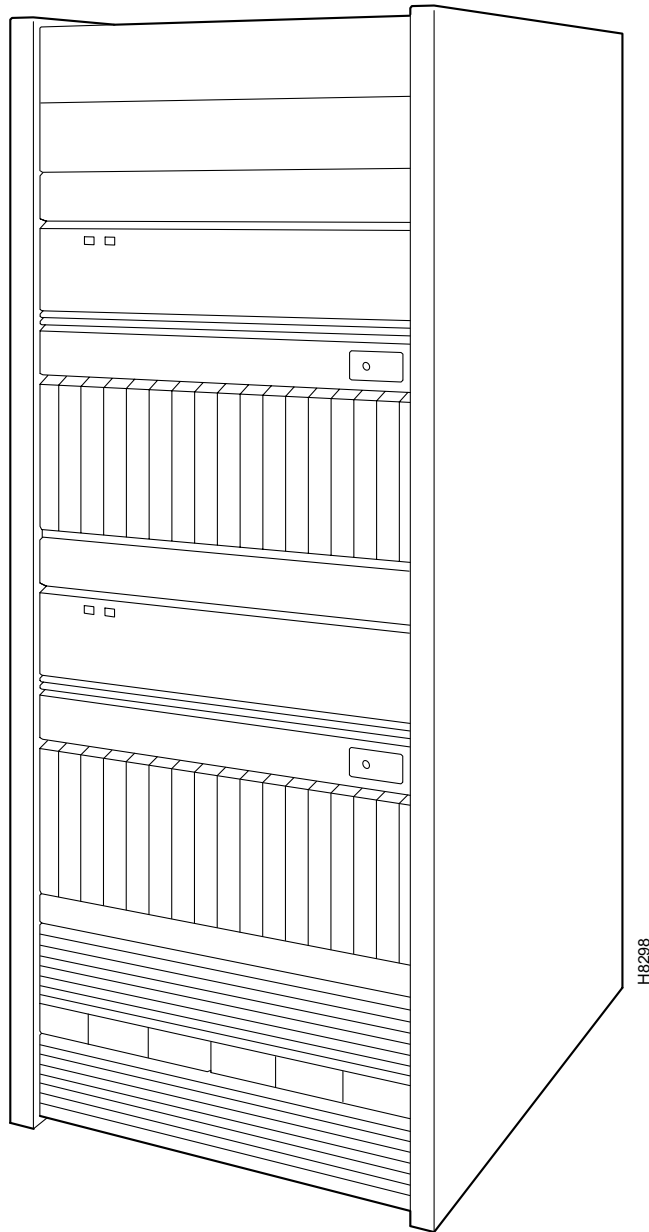
For descriptions of the hardware in an IGX 8410, IGX 8420, or IGX 8430 node, refer to the *Cisco IGX Reference.*

An IGX series switch is installed in the following steps:

1 Enclosure or rack installation

This includes procedures for installing all switches in the IGX series in a cabinet or rack, using appropriate tools and mounting rails.

2 AC or DC power supply installation

Mounting procedures for the AC or DC power supplies, installation of redundant power supplies and procedures for connection to the power-entry vback cards.

3 Cooling unit installation

Installation of cooling fans in the IGX enclosure.

4 Power and ground connections

Connecting the IGX to power and ground.

5 Card installation

Procedures for installing the various front and back cards available for the IGX node.

6 Node start-up

Starting the node for the first time.

Enclosure and Power Installation

Parts Checklist

Before you install the system, verify that all of the required parts are present and in good condition. If anything is missing or damaged, contact your sales representative.

IGX 8410 Enclosure

Check the cabinet for the following inventory:

_____   For rack-mount systems, four permanent mounting brackets are present. Also, for installation purposes only, a pair of temporary mounting brackets and a temporary spacer bracket are present.

_____   The unit has the correct power type (AC or DC) and the factory-installed Power Entry Back Card (PE-BC). For DC-powered systems, DC Power Entry Modules (PEMs) are installed in the PE-BC. For AC systems, check for the power supply tray, correct power cord, and correct number of supplies.

IGX 8420/8430 Enclosures

Check the cabinet for the following inventory:

_____   [IGX 8420/8430 enclosures] The unit has the correct number of card cages (1 or 2).

_____   The unit has the correct power type (AC or DC) and the factory-installed Power Entry Back Cards (PE-BC), one per shelf. For DC-powered systems, DC PEMs are factory-installed in each PE-BC. For an AC system, check for the power supply tray and correct number of power supplies and cables.

Plug-In Cards

Make sure all purchased cards are present. Check the number and type of cards shipped against the number and type of card purchased. In the following list, the column on the left lists the front cards. The column on the right lists the possible corresponding back cards.

An inventory list of the installed cards is shipped with the unit. The list includes each card's serial number, revision number, and slot number (serial and revision numbers are also found on the solder side of each card). Check for the presence of any other items on the shipping list. After verifying that the correct cards are present, tape a copy of the inventory list to the back of this manual.

____	Correct number and types of NPMs	____	One SCM
____	Correct number of NTMs	____	Correct number of BC-T1s
		____	Correct number of BC-E1s
		____	Correct number of BC-Y1s
		____	Correct number of BC-SRs
____	Correct number of BTMs	____	Correct number of AIT-T3s
		____	Correct number of AIT-E3s
		____	Correct number of AIT-T2s
		____	Correct number of AIT-HSSIs
		____	Correct number of BTI-E1s
____	Correct number of ALMs	____	Correct number of BC-UAI-1T3s
		____	Correct number of BC-UAI-1E3s
____	Correct number and types of UVMs	____	Correct number of BC-UVI-2E1ECs
		____	Correct number of BC-UVI-2J1ECs
		____	Correct number of BC-UVI-2T1ECs
____	Correct number and types of CVMs	____	Correct number of BC-E1s
		____	Correct number of BC-J1s
		____	Correct number of BC-T1s
____	Correct number of UFM-Cs	____	Correct number of UFI-8T1-DB15s
		____	Correct number of UFI-8E1-DB15s
		____	Correct number of UFI-8E1-BNCs
____	Correct number of UFM-Us	____	Correct number of UFI-12-V35s
		____	Correct number of UFI-12-X21s
		____	Correct number of UFI-4-HSSIs
____	Correct number and types of FRMs (including FRM-2s)	____	Correct number of FRI-T1s
		____	Correct number of FRI-E1s
		____	Correct number of FRI-X.21s
		____	Correct number of FRI-V.35
		____	Correct number of FRI-2-X.21s
____	Correct number of FTMs	____	Correct number of FPCs
____	Correct number of HDMs	____	Correct number of SDIs
____	Correct number of LDMs	____	Correct number of LDIs

____ Correct number of ARMs   ____ Correct number of ARIs

____   ____ Blank faceplates for unused back card slots

Site Preparation

The site must satisfy the following requirements:

- Space

    The standalone IGX 8410 node requires a floor area 19.9 inches (50.5 cm) wide and 60 inches (180 cm.) deep. This depth allows for opening the front door. Sufficient clearance around the cabinet must also be provided for access to the front and back of the cabinet while the door is open. The rack-mount IGX 8410 requires 24.44 inches of vertical space.

    A standalone IGX 8420 or 8430 node requires a floor area 19.9 inches (50.5 cm) wide and 47 inches (119.4 cm) deep. This spacing lets you open the front door. Clearance around the cabinet must also allow access to the front and back of the cabinet while the door is open. The rack-mount IGX 16 requires 32 inches (81.3 cm) of vertical space. The rack-mount IGX 8430 node requires 55 inches (139.7 cm) of vertical space.

    In a rack-mount system, the mounting rail pattern follows the EIA standard of 56 inches (or 32 rack-mount units). For displacement information for the IGX components and other components in the Cisco cabinet, refer to the appendix titled "Cisco Cabinet Dimensions."

- Environment

    The IGX operating environment should be as follows:

    Temperature and humidity range: 0° to 40° C (32° to 104° F) for normal operation, 50° C for up to 72 hours. Up to 85% relative humidity, non-condensing.

    Shock: the switch withstands 10 G, 10 ms. at 1/2 sine wave.

    Vibration: the switch withstands 1/4 G, 20 to 500 Hz.

- Power

    For AC power use, an AC power source must be available within 6 feet (1.8 m) of the IGX node. For systems using a DC source, Cisco does not supply the DC power cord, so the user or installer determines the cord length and the distance to the DC source. The wire should be 10 to 12 AWG or 4 sq. mm.

- Heat Dissipation

    A fully loaded, AC-powered IGX 8410 node dissipates up to 3,500 BTUs (1 KW hour).
    A DC-powered IGX 8410 node can dissipate up to 2720 BTUs.

    A fully loaded, AC-powered IGX 8420 node dissipates up to 4300 BTUs (1 KW hour).
    A DC-powered IGX 8420 node can dissipate up to 3600 BTUs.

    A fully loaded, AC-powered IGX 8430 node dissipates up to 8600 BTUs (1 KW hour).
    A DC-powered IGX 8430 node can dissipate up to 6800 BTUs.

- Weight

    A fully loaded IGX 8410 enclosure can weigh up to 173 lbs (79 Kgs). A fully loaded IGX 8420 enclosure can weigh up to 250 lbs (112.5 Kgs). A fully loaded IGX 8430 enclosure can weigh up to 500 lbs (225 Kgs).

Note If you move a Cisco-supplied cabinet, do not push it at its sides. Push at the front or back.

- Flooring

  Raised flooring with sufficient under-floor space to house the cables is recommended.

- Mounting

  An IGX node is either mounted in a rack or free-standing (in a stand-alone cabinet). The location of the IGX node should accommodate the routing of the data cables and the termination of the telephone company's or common carrier's circuits.

- Electrostatic Discharge

  The IGX 8410 node has one mounted wrist strap at the front and one at the back of the cabinet. Personnel with access to the IGX 8410 cards should put on a wrist strap before handling the cards. An IGX 8420/8430 node does not come with an attached wrist strap.

Seismic Considerations

To provide some protection against seismic activity, the feet and wheels of the IGX stand-alone cabinets can be removed to permit the cabinet to be bolted to a concrete floor or to a structural member in the floor.

In Cisco-supplied cabinets, provisions are available for seismic anchoring. Holes exist in the upper and lower corners for 3/8" or 1/2" bolts. Also, an optional *stability plate* can be purchased with the Cisco cabinet. The stability plate is bolted to the floor, then the Cisco cabinet is bolted to the stability plate. The "Seismic Anchoring for the Cisco Closed Rack" section contains instructions for installing the seismic stability plate.

Safety Requirements

The following paragraphs contain general safety information and information on T1 and CEPT (E1) safety requirements.

General Requirements

Warning The following safety requirements must be observed:

- Only authorized personnel should have access to the IGX node.

- Correct alignment of connector pins with connectors is vitally important. Before you insert a card, make sure the pins are straight and the connectors on the card and the backplane align with each other. Insert the card gently.

- For the IGX node and peripheral equipment to function safely and correctly, use only the power cords, cables, and connectors that are specified for the equipment, and make sure they are in good condition.

- Use a wrist strap when handling cards.

Power and Grounding

This section lists the requirements that relate to electrical power and grounding. These requirements cover installations at Central Office (CO) and Private Enterprise locations.

AC Power Circuit Breakers

For an AC-powered system, verify that the node's power comes from a dedicated AC branch circuit. The circuit must be protected by a dedicated, two-pole circuit breaker. The circuit breaker must have a rated current and trip delay that is greater than those of the IGX circuit breaker. Cisco Systems recommends the following:

- For IGX 8420 or IGX 8430 nodes, the site should have a 20A, 2-pole AC circuit breaker with a long trip-delay at each branch circuit.

- For IGX 8410 nodes, the site should have a 15A, 2-pole AC circuit breaker with a long trip-delay at each branch circuit.

The IGX 8420 and IGX 8430 nodes use a 20A, 2-pole circuit breaker for each AC input. The manufacturer of this circuit breaker is ETA, and the ETA part number for the circuit breaker is 8340-F120-P1P2-B2H020A. The IGX 8410 node uses a 15A, 2-pole AC circuit breaker on each input. This circuit breaker comes from either ETA (part number 8340-F120-P1P2-B2H015A) or Airpax (part number IEGH11-1-62-15.0-91V).

DC Power Circuit Breakers

For a DC-powered system, verify that the node's power comes from a dedicated DC branch circuit. The circuit must be protected by a dedicated circuit breaker. The circuit breaker must have a rated current and trip delay that is greater than those of the IGX circuit breaker. Cisco Systems recommends the site have a dedicated 25A, 1-pole circuit breaker with a medium trip delay at each branch circuit.

The DC-powered nodes use a 25A, 1-pole circuit breaker with a short trip delay on each -48V input. The manufacturer of this circuit breaker is ETA, and the ETA part number is 8340F110P1K1A2H00025.

Electrical Power for AC Units

An AC power source must be available within 6 feet (1.8 m) of the system and easily accessible. Before turning on the power, verify that the power supplied to the node comes from a dedicated branch circuit.

The power receptacles to which the node connects must be of the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth at the service equipment.

Electrical Power for DC Units

Only a –48 VDC supply that complies with the Safety Extra Low Voltage (SELV) requirements of EN 60950 can connect to the IGX DC input.

For DC supply connections, consult local and/or national codes for proper conductor sizing. The conductors must be suitable for 20 Amps. Wiring that is 10 to 12 AWG (4 sq. mm) is adequate.

Bonding and Grounding

To maintain the full EMI and EMC integrity of this equipment, it must be bonded to an Integrated Ground Plane or an Isolated Ground Plane network. The purpose of this is to mitigate the damaging effects to equipment from Electrostatic Discharge and Lightning. Refer to the latest edition of ITU Recommendation K.27 or Bellcore GR-1089-CORE requirements to ensure that the correct Bonding and Grounding procedures are followed. As recommended in these documents, a frame bonding connection is provided on the Cisco-supplied cabinet for rack-mounted systems and on the stand-alone cabinets.

Refer to "Making the Frame Bonding (Ground) Connection" later in this chapter for information on the locations of the frame bonding connections and how to make a connection.

Except for the AC power supply module, every module in a rack-mount system relies on the rack itself for grounding. Therefore, the rack must be properly connected to protective earth before operating the system.

A DC-powered IGX node must have grounding conductors that connect at two separate locations, as follows:

- The grounding conductor provided with the supply source must connect to the correct terminal of the Power Entry Module (PEM). The "DC Power Connections" section in this chapter describes how to make this connection.

- A grounding conductor as described in the first paragraph of this section ("Bonding and Grounding") must connect to the appropriate terminal of a rack assembly or to the chassis of an IGX node.

CEPT Requirements

These requirements may be relevant to a private network connected to the public switched networks in some international service areas.

- The following port types on the IGX node are approved to carry public-switched, non-voice traffic (OTR001, issue 3, port types 2DN):

    — BC-E1 ports (G.703 2048 Kbits per second).

    — SDI-RS-232, LDI-RS-232, BC-SR, SDI-RS-449, FRI-V.35 (approved for direct connection to V.35 leased digital circuit).

    — SDI-RS-449 (when connected via Cisco RS449/X.21 interface cable).

- The following port type on the IGX node is approved to carry PSTN voice traffic:

    — BC-E1 ports (G.703 2048 Kbps, when connected to a CVM or NTM front card).

Note Cables must be attached so that their securing bolts are tightened requiring a screwdriver for removal.

Seismic Anchoring for the Cisco Closed Rack

This section describes installing the Cisco-supplied cabinet with the optional stability plate for seismic anchoring. If the stability plate is not present, go to the next section. To set up the Cisco cabinet with the stability plate:

Step 1 Use the dimensions in Figure 2-1 to drill the holes for installing the stability plate.

Step 2 Remove the stability plate from the base of the Cisco cabinet. Save these nuts and bolts.

Step 3 With the user-provided anchoring bolts, attach the stability plate to the floor.

Step 4 Roll the Cisco cabinet over the stability plate as Figure 2-2 illustrates.

Step 5 Using the nuts and bolts from the shipping setup, secure the Cisco cabinet to the stability plate.

Figure 2-1   Stability Plate Dimensions
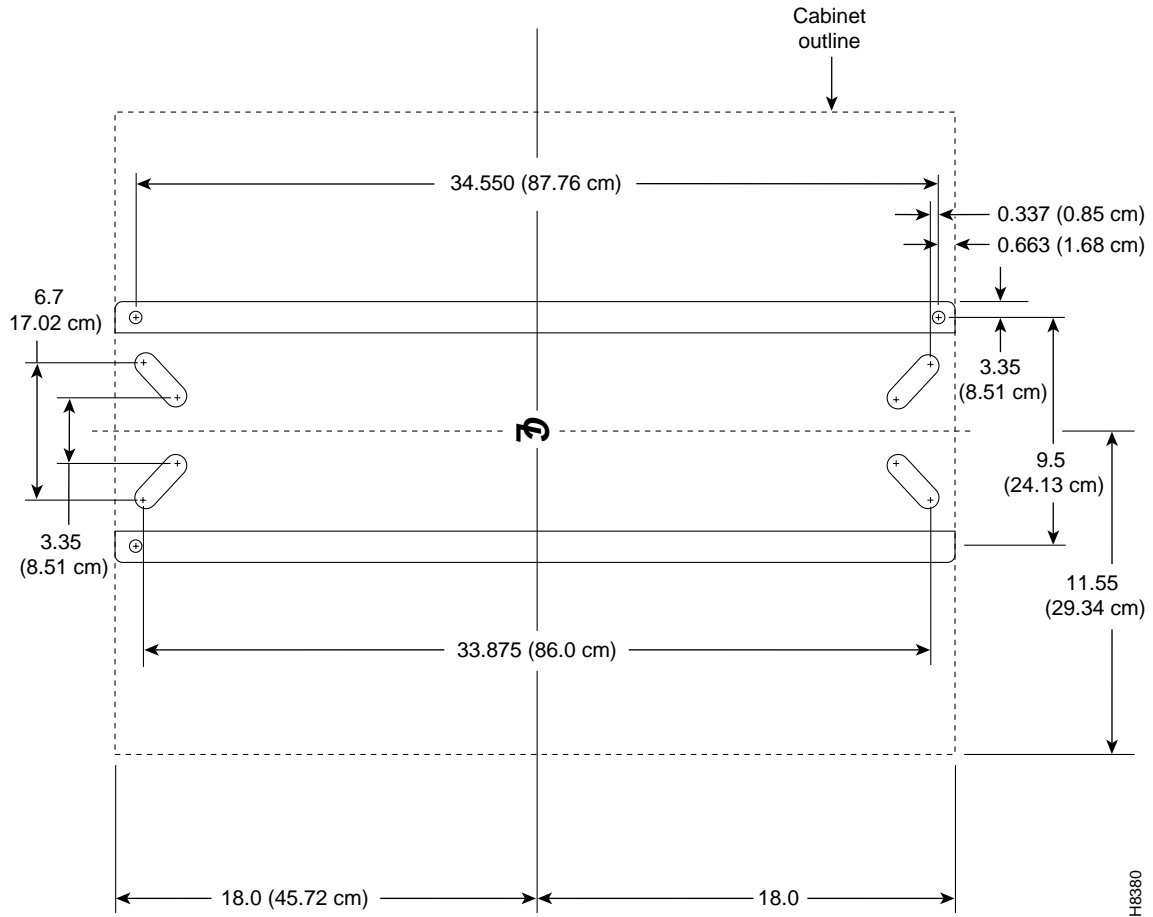
Figure 2-2   Installing a Cisco-Supplied Rack Over the Stability Plate

3/8 x 1 inch
bolts (4)

H8381

Stability
plate
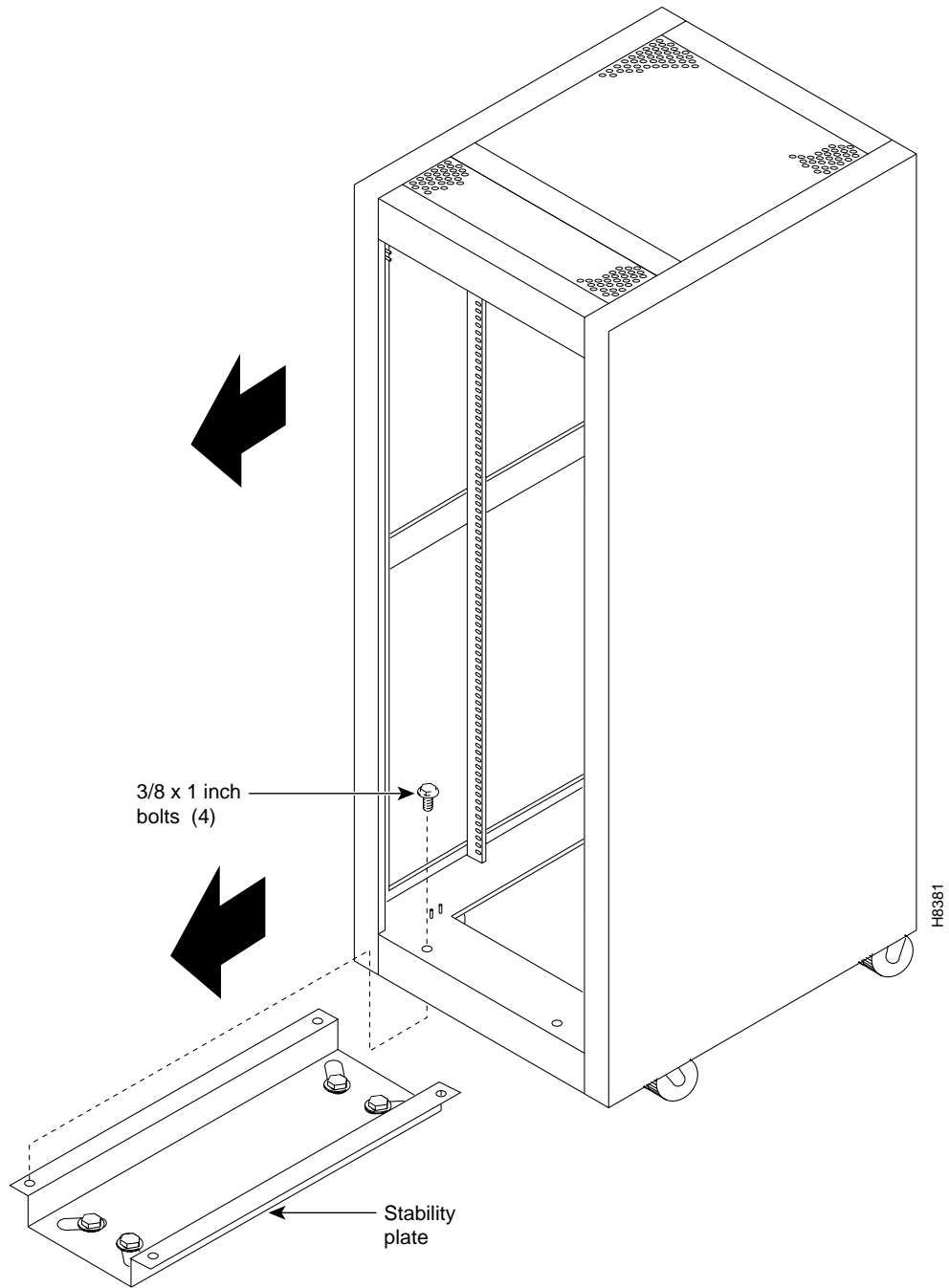
IGX 8410 Enclosure Installation

Installing an IGX 8410 switch requires the following tools and equipment:

- Box knife (or equivalent)

- Flat blade screwdriver set

- Phillips screwdriver set, which must include a No. 1 size for front card installation

- Grounding wrist strap

- A variety of wrenches, possibly including an adjustable wrench or channel locks, for raising and lowering cabinet feet (for example, a Cisco cabinet requires a 1 3/8" wrench)

- 5/32" Allen wrench for opening the IGX 8410 door (Cisco provides a wrench)

Stand-Alone System Installation

The installation steps consist of placing the stand-alone IGX 8410 node at its operating location, unpacking it, and verifying the integrity of the enclosure and power connections. Note that the cabinet is 19.9" wide.

After the system is at its operational location, follow the steps for connecting power. If the system has an AC power source, go to "AC Power Connections" section. If the system has a DC power source, go to the "DC Power Connections" section.

Rack-Mount Installation

The rack-mount IGX 8410 fits in a 19 inch (48.25 cm.) rack with a minimum of 17.75 inches between rails. For mounting the chassis in a rack, brackets are attached to the front of the chassis. A pair of mounting brackets are attached at the back of the chassis after it is placed in the rack. Brackets for a mid-rack mounting also come with the kit.

Because of the weight of the IGX 8410, Cisco includes two temporary spacer brackets and a temporary mounting bracket to help with the installation. These pieces are removed after installation. The temporary spacer brackets stabilizes the rack, and the temporary mounting bracket together with the spacer brackets creates a partial shelf onto which the installers can slide the node. These pieces support the system while installers secure the permanent front and back mounting brackets to the rack.

> ⚠ **Caution** If an IGX is mounted in a cabinet, be sure an unrestricted air flow is available in and out of the enclosure.

To install the IGX in a rack:

Step 1   Decide on the intended IGX 8410 position in the rack. See Figure 2-3 for external dimensions. Note that the vertical spacing between the IGX 8410 and other components, such as a BPX 8620 node or an MGX 8220 shelf, must be in the range .047" to .077" (0.119 cm to 0.196 cm).

Step 2   At the front of the rack, attach the temporary spacer bracket and temporary mounting brackets so that the uppermost portion of these pieces are at the bottom of the intended location of the IGX 8410. Figure 2-4 shows a temporary spacer and mounting bracket in a Cisco-supplied cabinet.

Figure 2-3   IGX 8410 Rack Mounting Dimensions
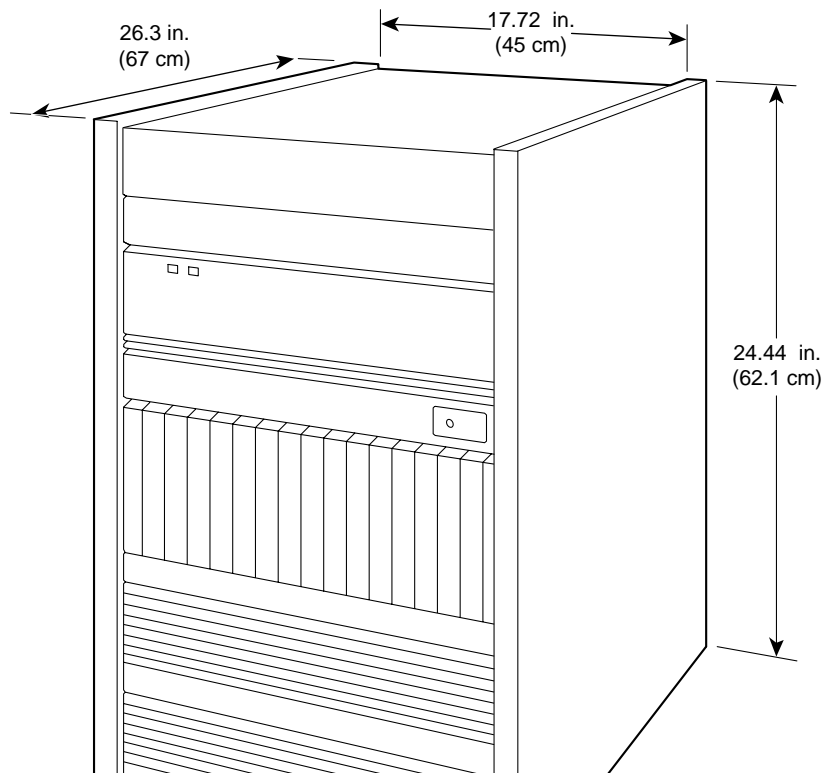
Caution   If you must move a Cisco cabinet to install an IGX switch, do not push the cabinet at its sides. Instead, grip the cabinet at the front or back edges to maneuver it to the setup location.

Step 3   Position the IGX 8410 in front of the cabinet. This position should be such that the back of the IGX card cage faces the front of the rack. If not already done, remove the foam strips from the sides, front, and back.

Step 4   Remove the attached mounting brackets (filler plates) for the stand-alone version. The mounting brackets for the rack-mount go in these places. See Figure 2-5 for the locations of the mounting brackets.

Figure 2-4 Temporary Spacer Bracket and Mounting Bracket

H8383

Temporary
spacer bracket
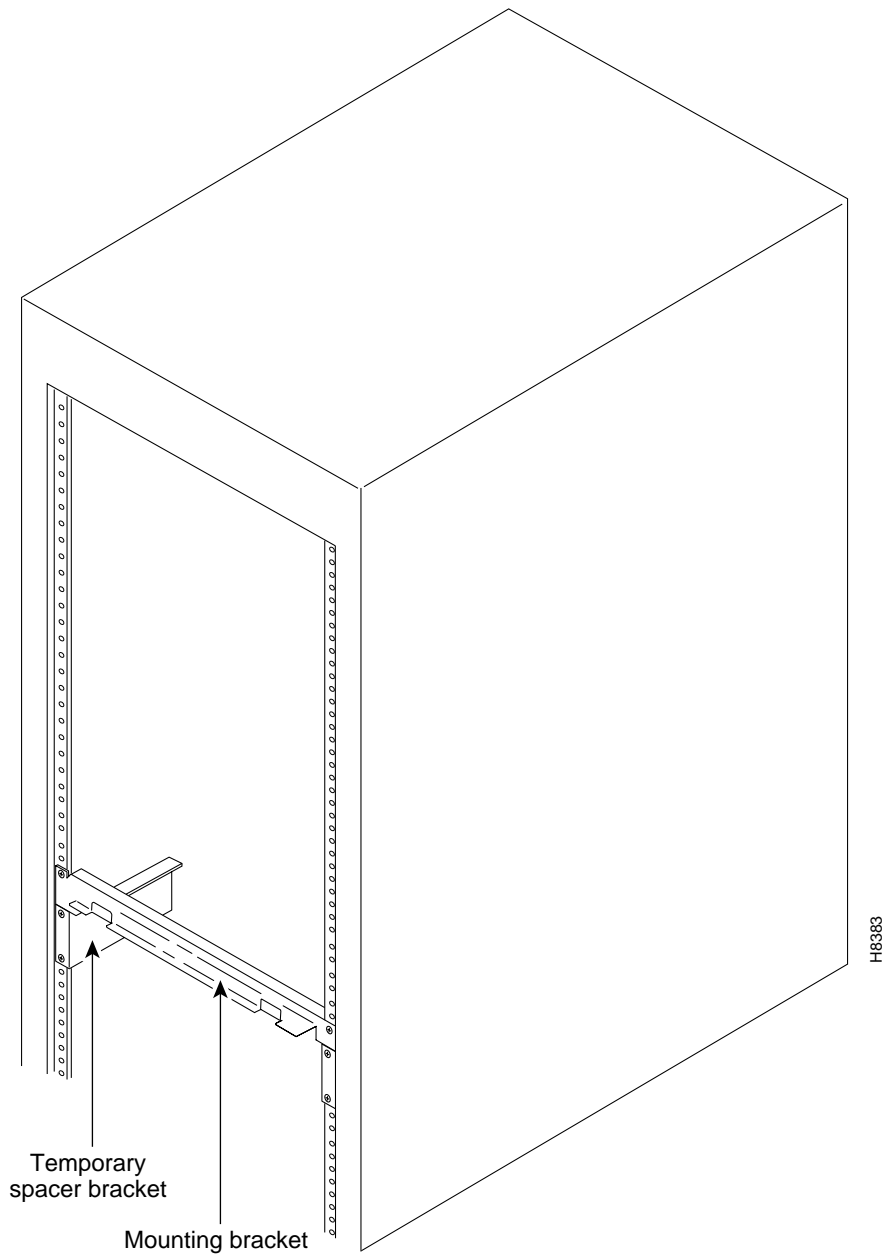
Mounting bracket

Step 5 Attach the front mounting brackets to the IGX 8410.

⚠ **Caution** An IGX 8410 requires a 2 or 3-person lift to put it in the rack.

Step 6 This step requires one person on each side of the IGX card cage. Lift and slide the card cage into the rack at the front of the rack. Slide the IGX 8410 to the back and rest the rear of the system on the temporary mounting brackets and spacer.

Step 7 Secure the front bracket (or mid-mount bracket) to the rack. The mid-mount brackets require the threaded rolling screws which the IGX 8410 kit includes. Attach the IGX 8410 to the rack with eight #10-32 machine screws.

Figure 2-5   Rack-Mount Cabinet
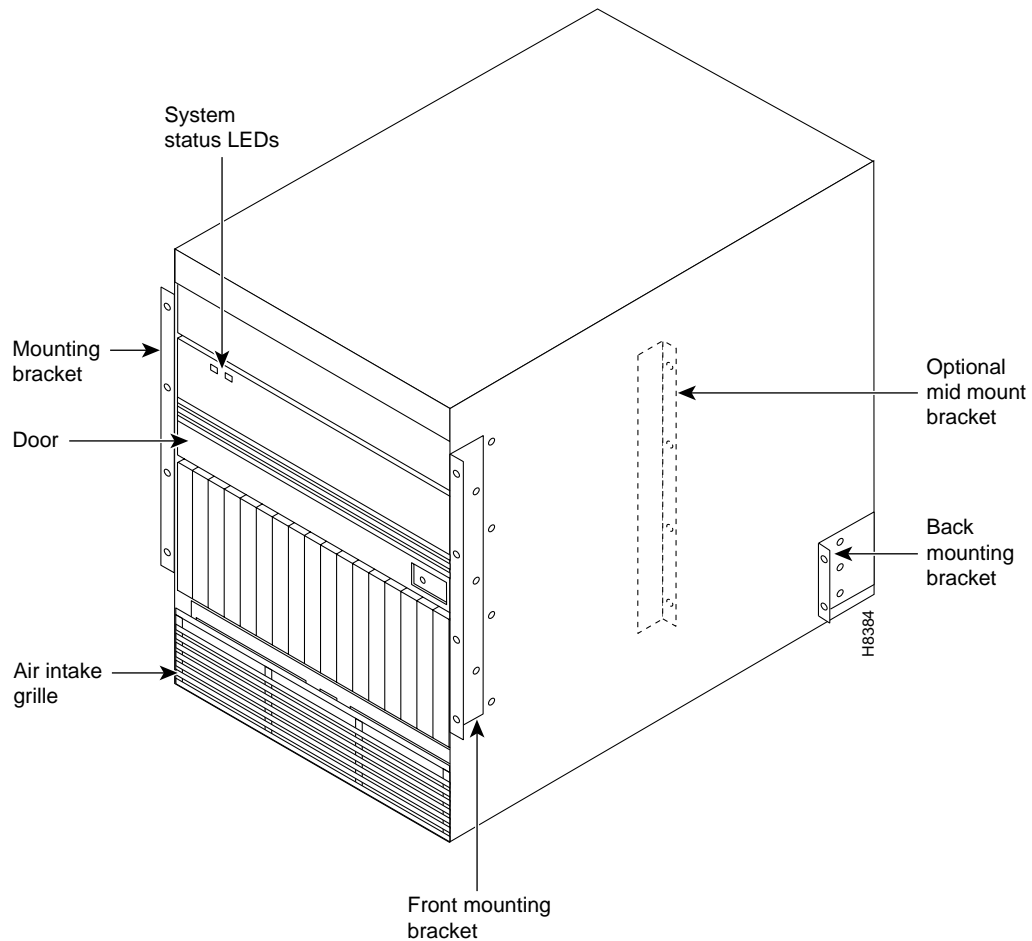
System
status LEDs

Mounting
bracket

Door

Air intake
grille

Optional
mid mount
bracket

Back
mounting
bracket

H8384

Front mounting
bracket

⚠ **Caution**   Make sure that mounting the equipment does not create a hazardous condition due to uneven mechanical loading. The equipment rack should be securely supported.

Step 8   Attach the permanent rear mounting brackets to the rack.

Step 9   Remove the temporary mounting brackets and temporary spacer bracket.

Step 10   If this is a DC-powered system, go to "DC Power Connections" section.

Step 11   Go to the procedures in the chapter titled "Card Installation and Node Startup."

IGX 8420/8430 Enclosure Installation

Installing an IGX requires the following tools and equipment:

- Box knife (or equivalent)

- Flat blade screwdriver set

- Phillips screwdriver set, which must include a No. 1 size for front card installation
  (the No. 1 Phillips comes on a combination tool that Cisco provides for installing Cisco 8400
  series WAN Switching nodes)

- Grounding wrist strap

- A variety of wrenches—possibly including an adjustable wrench or channel locks—for raising and lowering cabinet feet (for example, the Cisco-supplied cabinet requires a 1 3/8" wrench, and the stand-alone requires a 5/8" wrench)

- 5/32" Allen wrench for opening and closing the door latch (comes on a combination tool that Cisco provides)

Rack-mount systems come with the parts described in the assembly instructions.

Stand-Alone System Installation

Because Cisco WAN Switching stand-alone systems come with all components installed in the cabinet, the installation steps consist of placing the unit at its operational location, unpacking it, and verifying the structural and power connection integrity before turning on the power. Note that a stand-alone cabinet is 19.9" wide. The adjustable levelers require a 5/8" wrench. If the system has an AC power source, go to the "AC Power Connections"section. If the system has a DC power source, go to the "DC Power Connections" section.

IGX 8420 Rack Mount Installation

The rack-mount IGX 8420 fits in a 19 inch (48.25 cm.) rack. The front of each assembly has flanges that serve as the front mounting brackets. The assembly kit contains other brackets for different mounting setups. The following order of component installation is the most convenient and efficient. For some of these components, separation sections follow that contain detailed installation steps.

1 Optional AC power assembly

2 Cooling unit

3 Card cage

4 Exhaust plenum

Note that the vertical spacing between components, such as the card cage and fan tray, must be in the range .047" to .077" (0.119 cm to 0.196 cm).

The miscellaneous parts kit for rack systems contains brackets for both a Cisco-supplied cabinet and a user-supplied rack. The kit includes mid-mount brackets for open racks.

The rear-mount brackets attach to the rear vertical rail in a Cisco-supplied cabinet. Each of these brackets has a horizontal flange upon which the back of each IGX component rests. The front of each assembly chassis has flanges that serve as the front mounting brackets.

> ⚠️ **Caution** If an IGX is mounted in a user-supplied cabinet, be sure air can flow unrestricted in and out of the cabinet. For assistance, contact the WANBU TRT through Cisco Customer Engineering.

To install the IGX in a rack:

Step 1 Decide on the IGX location. See Figure 2-6 for dimensions (Figure 2-7 for metric).

> ⚠️ **Caution** When moving a Cisco-supplied cabinet, do not push the cabinet at its sides. Instead, grip its front or back edges.

Step 2   To install the optional AC power supply kit, do the steps in the "Installing the AC Power Supply Assembly" section later in this chapter.

Step 3   To install the cooling unit, do the steps in the "Installing the Cooling Unit" section later in this chapter.

Step 4   Position the IGX card cage so that the back of it faces the rack.

⚠ **Caution**   An empty IGX card cage weighs 75 pounds (34 Kgs.) and requires a 2 or 3-person lift to move into place.

Figure 2-6   IGX 8420 Rack Mounting Dimensions
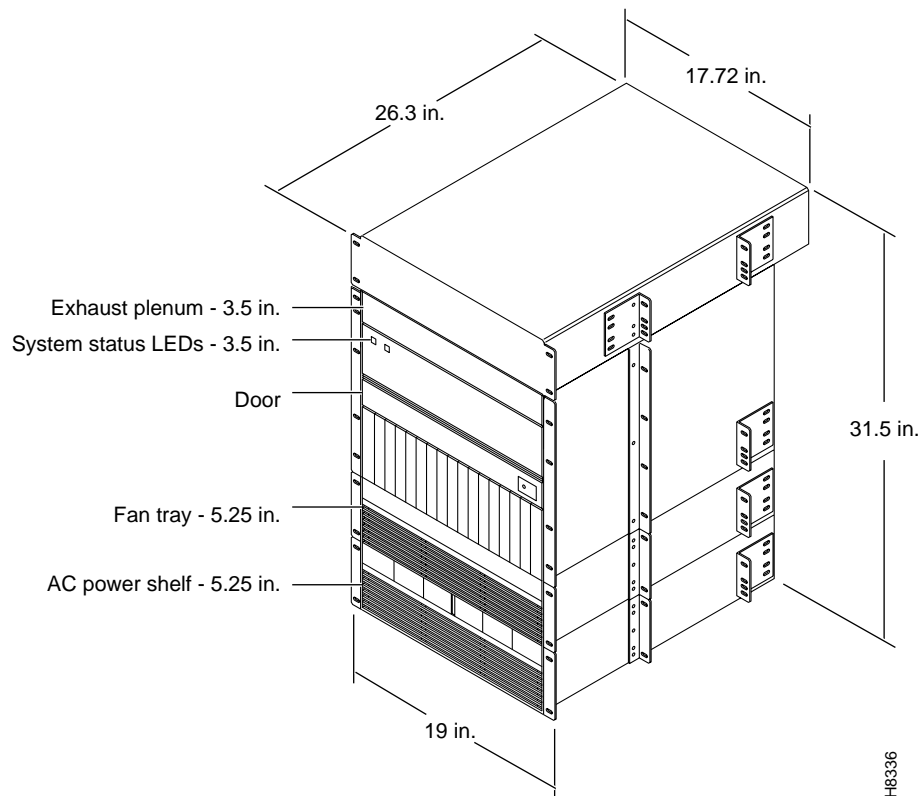
Step 5   With one person on each side of the card cage, lift and slide it into the rack.

Step 6   Attach the cabinet to the rack with 8 #10-32 machine screws (from the kit).

Step 7   For system DC-powered systems, see the "DC Power Connections"section. For AC-powered systems, see the section titled "Installing the AC Power Supply Assembly" later in this chapter.

⚠ **Caution**   Make sure that mounting the equipment does not create a hazardous condition due to uneven mechanical loading. The equipment rack should be securely supported.

IGX 8430 Rack Mount Installation

The IGX 8430 is designed for mounting in a 19 inch (48.25 cm.) equipment rack. The following order of component installation is the most convenient and efficient. For some of these components, separate sections follow that contain detailed installation steps.

1 Optional AC power assembly

2 Lower cooling unit

3 Lower card cage

4 Upper card cage

5 Ribbon cables for connecting upper and lower backplanes

6 Card cage tunnel around backplane ribbon cables

7 Upper cooling unit (also called booster fan unit)

8 Exhaust plenum

The miscellaneous parts kit contains brackets for rack-mounting in either a Cisco-supplied cabinet or a user-supplied rack. The kit includes mid-mount brackets for open racks. For a Cisco-supplied cabinet, the rear-mount brackets attach to the rear vertical rail. Each of these brackets has a horizontal flange upon which the back of an individual component rests. The front of each assembly chassis has flanges that serve as front mounting brackets.

⚠ **Caution**   If an IGX goes in a user-supplied cabinet, be sure air can freely flow in and out of the enclosure. Note also that the vertical spacing between components, such as the card cage and fan tray, must be in the range .047" to .077" (0.119 cm to 0.196 cm).

⚠ **Caution**   When moving a Cisco-supplied cabinet, do not push the cabinet at its sides. Instead, grip the front or back edges.

Step 1   Refer to Figure 2-7 for component dimensions. Note that, although Figure 2-7 shows mid-mount and rear-mount brackets, these brackets are not normally used together.

Step 2   To install the optional AC power supply kit, complete the steps in the "Installing the AC Power Supply Assembly" section next.

Step 3   To install the cooling unit, complete the steps in the section titled "Installing the Cooling Unit" later in this chapter.

Step 4   Install the brackets for the card cages.

Step 5   Position the IGX card cage so the back of it faces the front of the cabinet.

Figure 2-7   IGX 8430 Rack Mounting Dimensions

17.72", 45 cm

26.3", 67 cm

Exhaust
plenum
3.5", 8.9 cm

Booster fan
3.5", 8.9 cm

Card shelf
and door
17.5", 44.5 cm

52.5", 133.4 cm

Cooling unit
5.25", 13.34 cm

AC power
module area
5.25", 13.34 cm

26.3", 67 cm

19", 48.3 cm
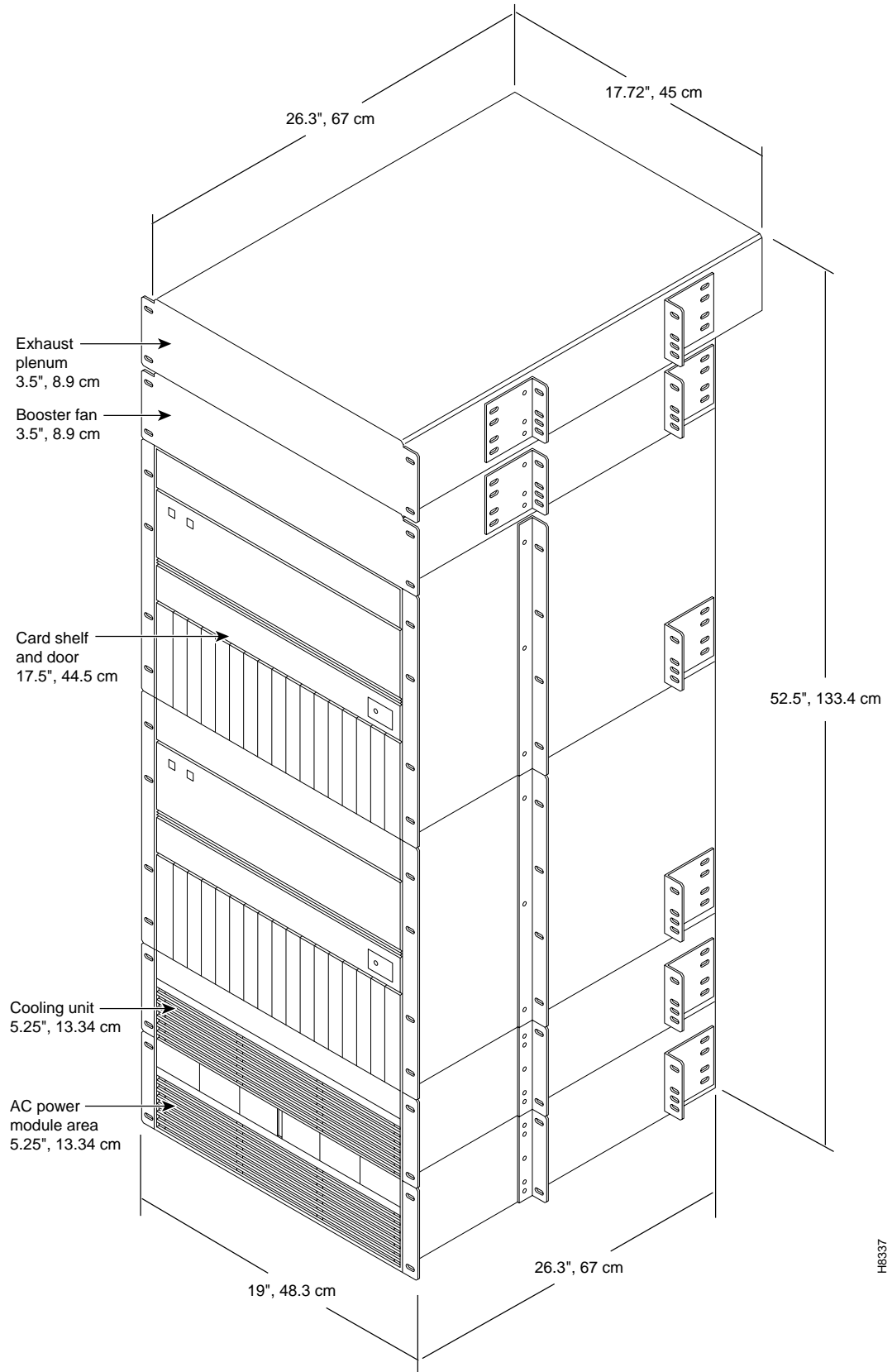
H8337

> ⚠ **Caution** An empty card cage requires a 2 or 3-person lift to move.

Step 6 With one person on each side of the card cage, lift it into the rack. In a Cisco-supplied cabinet, rest the back of the card cage on the rear-bracket flange.

When mid-mount brackets are used, screw the card cage to the brackets with #10-32 machine screws from the miscellaneous parts kit.

Step 7 Secure the front of the card cage to the front of the rack with #10-32 machine screws from the miscellaneous parts kit.

> ⚡ **Warning** Make sure that mounting the equipment does not create a hazardous condition due to uneven mechanical loading. The equipment rack should be securely supported.

Step 8 The folded ribbon cables that connect the upper and lower backplanes pass through a cut-out space in the card cages. The cables connect to two, 100-pin connectors on the front of each backplane. See Figure 2-8. If NPM cards are present, these and possibly other front cards need removing prior to ribbon cable installation.

Connect the cable from the upper connector of the upper backplane to the upper connector in the lower backplane.

Connect the cable from the lower connector of the upper backplane to the lower connector in the lower backplane.

Step 9 A two-piece conduit called the *card cage tunnel* surrounds the ribbon cables and sits in the cut-out space of the card cages. Fit the pieces of the card cage tunnel around the ribbon cables and screw this unified piece into the cut-out space. Figure 2-8 shows the card cage tunnel in its normal location and prior to assembly.

Step 10 Slip the ribbon cables through the fastener clamps, then attach the fastener clamps (which include a self-adhesive base) to the side of the card cage. See Figure 2-8.

Step 11 If this is an AC-powered system, complete the procedures in the section titled "Installing the AC Power Supply Assembly," later in this chapter.

Step 12 If this is a DC-powered system, go to the section titled "DC Power Connections," later in this chapter.

Figure 2-8   IGX 8430 Backplane Connector Cables

Fastener clamp,
ribbon cable

Card cage tunnel
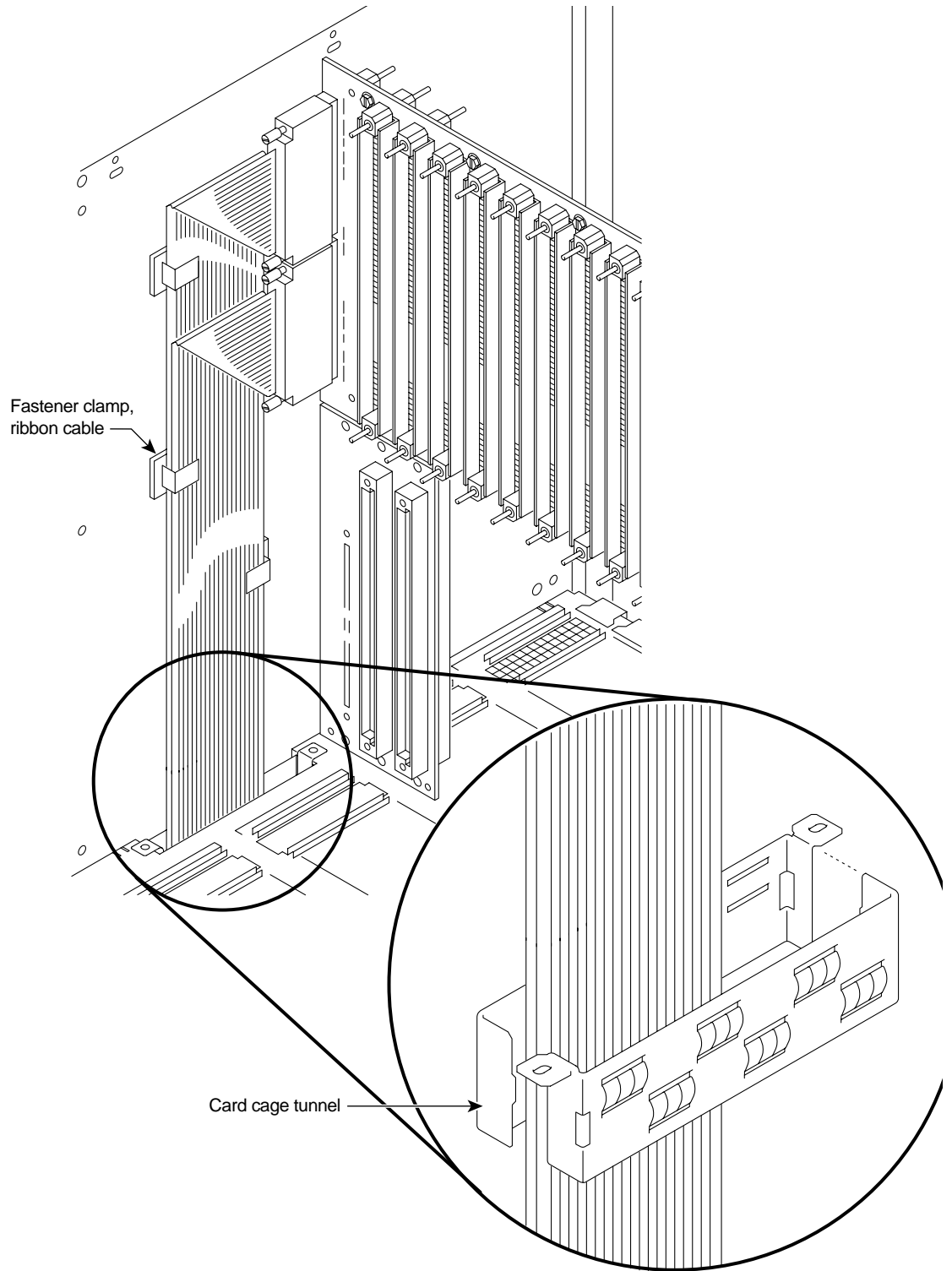
Installing the AC Power Supply Assembly

If the IGX 8420 or 8430 uses an AC power source, proceed with this section. In a rack-mount system, the AC Power Supply Assembly is shipped separately (as are all the other assemblies). The first assembly to install in a rack-mount system is the AC power supply assembly.

The AC power supply assembly consists of the following items:

- Power supplies—up to a maximum of six
- Power supply tray
- Power and sense cables between the AC power module and Power Entry Back Card (PE-BC)
- Dummy cover panels for unused power supply slots
- Mounting brackets and screws
- Air inlet bezel

Power supply installation or replacement requires the following tools:

- Flat blade screwdriver set
- Phillips screwdriver set

Understanding the AC Power Supply Configuration

The setup for power supplies depends on the number of AC power inputs, the IGX model, and the number of cards in the system. The minimum configuration is one AC source and one supply. This minimum number applies to the IGX 8420: with 12 or fewer cards, one supply is enough. Figure 2-9 illustrates the alphanumeric slot designations in a full tray. The paragraphs that follow refer to these designations.

Figure 2-9　　Power Supply Slot Designations
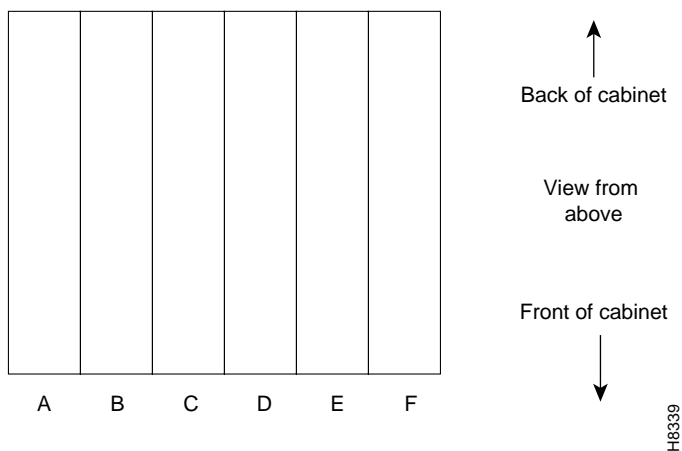
Redundancy

Two types of redundancy exist in the AC power supply configuration. One redundancy is that of AC power inputs. A redundant AC power source from a building circuit that is separate from the other AC circuit provides backup if one AC circuit at the site fails. The other redundancy is that of the 875-Watt power supply modules. Redundancy of the 875-Watt supplies provides a backup if one supply fails.

In supporting the two types of redundancy, power supply arrangements differ, as follows:

- When a system uses two AC inputs, the number of supplies on the left and right sides must match. For example, if a system with dual AC inputs has four supplies, the supplies must occupy slots A, B, D, and E.

- When a system uses one AC source, the number of supplies on the left and right sides can differ. For example, three supplies on the left and one on the right is permissible.

Power Supply Quantities

Table 2-1 shows the required number of power supplies for the different IGX systems. In Table 2-1, the locations for primary (or minimal) power supplies are marked with an X. The primary supplies reflect redundancy of AC inputs and backup supplies. An O indicates a slot that must have a supply because the card cage contains more than 12 cards.

In Table 2-1, the System column lists the IGX model number coupled with the number of AC inputs and whether the single-AC input models have power supply redundancy. The table also shows the slot locations A through F and the part number of the kit that contains all the pieces for the item in the System column. Extra supplies for more than 12 cards (O) are not a part of a kit under Kit Part No. but have another part number. The part number of a supply ordered to fill extra power demands is IGX-AC-PS.

Table 2-1 **Locations of Primary and Additional Supplies**

System	A	B	C	D	E	F	Kit Part No.
IGX 8420: 1 AC input, no power supply redundancy	X	O					IGX16-AC1-1
IGX 8420: 1 AC input, with power supply redundancy	X	X	O				IGX16-AC2-1
IGX 8420: 2 AC inputs	X	O		X	O		IGX16-AC2-2
IGX 8430:1 AC input, no power supply redundancy	X	X	O				IGX32-AC2-1
IGX 8430: 1 AC input, with power supply redundancy	X	X	X	O			IGX32-AC4-1
IGX 8430: 2 AC inputs	X	X	O	X	X	O	IGX32-AC4-2

Note that, with all power supply configurations, locations for the power supplies begin at the lowest lettered slot on either side, and the occupied positions are contiguous. For example, in a dual AC system, insert a supply in A, B, D, and E.

AC Installation in a Rack-Mount Cabinet

The procedures in this section apply to both the IGX 8420 and the IGX 8430 in a rack. (For stand-alone systems, the power supplies are already installed.) To replace a power supply, follow the steps in the chapter titled "Repair and Replacement."

Step 1   Attach the mounting brackets to the frame. For illustrative purposes, Figure 2-10 shows mounting brackets at mid-frame and the back (using rear and mid-mount brackets is not a likely configuration). In this view of the cabinet, the rear bracket shown is labeled with a -00. Brackets on the other side of the system are labeled with a -01.

Figure 2-10   Front of Rack Mount System

Release

Air intake grille

Mounting bracket (marked -00)

Optional midmount brackets

Front flange

H8340
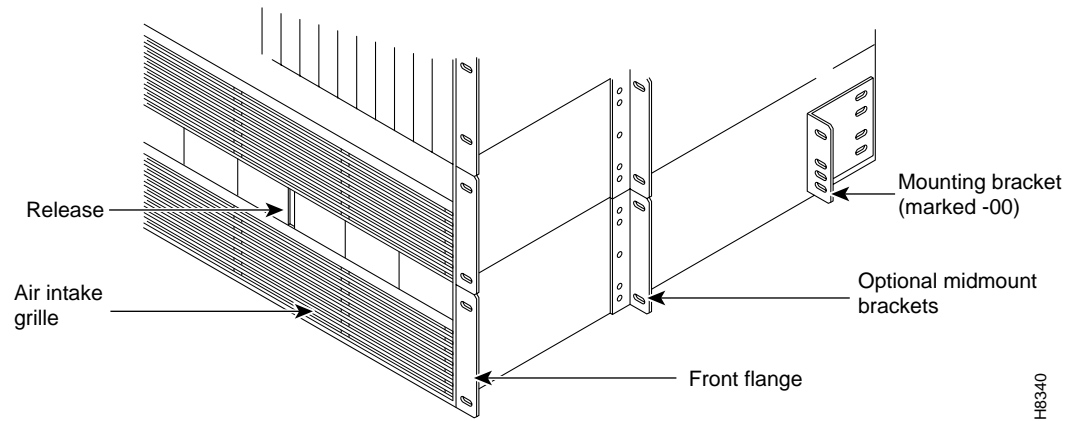
Step 2   This step may require more than one person. If rear-mount brackets are used, slide in the power supply tray so its back rests on the rear bracket.

For a mid-mount rack only, attach the tray to the mounting brackets with the head of each mounting screw on the inside of the tray and each associated nut on the outside of the bracket.

Step 3   Secure the front of the power supply tray with the front screws. When tightening each of the front screws, hold the adjacent front flange of the tray slightly to the outside so the hinged door can freely open and close. See "Front Flange" in Figure 2-10. The space between the right-angle edge of the flange and the edge of the hinged door should be approximately the width of a thumbnail.

Step 4   Install the power supplies. See Figure 2-11 for an illustration of a power supply. When a power supply almost reaches the end of the slot in the tray, a slight resistance is encountered. Push the power supply slightly farther in to achieve the final position and full connector mating.

Step 5   At the front of each supply, secure the supply to the tray by tightening the captive screw at the bottom/front of the supply.

Figure 2-11   Power Supply (Viewed From Front and Left)
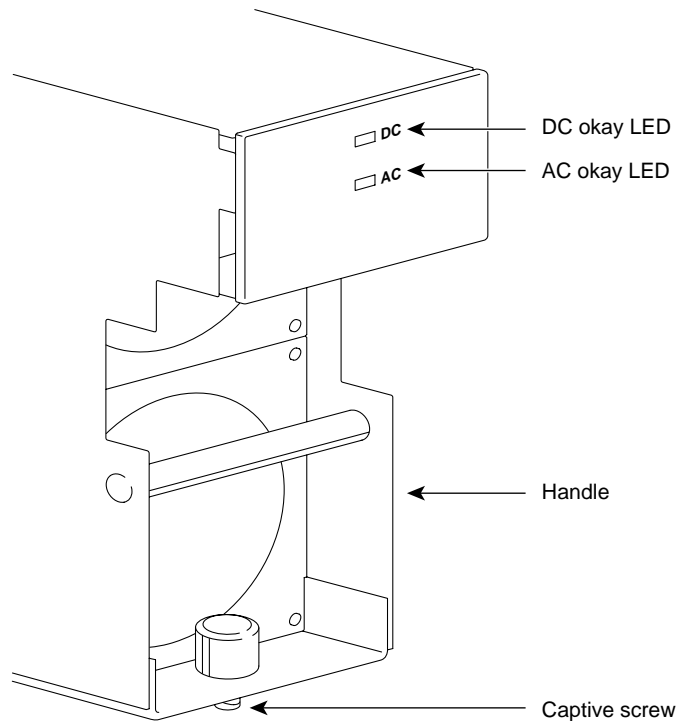
Step 6   For slots without a power supply, the hinged door has a removable, dummy panel.

Step 7   Close the hinged door and secure it with the screw at the top-center of the door. For the
          next step, refer to Figure 2-12, Figure 2-13, and Figure 2-14.

Step 8   Connect the power cables according to the applicable AC configuration shown in
          Figure 2-12. The cables in Figure 2-12 differ only in length: pinouts are identical. Attach
          cable 215982-01 from the far right connector—labeled A 1-16 in Figure 2-13—to the
          lower connector on the upper PE-BC. Figure 2-14 shows where system power connects
          to the PE-BC. It also shows the blank plate over an unused connection. If power supply
          trays D–F contain one or more supplies, run cable 215982-02 from the connector on the
          far left (B 1-16) to the upper connector on the PE-BC. See Figure 2-12 and Figure 2-13.
          For an IGX 32, run cable 215982-00 from the connector labeled 17-32 to the lower
          connector on the lower PE-BC.

Step 9   Attach the cable guard and tighten the captive screw at its base.

Step 10   Go to the "Installing the Cooling Unit" section.

Figure 2-12   Wire Diagrams for Different Power Configurations

Cabling for PS to PE-BC
for IGX 8420, dual AC input

Cabling for PS to PE-BC
for IGX 8420, single AC input

Cabling for PS to PE-BC for
IGX 8430, single or dual AC
input, 3 or fewer supplies

Cabling for PS to PE-BC for
IGX 8430, single or dual AC
input, 4 or more supplies
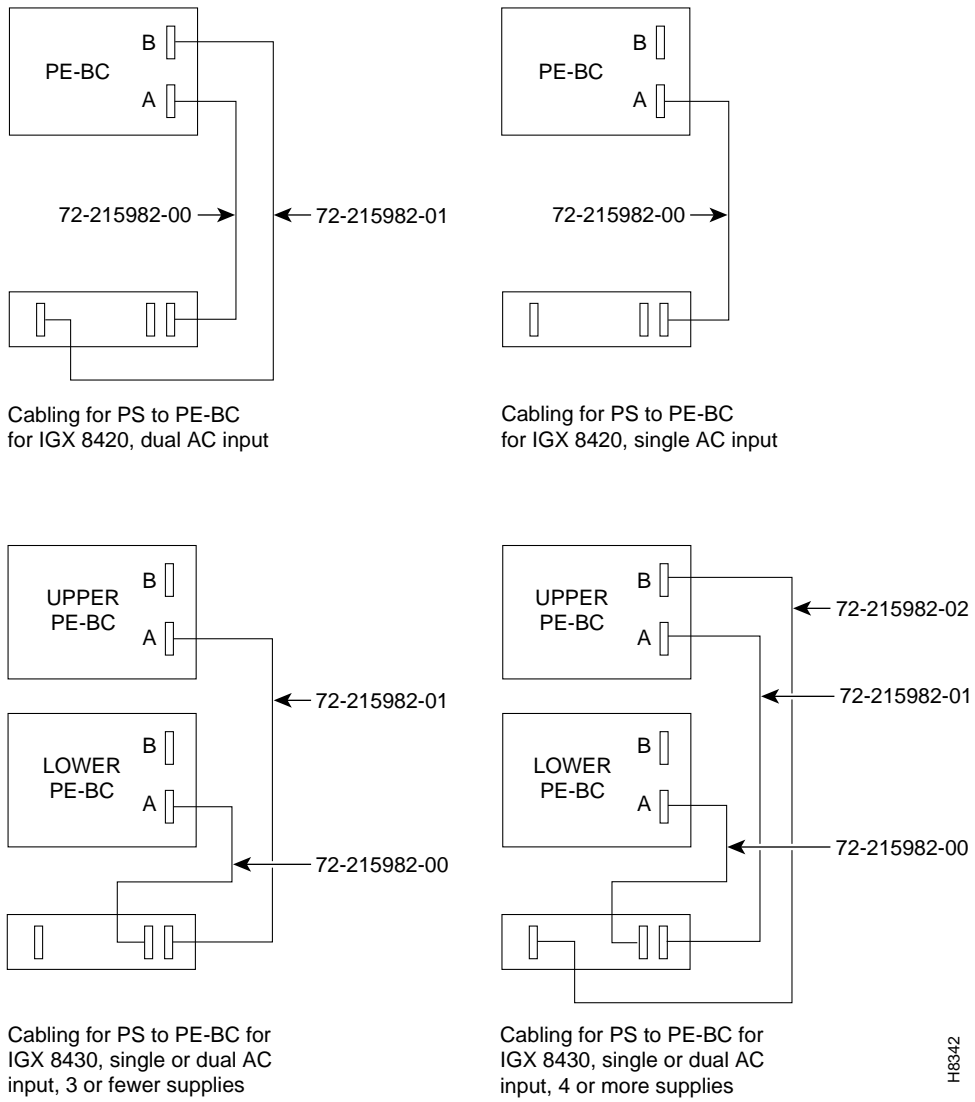
Figure 2-13   AC Power Supply Shelf Back View

B 1-16   17-32   A 1-16
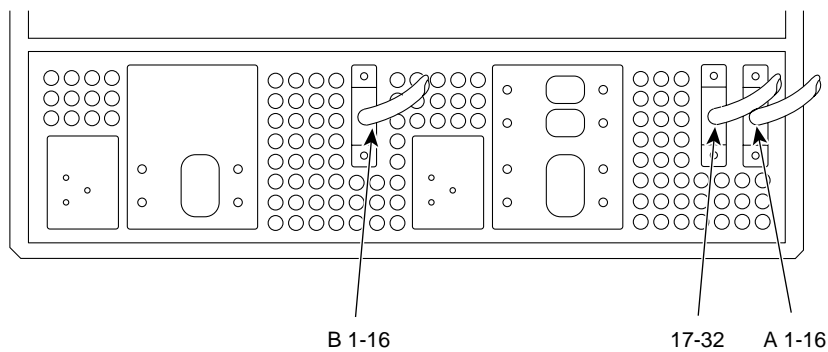
Figure 2-14   Inserting System Power Connector to E-Card, AC-Powered System

Connector (fan 2)

Power connector

Plate for unused connection

Power connector

System power

Connector (fan 1)
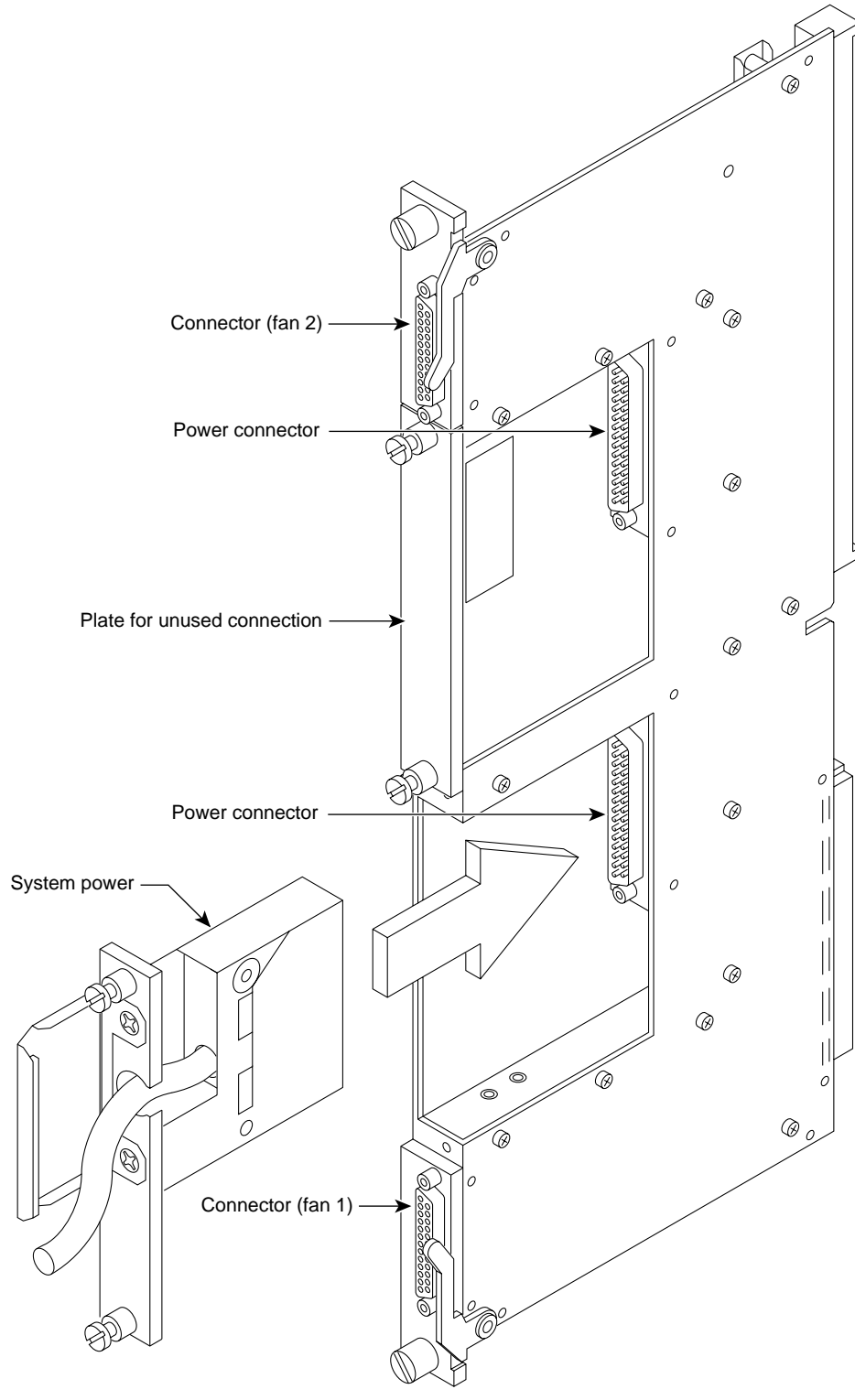
H8302

Installing the Cooling Unit

This section describes how to install the main fan tray (Fan Tray 1) in an IGX 8420 or an IGX 8430 node and the upper or booster fan tray (Fan Tray 2) in an IGX 8430 node. Figure 2-15 shows the main fan tray. Figure 2-16 shows the locations of Fan Tray 1 and Fan Tray 2 in an IGX 8430.

Figure 2-15   Fan Tray Assembly
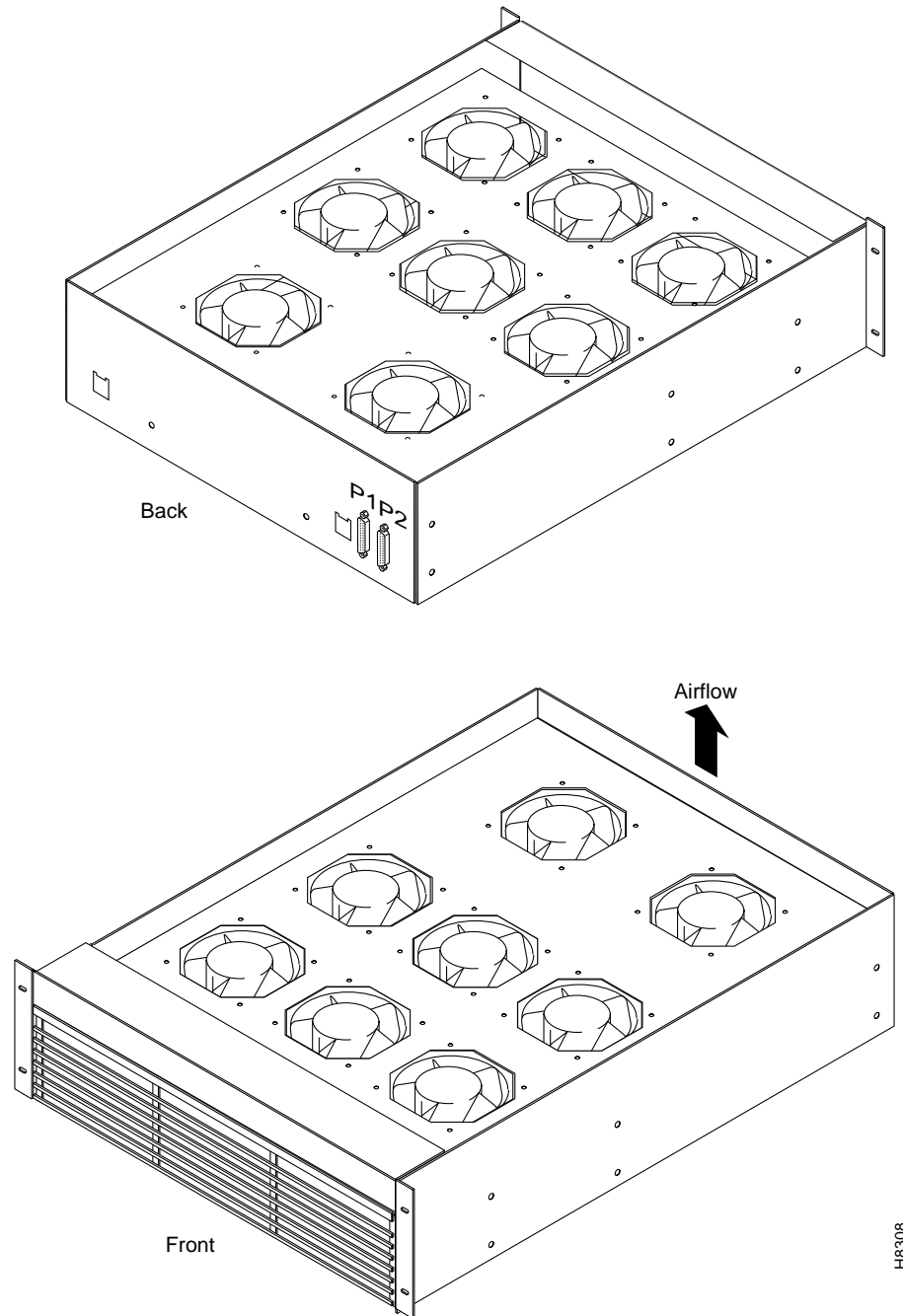
Two cables exist for supplying power to the fans. The short fan power cable is used in both the IGX 16 and the IGX 8430. The long "Y" cable is used in the IGX 8430 only. See Figure 2-16. In an IGX 16, the short cable connects to connector "Fan 1" of the PE-BC.

In an IGX 8430, the short cable goes from the "Fan 2" connector of the upper PE-BC to the power connectors on Fan Tray 2. One branch of the Y cable for Fan Tray 1 is significantly longer than the other branch. The longer branch connects to the "Fan 1" connector of the upper PE-BC. The shorter branch connects to the "Fan 1" connector of the lower PE-BC.

To install the cooling unit assembly:

Step 1   Examine the front and back of the fan tray to become familiar with the setup. Note that, for the bottom fan tray, the captive screws that secure the fan tray are in the front. For the booster fan tray, the captive screws reside at the back of the cabinet.

Step 2   Slide in the cooling unit. and secure it by tightening the four rack screws.

Step 3   On the PE-BCs, plug each D-connector of the appropriate fan power cable into the appropriate PE-BC connector.

Step 4   Plug the power connectors into the fan trays. At the power receptacles on each fan tray, the power connector is a latched housing. Plug P1 into connector P1. Plug P2 into connector P2. Refer to Figure 2-15.

Step 5   Attach the clamp for the fan power cord to the chassis.

Step 6   For lower fan tray installation, attach the air intake bezel.

Step 7   When power is turned on, make sure all fans are running, and execute the command **dsppwr**.

Figure 2-16   IGX 8430 Back View
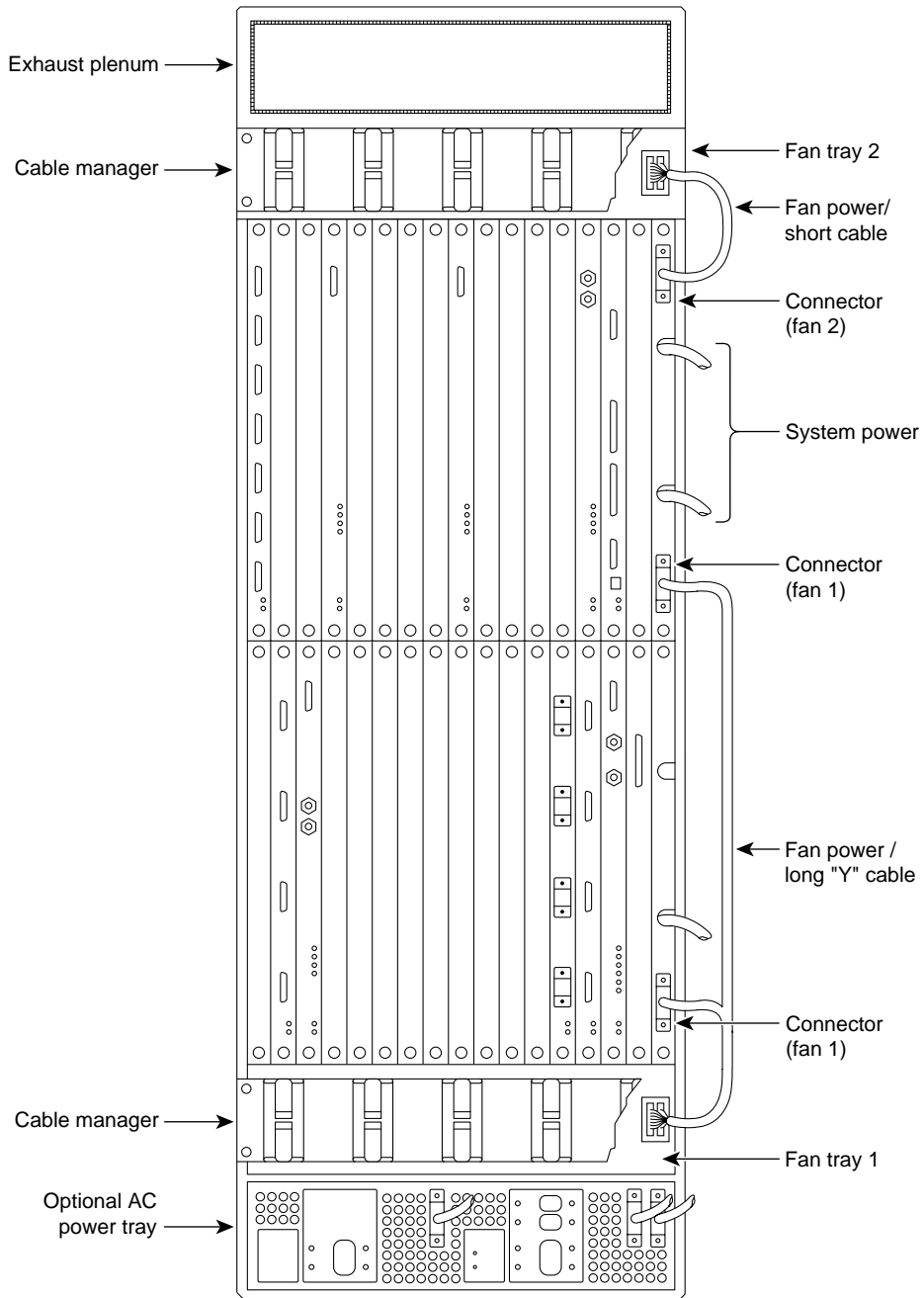
Making Power and Ground Connections

This section contains information on making connections to AC and DC-powered systems.

⚠ **Warning**   Before connecting power, make sure all IGX circuit breakers are off.

Making the Frame Bonding (Ground) Connection

The Cisco-supplied cabinet comes with attached studs (with hardware for securing a ground conductor to the studs) at the top and bottom of the cabinet for securing the grounding conductors. These studs a 1/4" by 20 threads per inch. Figure 2-17 shows the Cisco cabinet with the ground attachment studs in the upper and lower parts of the cabinet.

A stand-alone cabinet has provisions for mounting grounding conductors on the chassis by screws. In the stand-alone cabinet, this provision is a pair of captive nuts (threaded holes) for the screws on the mounting rail of the chassis (1/4" by 20 threads per inch). Figure 2-17 shows the location of the captive nuts and screws in a stand-alone cabinet for securing in the ground attachments.

The attachment points in the Cisco-supplied rack and stand-alone cabinets for the IGX series are indicated by a ground symbol on the cabinet near the point of attachment.

Cisco Cabinet Connections

Cisco recommends the following stacking order for attaching a ground conductor to the frame of a Cisco-supplied cabinet:

Step 1 Place an external, toothed starwasher onto the stud.

Step 2 Place the connector terminating the grounding conductor closed-loop ring or two-hole compression fitting onto the stud.

Step 3 Place another external, toothed starwasher or lockwasher onto the stud.

Step 4 Screw a nut onto the threaded stud.

Stand-Alone Cabinet Connections

Cisco recommends the following stacking order for attaching a ground conductor to the frame of a standalone enclosure:

Step 1 Place an external, tooth starwasher onto the screw.

Step 2 Place the connector terminating the grounding conductor closed-loop ring or two-hole compression fitting.

Step 3 Place another external, tooth starwasher or lockwasher.

Step 4 Screw the entire assembly into the captive nut in the mounting rail beneath the cover plate. See Figure 2-18 for an illustration of this stacking order in an IGX 8420. Figure 2-19 shows the location of the frame bonding connection on an IGX 8410.

Figure 2-17   Frame Bonding Connection in Cisco-Supplied Rack

Frame
bonding
connection

Frame
bonding
connection

H8215
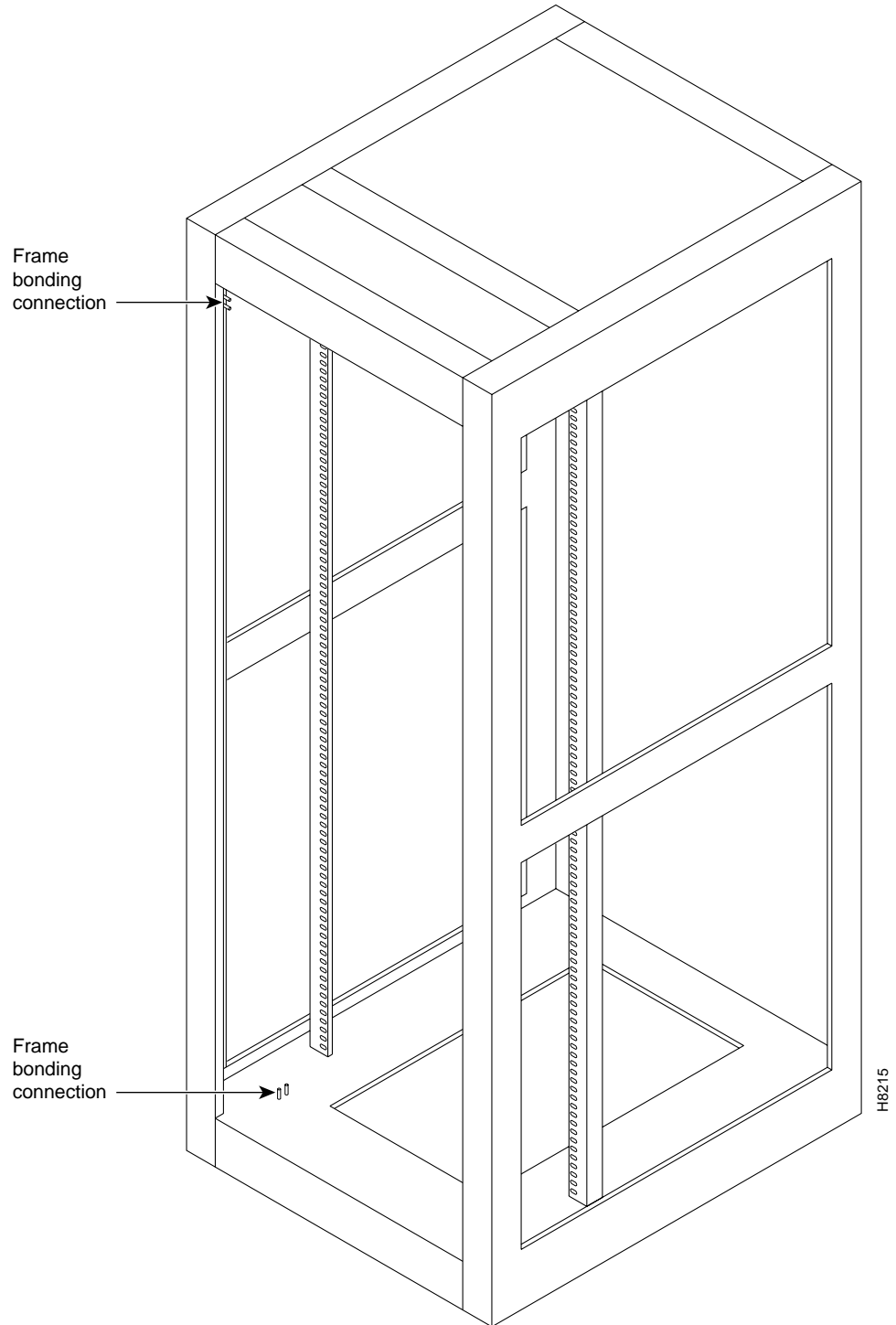
Figure 2-18   Frame Bonding Connections in IGX 8420 Stand-Alone Node

Exhaust plenum

Captive nuts
(for frame bonding
connection)

Cover plate

Mounting rail

Side panel

h8348
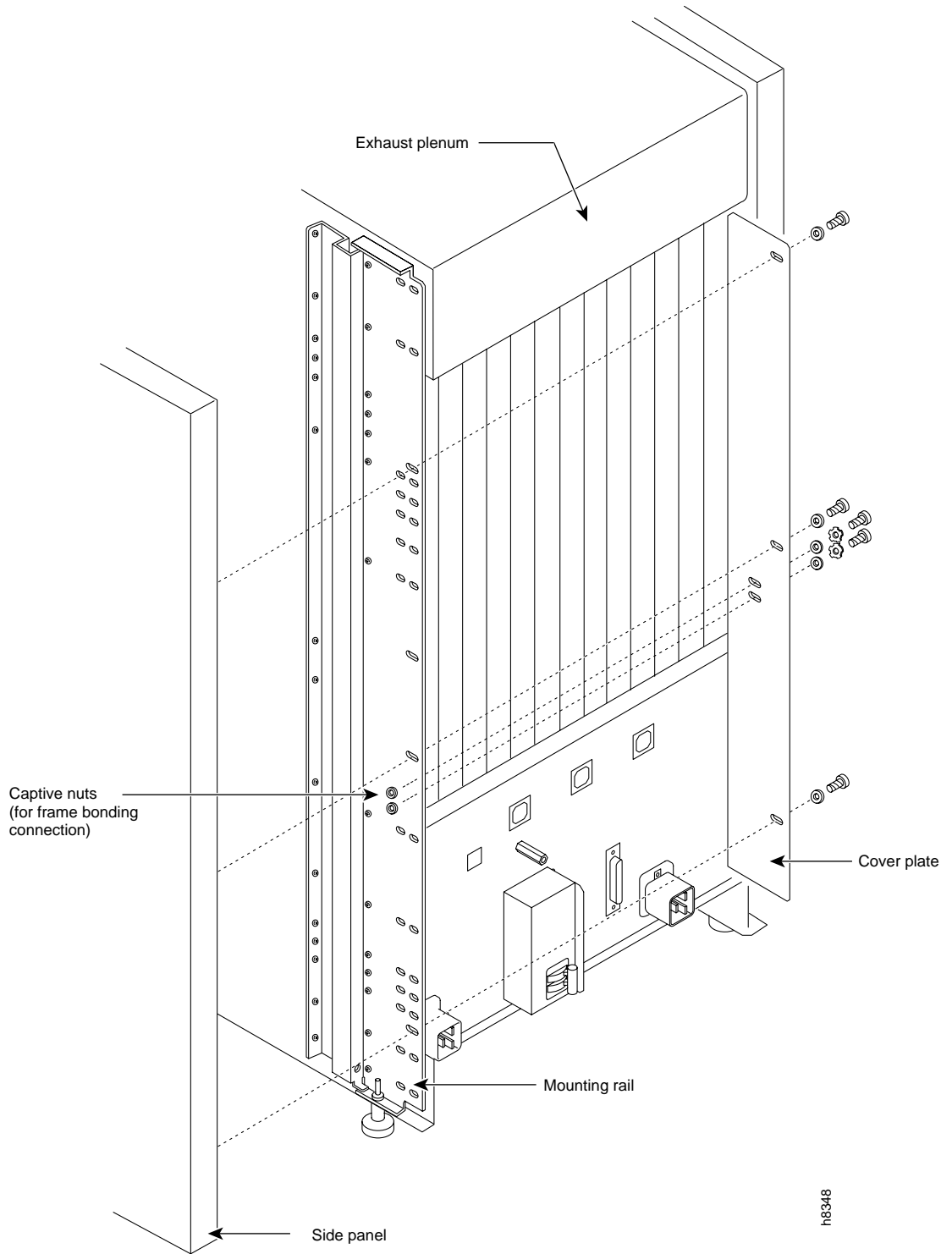
Figure 2-19   IGX 8410 Frame Bonding Connections

PE-BC

H8387

Frame bonding
connection
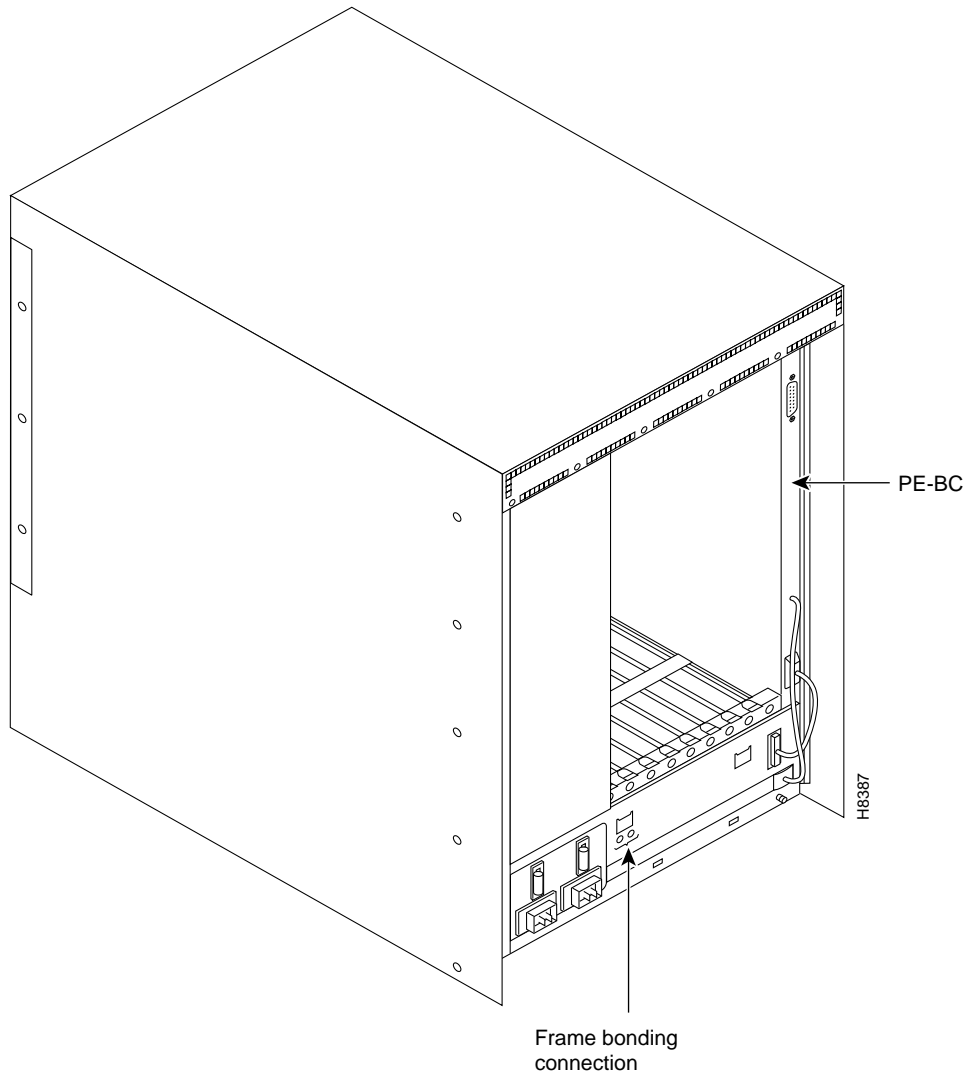
AC Power Connections

Cisco provides at least one, eight-foot (three meter) power cord with each AC Power Supply
Assembly. To make AC power connections to the IGX:

Step 1   Make sure all AC and system power circuit breakers are in the OFF position.

Step 2   Make sure the AC plug wiring has the correct relationship. Figure 2-20 shows the voltage
across the wires in an IGX 8410 plug. Figure 2-22 shows the voltage across the wires in
an IGX 8420/8430 plug.

Figure 2-20   IGX 8410 AC Connection Wiring

L1 ──────────────────────

100 - 240 VAC

L2 ──────────────────────

S5895
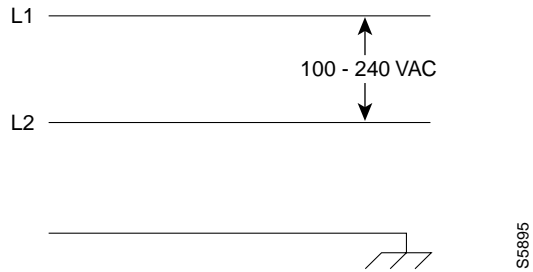
Step 3   Plug the power cord into the IEC connector and tighten the screw on the clamping ring.
See Figure 2-21 for an example of an IGX 8410 and Figure 2-22 for an IGX 8420/8430.

Figure 2-21   IGX 8410 Circuit Breakers
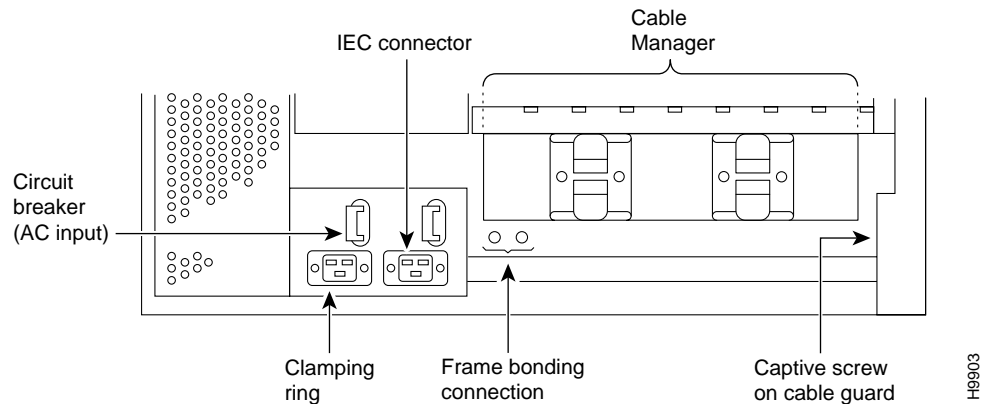
Figure 2-22   IGX 8420/8430 AC Connection Wiring

L1 ──────────────────────

200 - 240 VAC

L2 ──────────────────────

H8397
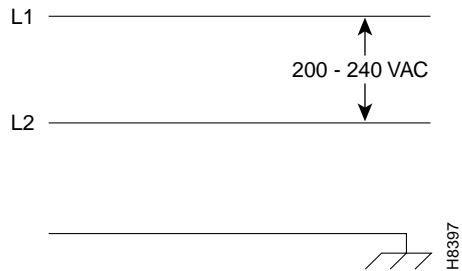
Figure 2-23   IGX 8420 Circuit Breakers
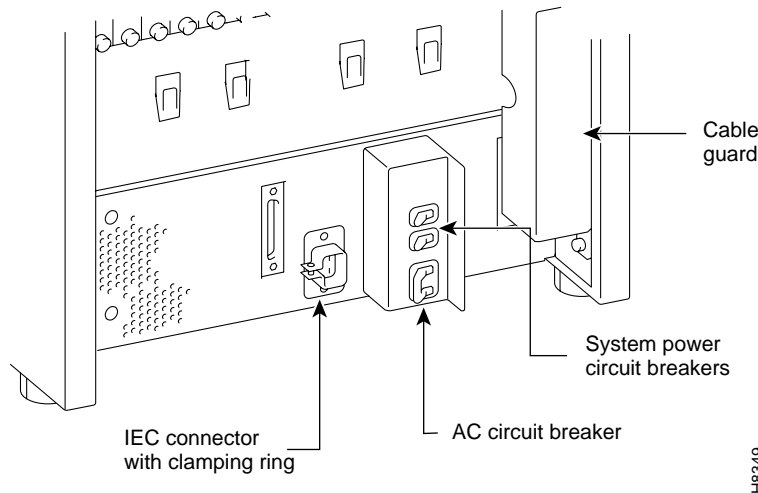
Step 4   Plug the AC power cord into a single-phase wall outlet rated for a nominal voltage.

For an IGX 8410, the AC voltage should be between 200 to 240 VAC or 100 to 120 VAC. The outlet must also be capable of supplying up to 12 Amps (13 Amps in the UK). The building circuit should be protected with a 15 or 20 Amp circuit breaker.

For an IGX 8420 or 8430, the AC voltage should be between 200 and 240 VAC. Each outlet must also be capable of supplying up to 16 Amps (13 Amps in the UK, where the plug has a built-in, 13 Amp fuse). In North America, the building circuit should be protected with a 20 Amp circuit breaker.

Step 5   For the dual power feed version, plug each power cord into a receptacle that connects to a separate building circuit to provide backup if one building circuit fails. Each building circuit should have a 15 or 20 Amp circuit breaker.

Step 6   The ground (green) wire of the AC power cord is connected to the IGX for safety ground. Make sure each AC receptacle in the building is grounded.

Step 7   In addition to the preceding, Cisco recommends that you provide an AC power strip with at least four outlets. Place the strip near the IGX to supply optional modems, CSUs, DSUs, or test equipment. Be sure to connect this power strip to an AC source voltage that is standard for the region (for example, 115 VAC in North America or 230 VAC in Europe).

Note   Neither the AC power supplies nor any other components have test points for checking power supply voltages. For a visual check when power is on, observe whether the AC OK LED and DC OK LED are lit. Also, use the **dsppwr** command to check the state of power supplies.

DC Power Connections

A system that uses a DC power source have one or two configurations, as follows:

- IGX 8410

    — Single power source

    — Dual power source (a separate branch circuit supplies each source)

- IGX 8420

    — Single power source

    — Dual power source (a separate branch circuit supplies each source)

- IGX 8430

    — Single power source for each shelf

    — Dual power source for each shelf (a separate branch circuit supplies each source)

Wiring is connected from one or two –48 VDC power sources to one or two DC PEMs per shelf. Cisco does not provide the wire between the node and the source. Instead, the installer or customer must supply it. These wires should be capable of carrying 20 Amps. The diagrams on the pages that follow show DC wiring for single and redundant DC sources for all IGX models.

- For an IGX 8410 or IGX 8420 with a single DC power source, see Figure 2-24.

- For an IGX 8410 or IGX 8420 with redundant DC power sources, see Figure 2-25.

- For an IGX 8430 with a single DC power source, see Figure 2-26.

- For an IGX 8430 with redundant DC power sources, see Figure 2-27.

Figure 2-24   Single Shelf With Single DC Source
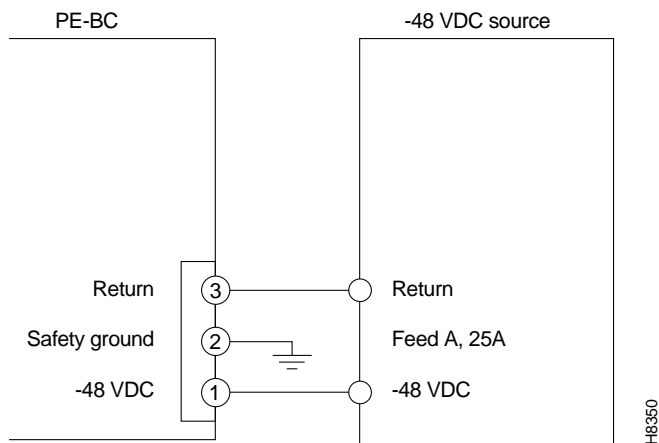
Figure 2-25   Single Shelf With Dual DC Sources
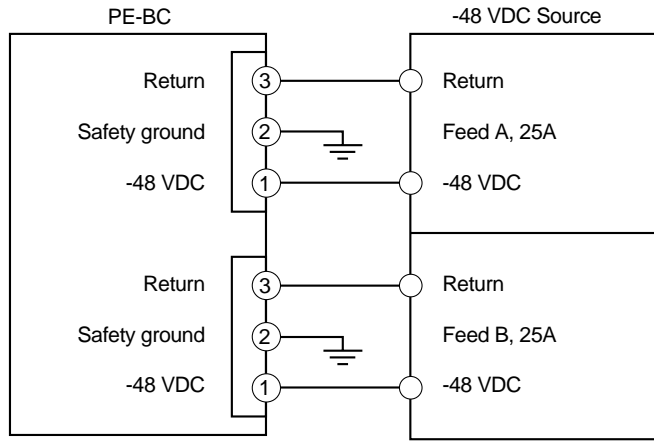
Figure 2-26   IGX 8430 With a Single DC Source
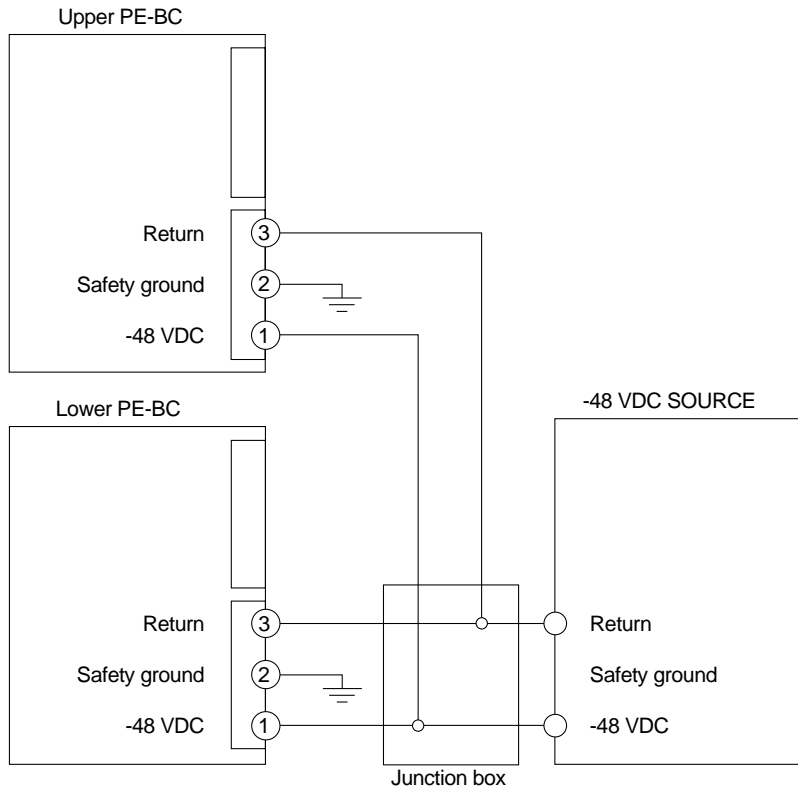
Figure 2-27   IGX 8430 With Redundant DC Sources
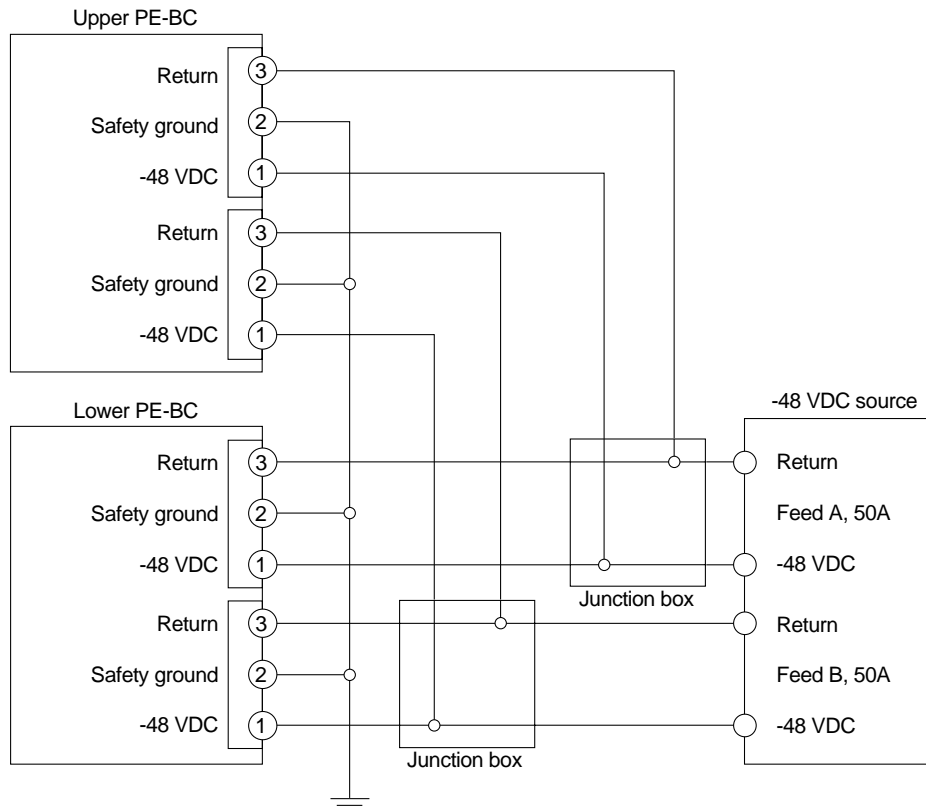
As the detailed steps on the following pages explain, installing DC power consists of attaching the three wires of the DC power source to a removable wiring block, then plugging that block into the connector on the PEM. The PEM is plugged into the PE-BC. Figure 2-28 is a view of a PE-BC (out of the card cage) with the PEM wired up and plugged into the PE-BC. Figure 2-28 shows a non-redundant DC power configuration. Note the blank plate that covers the unused connection.

Note   A DC-powered system makes no distinction between a *primary* and *redundant* PEM (unlike the redundancy scheme in an AC-powered system). However, Cisco suggests putting a label of some type on the PEM to identify the branch circuit to which it goes.

Figure 2-28   PE-BC and DC PEM With Plug

Connector (fan 2)

Redundant

Primary

Circuit breaker

DC receptacle
for pluggable
terminal block

Pluggable terminal block

Customer-supplied wiring

Strain relief mechanism

Connector (fan 1)

H8303
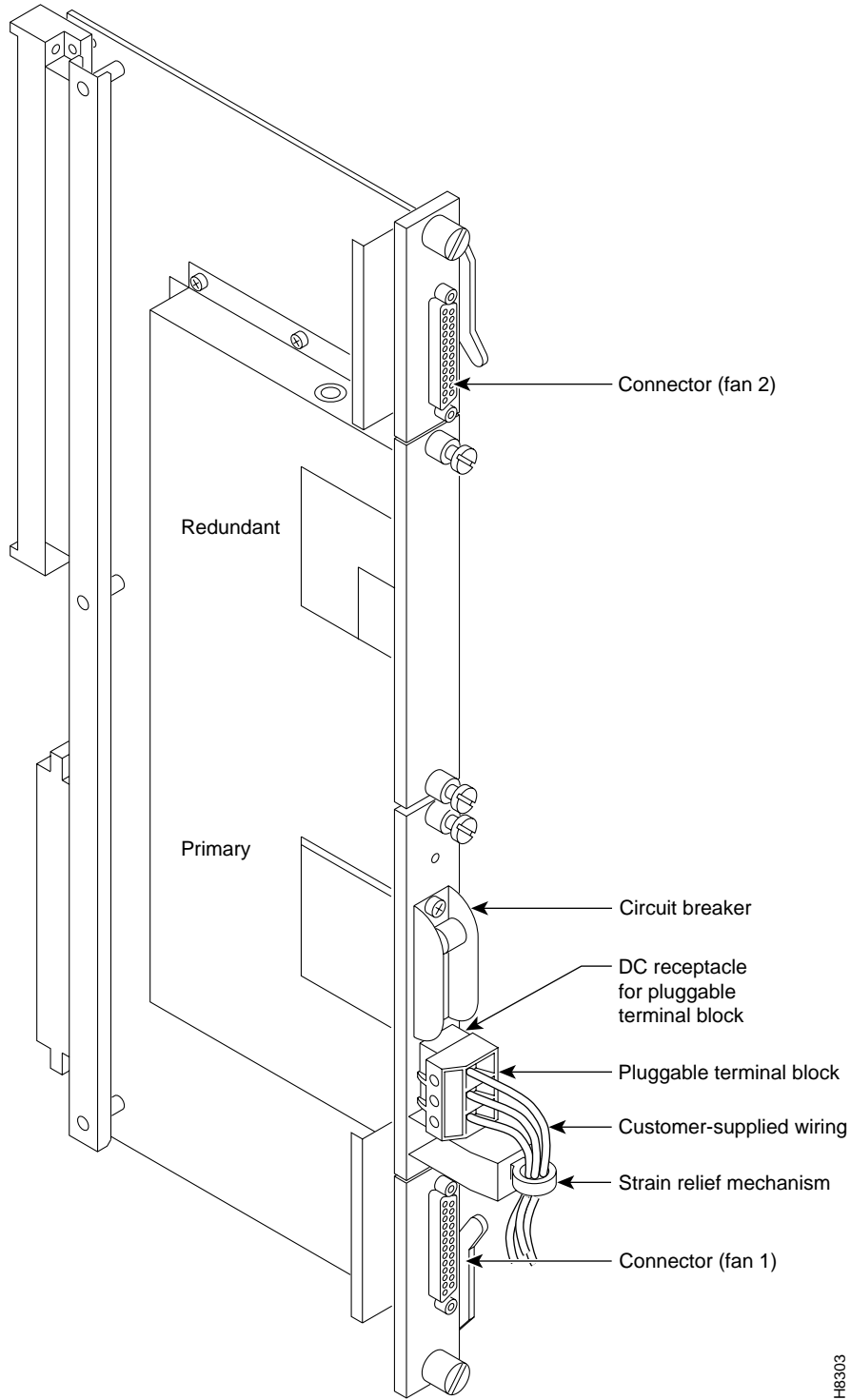
Warning Remember that this is a positive ground system. Ensure that polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity may trip the primary circuit breaker and/or damage the equipment.

Make sure the circuit breaker is in the OFF position.

To make a DC power connection:

Step 1 For both stand-alone systems, the cable guard (located at the right edge of the chassis) remains off until the system is ready to power up. Remove the cable guard by loosening the captive screw at its base then swinging it away from the chassis (do this latter movement holding the top of the cable guard in place while moving the bottom of it away from the chassis).

Step 2 Insert and secure the stripped ends of the wire in the wiring block according to the scheme in Figure 2-29 and Figure 2-30. Figure 2-29 illustrates the polarity of each connection on the pluggable terminal block. The numbers start with 1 at the bottom and go to 3. The connection at the bottom is for the –48 VDC wire. The middle wire is Safety Ground. The connection at the top is for the positive return wire (for the –48 VDC). Figure 2-30 shows the assembly with an example wire and the screw that secures it in the pluggable wire block.

Figure 2-29   Polarities at Pluggable Terminal Block
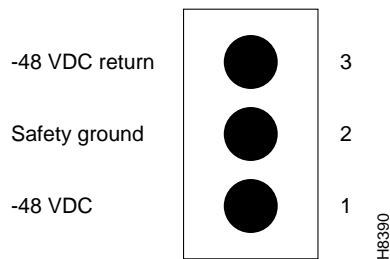
Step 3 Attach the pluggable terminal block to the receptacle on the PEM.

Step 4 Loop the DC wiring through the strain relief clamp.

Figure 2-30 **Pluggable Terminal Block**

48 VDC Return

Safety ground

- 48 VDC

10 - 12 AWG
or 4 sq. mm.

H8304
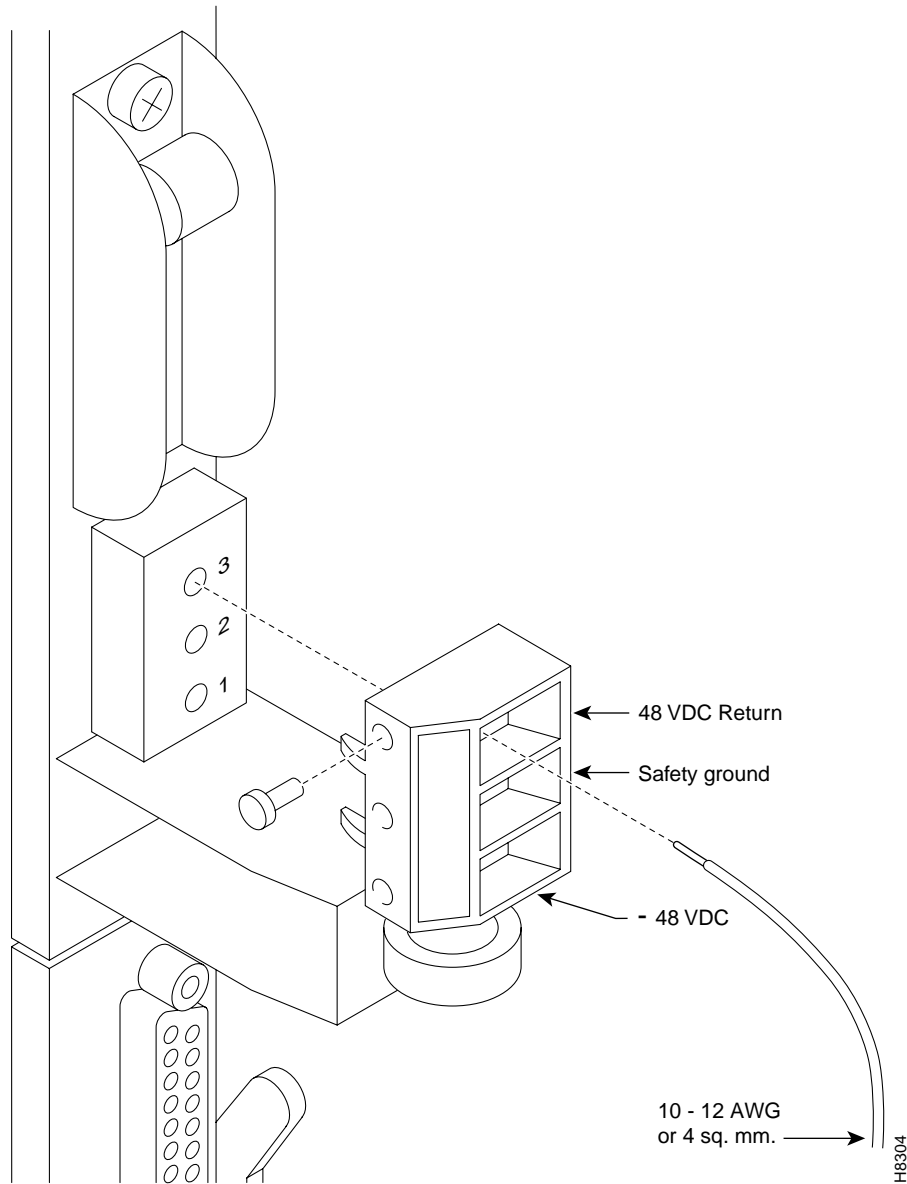
> **Warning** For personnel safety, the green or green/yellow wire must connect to safety (earth) ground at both the equipment and at the supply side of the DC wiring.

Step 5 Connect the DC input wiring to a DC source capable of supplying at least 20 Amps (typical). The –48 VDC power source in the building should have a 25 A DC circuit breaker. The building's wiring should include an easily accessible disconnect device. Make sure the ground wire connects to a reliable building (earth) ground.

Step 6 Leave the cable guard off until power is on.

Step 7   Before you turn on the system power, check the supply voltage. Use the screws at positions 1 and 3 on the pluggable terminal block as a convenient measuring point. Also, check the impedance between the safety ground (screw at location 2 on the pluggable terminal block) and the chassis. It should be close to 0.

Step 8   Turn on the power, and check the voltage at the screws at positions 1 and 3 on the pluggable terminal block.

Step 9   Turn off the power, and go to the chapter titled "Card Installation and Node Startup."

Warning   The building circuit breaker provides primary over-current protection. In North America, this protection should accord with standards NEC ANSI/NFPA70 in the U.S or CEC C22.1 in Canada for excess current, short circuits, and earth faults.

Card Installation and Node Startup

This chapter covers the following topics:

- How and in which slots to install the cards in an IGX node that has arrived without cards already installed. (The rack-mount models of the IGX 8420 and IGX 8430 nodes arrive with cards not installed.)

- Information unique to each card type that applies to bringing up the node and the network.

- Connections to LAN, modem, and printer ports.

- Checklist of readiness before you attempt to bring up the node.

- The commands and steps for bringing up the node and each type of card set in the node.

- Power-up diagnostics.

- IGX configuration summary and IGX management.

Readying the Cards

This section describes card placement in the IGX node. The locations of the system cards depend on the hardware configuration. Reserved slots are for the NPMs and SCM. Primary and redundant NPMs reside in front slot 1 and 2. The SCM must reside in back slot 1. Except for the reserved slots, cards can reside in any slot on the appropriate side of the node (but Cisco recommends that the optional ARM/ARI card set reside in the slot on the far right). Refer to Figure 3-1 for a front view of a shelf with 2 NPMs.

Before you install cards in a rack-mounted IGX 8420 or IGX 8430 node, a step is necessary to indicate to the SCM whether the system is an IGX 8420 or an IGX 32. The step consists of either removing or leaving a jumper switch on the SCM. (For the IGX 8410 node and standalone IGX 16/32 systems, Cisco sets the switch at the factory.) The switch is W6. It sits above component U7P (near the top of connector P2). To indicate an IGX 8430 node, remove the jumper. To indicate an IGX 16, leave the jumper. Make a record of this step so you do not have to remove the SCM later to check it.

Many card sets support Y-cable redundancy. This feature requires an extra set of cards and a Y-cable. A set of commands exist to specify, delete, and display Y-cable redundancy. For instructions on setting up Y-cable redundancy, refer to the setup section for the specific card set.

Note FRM and NTM front cards exist in one or two-piece versions. The two-piece card uses an ACM1. Refer to the *Cisco IGX 8400 Series Reference* for details.

Note A 5/32" Allen wrench is necessary to open the door. The Cisco combination tool (Part No. 218705) has this wrench and a No. 1 Phillips screwdriver for front card screws.

An IGX 8430 node can support a configuration of up to 16 trunk cards. This trunk maximum includes combined NTM and BTM card sets.

Caution Connector pins must align with receptacles. Before card insertion, make sure that pins are straight and that card connectors and the backplane align. Insert the card gently. It may be necessary to push the edge of the card slightly to one side for alignment (this may require removing cards).

The locations for the NPMs and SCMs in an IGX:

- Non-Redundant
    — NPM in front slot number 1
    — SCM in back slot number 1 behind NPM front slot number 1
- Redundant
    — NPMs in front slot numbers 1 and 2
    — SCM in back slot number 1 behind NPM front slot number 1

Figure 3-1 and Figure 3-2 illustrate the front and back shelf views of an IGX 8410 node, respectively. Figure 3-3 illustrates the front shelf view of an IGX 16. Figure 3-4 shows the back of an IGX 8430 node.

Figure 3-1   IGX 8410 Cards, Front View

General purpose card slots
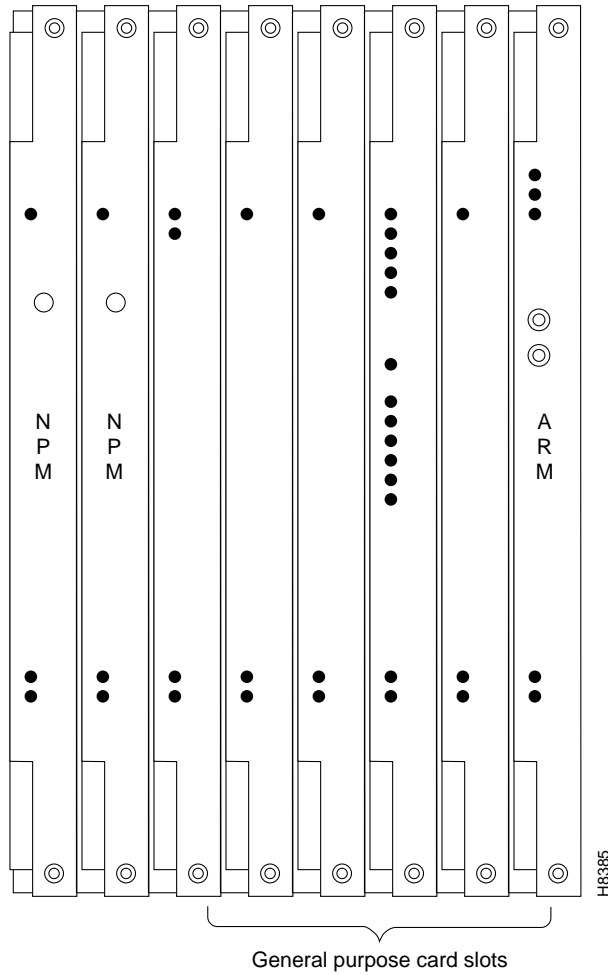
Note   Opening the door requires a 5/32" Allen wrench. Cisco provides this in a combination tool (Part No. 218705).

Caution   When handling the cards, wear a wrist strap to prevent damage to the cards from electrostatic discharge. The IGX 8410 cabinet has an attached wrist strap both at the front and back.

Figure 3-2   **IGX 8410 Cards, Back View**
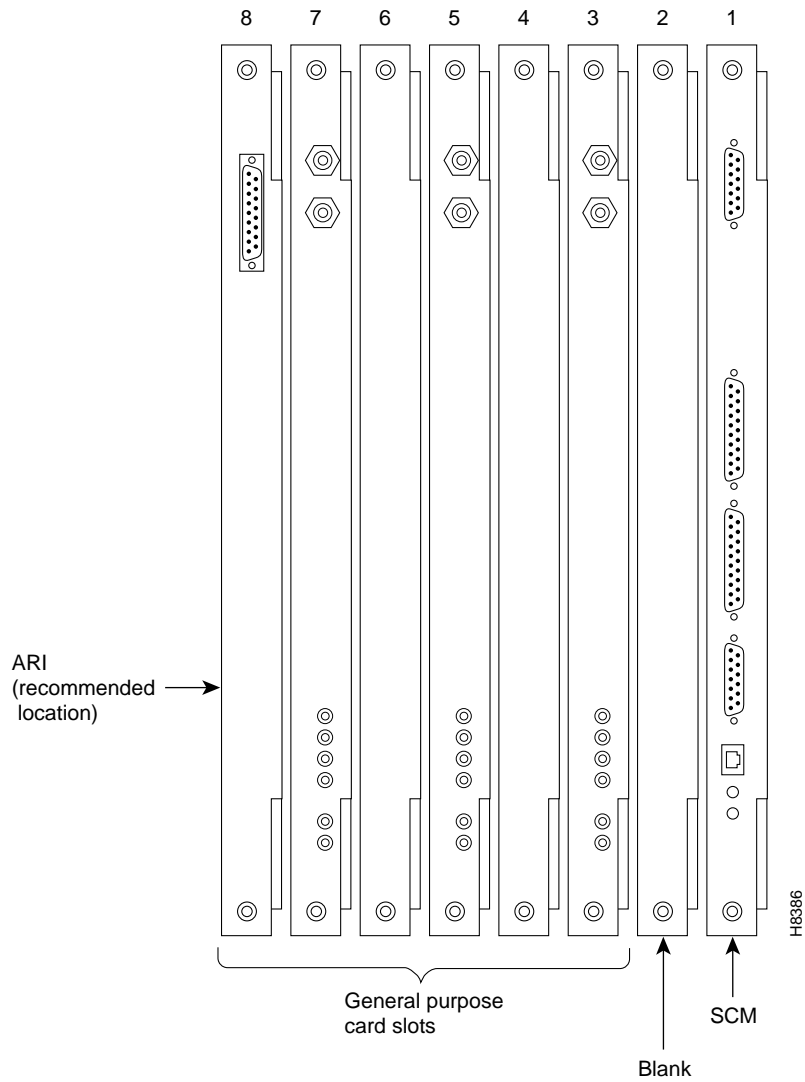
Note   When handling the cards, wear a wrist strap to prevent damage to the cards from electrostatic discharge. The IGX 8410 cabinet has an attached wrist strap both at the front and back.

Figure 3-3   **IGX 8420 Card Shelf, Front View**

General purpose card slots
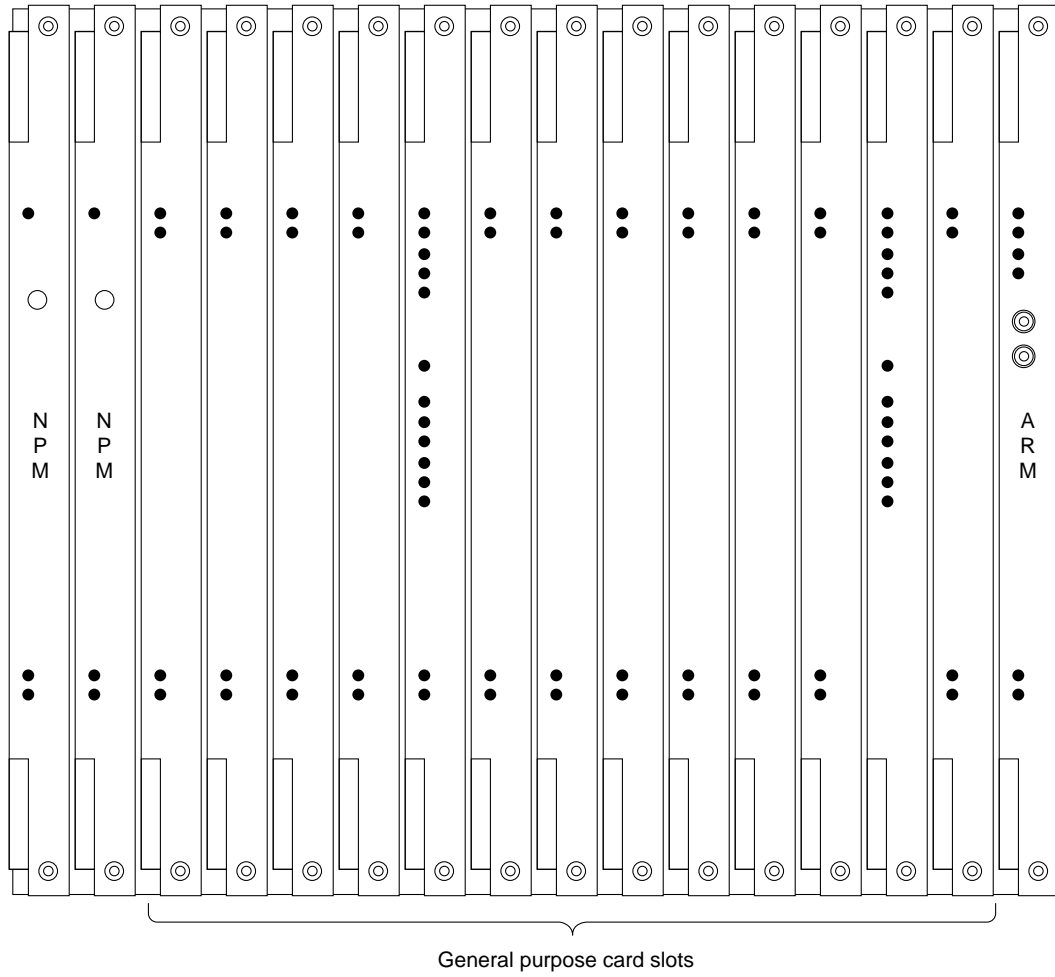
Figure 3-4   IGX 8430 Back View

Exhaust plenum

Cable manager

Fan tray 2

Fan power/
short cable

Connector
(fan 2)

System power

Connector
(fan 1)

Fan power /
long "Y" cable

Connector
(fan 1)

Cable manager

Fan tray 1

Optional AC
power tray
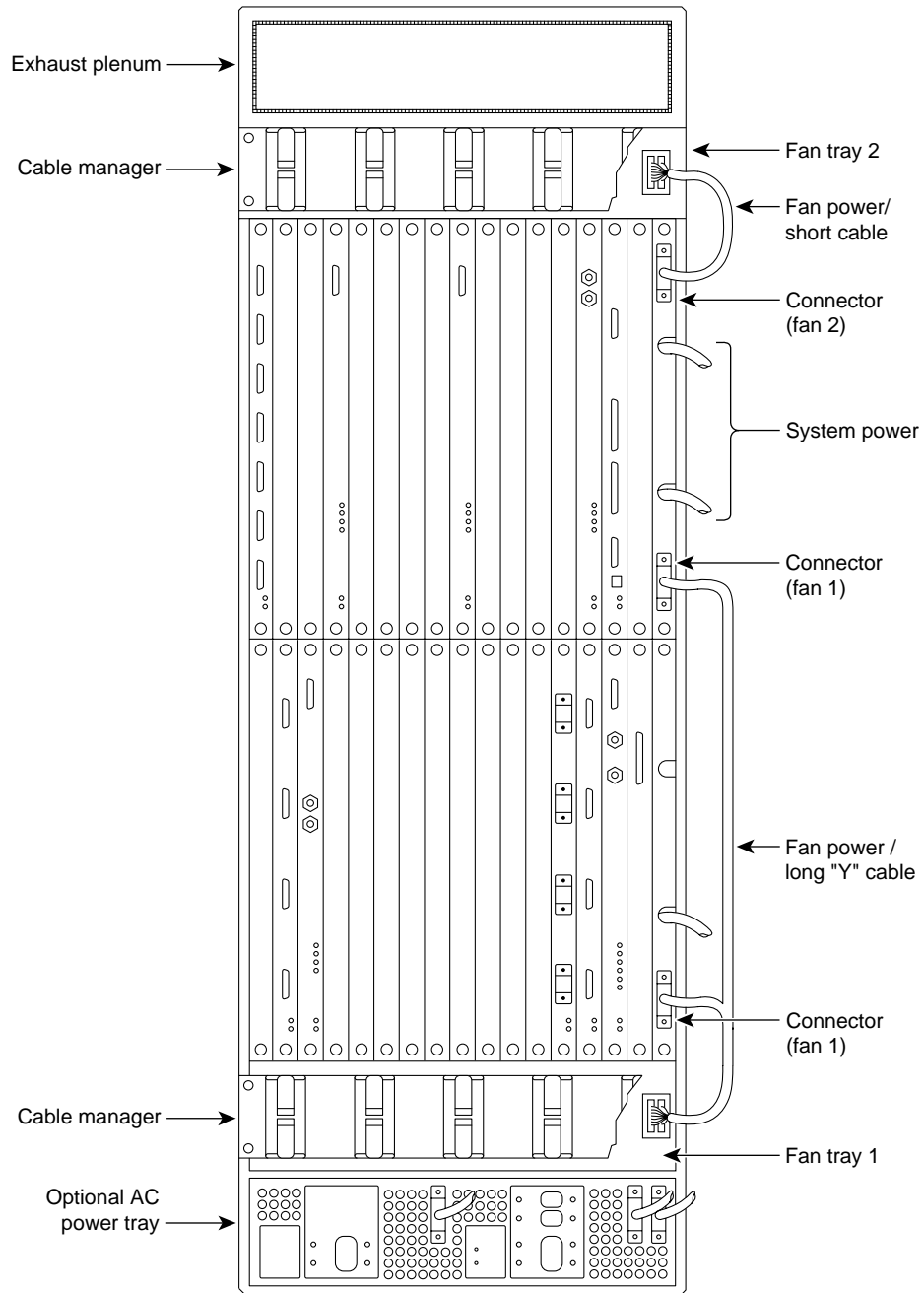
H8347

Making Signal Connections

The remaining sections of this chapter describe how to set up physical lines, ports, trunks, and signal connections. The *Cisco Command Reference* and *Cisco SuperUser Command Reference* provide important details on the commands appearing in this chapter.

The following trunk connections are supported:

- T1

- E1

- Subrate (less than T1 or E1 rates)

- Y1

- T3

- E3

The following service module (or circuit line) connections are supported:

- Channelized Voice/Data

  — T1, E1, or J1

- Data

  — EIA/TIA-449

  — V.35

  — EIA/TIA-232D

  — EIA/TIA-232C

- Frame Relay

  — T1

  — E1

  — V.35

  — X.21

- FastPAD

  — V.35

  — X.21

- ATM

  — T3

  — E3

- Alarm Relay

Connecting Trunks

The sections that follow contain basic information on how to set up the two types of trunks on the IGX node. The two trunk types are FastPacket and ATM. The supported line types are T1, Y1, E1, T3, and E3. The card sets described in this section are the Network Trunk Module (NTM), ATM Line Module B (ALM/B), and Broadband Trunk Module (BTM).

Connecting an NTM T1 or Y1 Trunk

T1 trunk connections use the NTM front card and the BC-T1 back card. Japanese Y1 connections use the NTM front card and the BC-Y1 back card. The procedure for making Y1 connections is the same as for T1 connections described below.

Make the T1 connections as follows:

Step 1 Bring each T1 cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit.

Step 2 Use the cable management feature to help route the cables.

Step 3 Connect the trunks to the connectors on the BC-T1s that are part of NTM/BC-T1 card sets. The T1 lines are attached to DB-15, Sub miniature, 15-pin connectors on the BC-T1 cards.

The back slot line numbers correspond to the back slot number in which the BC-T1 card resides. Record the back slot number of each line. These numbers are necessary for configuring the system after you complete hardware installation.

Note If the number of trunks is odd, connect as many as possible in pairs, and connect the remaining lines in ascending order.

Connecting an NTM E1 or Subrate Trunk

E1 trunk connections use the NTM front card and the BC-E1 back card. Subrate E1 connections use the NTM front card and the BC-SR back card. The E1 Trunk Interface Card BC-E1 contains the E1 trunk connector (G.703 Input/Output) that is located at the top of the back card. The BC-E1 faceplate has four, 75-Ohm BNCs.

Note The BC-E1 faceplate provides two connector arrangements for attaching E1 lines. Use either the two BNC (RX and TX) connectors or the 15-pin DB connector.

Make the E1 connections as follows:

Step 1 Bring each E1 BNC patch cable (or 15-pin cable) through the opening at the top or bottom of the cabinet (whichever applies) and along the back of the unit.

Note Some versions of the BC-E1 use a metal BNC connector instead of a plastic BNC. For terminating 75 or 120 ohm balanced E1 lines at the metal BNC connectors, remove the BNC mounting nuts. This removes the ground that normally appears on one side of the connector shell.

Step 2 Use the cable management feature to help route the cables.

Step 3 Connect the cables to connectors on the BC-E1s that are part of a NTM/BC-E1 card sets.

Record the slot numbers of the NTM/BC-E1 card set. You need these numbers when you configure the system.

Setting Up an ALM/B

The ATM Line Module Model B (ALM/B) provides a T3 or E3 trunk interface. This section describes the requirements for bringing up the ALM/B. For a description of the ALM/B, refer to the *Cisco IGX 8400 Series Reference*.

Before you set it up, note the following characteristics of an ALM/B:

- One receive cable and one transmit cable connect to female BNCs on the BC-UAI-1T3 or BC-UAI-1E3. Use 75-ohm coax cable RG-59 B/U for short runs or AT&T 734A for longer runs. For cabling characteristics, see the appendix titled "Cabling Summary"

- The maximum number of complex gateway connections is 1771.

- All traffic types are supported.

- Y-cable redundancy and (the less common) trunk redundancy are supported.

- The ALM/B *transmits* at the full T3 or E3 rate. In the *receive* direction, however, you can configure the maximum receive rate with the **cnftrk** command. The only configurable parameters are the Receive Packet Rate and the header type.

Note If you need to determine whether an ALM is a Model A or Model B, use the **dspcds** command. If the front card is an ALM/A, the **dspcds** screen shows an ALM with "A*xx*" in the Rev column. If the card is an ALM/B, the Rev column shows "B*xx*."

Attach the cables as follows:

Step 1 Bring each T3 or E3 cable through the opening at the bottom of the cabinet (if applicable).

Step 2 If the unit has the optional cable manager, you can use it to help route the cables.

Step 3 Connect the cables to the BNC connectors on the back cards.

To bring up the ALM/B, take the following steps:

Step 1 Activate the trunk with the **uptrk** command.

Step 2 Using **cnftrk**, specify a maximum receive rate in packets per second (pps) and a header:

- Receive rate range is 1K–192K pps for T3 and 1K–160K pps for E3.

- Specify the header type as STI or NNI

- Optionally select UNI-CAM (Cloud Addressing Mode)

Step 3 Use **addtrk** to add the trunk. Adding the trunk makes it a usable resource, so you can subsequently add connections through StrataView Plus or the CLI (**addcon**). Add the trunk at only one node. If, after you add the trunk, you later determine that some change to the trunk parameters is necessary, you can change certain parameters with **cnftrk** without taking the trunk out of service. See the information on reconfiguring a trunk in the chapter titled "Setting Up Trunks" in the *Cisco Command Reference*.

Step 4 You can set up optional Y-cable redundancy by using **addyred** or trunk redundancy by using **addtrkred**.

After configuring the line with **cnftrk**, use **dsptrkcnf** to check the configuration. During network operation, you can use **dsptrkutl** to see the amount of traffic and percent of utilization on the trunk.

Note The only available debug command for the ALM Model B is **dsptrkutl**.

For a summary of commands you use to bring up an IGX node, refer to the section titled "IGX Configuration Summary" at the end of this chapter.

Setting Up a BTM

The BTM back card can be either a BTI-E1, AIT-T3, AIT-E3, AIT-E2, or AIT-HSSI. Each back card has either a pair of female BNC connectors (one for each direction) or a balanced, D-type connector. For the balanced connectors, use 120-Ohm twisted pair cable. For the BNC connectors, use 75-ohm coax cable RG-59 B/U for short runs or AT&T 734A for longer runs. For cabling requirements, see the appendix titled "Cabling Summary."

Attach the cables to a back card as follows:

Step 1 Bring each cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit.

Step 2 If the unit has the optional cable manager, you can use it to help route the cables.

Step 3 Connect the cables to the connector or (BNC) connectors on the back card.

The following is the command sequence for bringing up the trunk. You must bring up the trunk before you add connections. For complete command descriptions, see the *Cisco StrataCom Command Reference*.

Step 1 Verify the correct card locations in both the local and remote nodes (**dspcds**).

Step 2 Up the trunk at each node (**uptrk**).

Step 3 At each end, configure trunk parameters as required by using **cnftrk**. Refer to the **cnftrk** description in the *Cisco Command Reference* for supported bit rates.

Step 4 Use **addtrk** to add the trunk. Adding the trunk makes it a usable resource, so you can subsequently add connections through StrataView Plus or the CLI (**addcon**). Add the trunk at only one node. If, after you add the trunk, you later determine that some change to the trunk parameters is necessary, you can change certain parameters with **cnftrk** without taking the trunk out of service. See the information on reconfiguring a trunk in the chapter titled "Setting Up Trunks" in the *Cisco Command Reference*.

Step 5 Set up optional trunk redundancy if you require it (**addtrkred**).

For a summary of commands you use to bring up an IGX node, refer to the section titled "IGX Configuration Summary" at the end of this chapter.

Making Connections on an ALM/A

This section describes how to set up an ALM/A. The first part of this section describes the issues to keep in mind before you begin adding connections. The second part lists the steps for hardware installation, bringing up and configuring the line, and adding connections.

Planning for Connections on an ALM/A

Before you add bring up an ALM/A, consider the implementation of the header and the other characteristics of the ALM/A. Note that:

- Receive and transmit traffic use a pair of BNC connectors on the BC-UAI-lT3 or BC-UAI-1E3.

- The maximum number of connections is 1000.

- The supported interface is UNI.

- The supported connection types are CBR and VBR.

- An ALM/A supports network interworking (atfr) and service interworking in transparent mode (atft).

- The only configurable line parameters are the receive rate and the mode of the card. The VPC or VCC header type is the mode of the ALM/A. (The transmit rate is fixed at the T3 or E3 rate.)

- If the endpoints are an ALM/A and an ASI, the header you select with **cnfln** must be VCC.

- Y-cable redundancy is available.

When you specify a header type of VPC or VCC, the type of connections that can terminate on the card and the use of a VCI=0 are affected. If the you put the card in VCC mode by specifying the VCC header type with the **cnfln** command:

- No VPCs can terminate on the card.

- Any VCC can have a VCI=0.

If the you put the card in VPC mode by specifying the VPC header type with the **cnfln** command:

- VPCs can terminate on the card.

- Any connection with a VCI=0 that terminates on the card is a VPC.

- No VCC can have a VCI=0.

Steps for Bringing Up the ALM/A

Note To determine whether an ALM is a line card (UNI) Model A or (trunk) Model B, use the **dspcds** command. If the front card is an ALM/A, the **dspcds** screen shows an ALM with "A*xx*" in the Rev column. If the card is an ALM/B, the Rev column shows "B*xx*." You can also use **dspcd**. If the **dspcd** display states "Supports VC queuing," the card is an ALM/A.

Attach the cabling as follows:

Step 1 Make sure you have correct slot intended for each ALM/A.

Step 2 Bring each T3 or E3 cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit.

Step 3 If the unit has the optional cable manager, you can use it to help route the cables.

Step 4 Connect the cables to the BNC connectors on the back cards.

Step 5 Note the slot location.

To bring up the ALM/A and add connections on it, take the following steps:

Step 1 Activate the card with the **upln** command.

Step 2 For T3 and E3 trunks, use option No. 4 of the **cnflnparm** (or **cnfclnparm**) command to specify a gateway efficiency of 3.0 (3 FastPackets per ATM cell).

Step 3 Using **cnfln**, specify the maximum receive cells per second (cps) and the header type and whether payload scramble is enabled:

- The range for a T3 line is 150–96000 cps. The range for an E3 line is 150–80000 cps.

- Specify the header type as VPC or VCC. With a VCC header type, subsequent use of the **addcon** command requires a VPI and VCI for each connection.

- If appropriate, enable payload scrambling by entering a "y" at the prompt.

Note If both endpoints are ALM/As, the header type for the cards must be the same.

Step 4 Use the **addcon** command to add connections. The applicable syntax depends on the header type you specified with **cnfln** and the type of connection:

- For ATM or cell forwarding connections, the syntax is:

  addcon slot.vpi.vci remote_node slot.vpi.vci {*abr* | *vbr* | *cbr*} cps [*queue_size*]

  where *cps* is cells per second for the receive rate.

  If you do not enter the optional queue size, the system calculates a queue size based on the cell rate. To see the queue size after you add a connection with a calculated queue size, use **dspcon**.

- For ATFR connections (where the far end card is a UFM, FRM, or FRP), the syntax is:

  addcon *slot.vpi.vci remote_node slot.port.DLCI cls*

  where *cls* is the frame relay class.

- For ATFT connections, the syntax is:

  addcon *slot.vpi.vci remote_node slot.port.DLCI* atft *cls*

  where *cls* is the frame relay class.

After configuring the line with **cnfln**, use **dsplncnf** to check the configuration. During network operation, the **dsputl** command shows the amount of traffic and percent of utilization on the line.

Note The only available debug command for the ALM/A is **dsputl**.

For a summary of commands you use to bring up an IGX node, refer to the section titled "IGX Configuration Summary" at the end of this chapter.

Installing Voice Cards

This section describes how to install the voice cards. The two voice card sets are the Channelized Voice Module (CVM) and the Universal Voice Module (UVM). These cards can also carry *channelized* data. The *serial* data card sets are the HDM and LDM. This section also describes the considerations for using the TDM Transport feature on the CVM.

Connecting a CVM to a T1 or J1 Line

Voice or data connections on a T1 line use the CVM front card and the BC-T1 back card. Japanese J1 connections use the CVM front card and the BC-J1 back card. The procedure for making J1 connections is the same as for T1 connections. Make the T1 connections as follows:

Step 1   Bring each cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit.

Step 2   Use the cable management feature to help route the cables.

Step 3   Connect the trunks to the connectors on the BC-T1s that mate with the CVM (not NTM). The T1 lines are attached to DB-15, sub-miniature, 15-pin connectors on the BC-T1 cards.

The back slot line numbers correspond to the back slot number in which the BC-T1 card resides. Record the back slot number of each line. These numbers are necessary for configuring the system after you complete hardware installation.

Note   If the number of lines is odd, connect as many as possible in pairs, and connect the remaining lines in ascending order.

Connecting a CVM to an E1 Line or a Subrate Trunk

Channelized voice or data connections on an E1 line use the CVM front card and the BC-E1 back card. Subrate E1 connections use the CVM front card and the BC-SR back card. The E1 Trunk Interface Card BC-E1 contains the E1 connector (G.703 Input/Output) that resides at the top of the back card. The BC-E1 faceplate has four, 75-Ohm BNCs.

Note   The BC-E1 faceplate provides two connector arrangements for attaching E1 lines. Use either the two BNC (RX and TX) connectors or the 15-pin DB connector.

Make the E1 connections as follows:

Step 1   Bring each E1 BNC patch cable (or 15-pin cable) through the opening at the bottom of the cabinet (if applicable) and up the back of the unit.

Note   Some versions of the BC-E1 use a metal BNC connector instead of a plastic BNC. For terminating 75 or 120 ohm balanced E1 lines to the metal BNC connectors on these back cards, remove and discard the BNC mounting nuts. With the mounting nuts removed, the ground that normally appears on one side of the connector shell is also removed. This step is not required for DB15 connectors or for back cards that use the plastic BNC connectors.

Step 2   Attach the cabling to connectors on the BC-E1s that mate with the CVM (not an NTM).

Step 3   Use the cable management feature to help route the cables.

The back slot line numbers correspond to the back slot number in which the BC-E1 card resides. Record the back slot number of each line. These number are necessary for configuring the system after installation is complete.

The next section describes a specialized version of data transmission service called TDM Transport. It applies to older, non-Cisco WANs.

TDM Transport on the CVM

This section describes how to plan for use of the Time Division Multiplexing Transport (TDM Transport) feature. Note that TDM Transport requires Rev. C firmware on all connected CVMs or CDPs that use this feature. Refer to the TDM Transport description in the *Cisco StrataCom IGX Reference* for details on Rev. C firmware features and limitations. Refer to the *Cisco Command Reference* for a description of the command parameters in related commands.

Before adding a bundled connection under TDM Transport, consider the following:

- If a connection uses a T1 trunk, use **cnftrk** to configure the line coding for B8ZS instead of ZCS.

- Add the least number of bundled connections to create the data channels.

- The longest delay for a connection determines the end-to-end delay for the entire transparent circuit through the network.

- The *Maximum Network Delay* is the sum of maximum queuing delays for the trunk cards over which an individual connection is routed. The Maximum Network Delay for a high-speed data connection is 45 ms. Specify this limit using the **cnfsysparm** command.

- The *total* delay for a connection is defined as the sum of the propagation and trunk queuing delays. The total delay for a connection cannot be more than 25 ms different from the total delay for any other connection on the same card. The user is responsible for configuring the connections so that no difference between total delays exceeds 25 ms. If the 25 ms is exceeded, an error message is generated in the form *CC*0700d6, where *CC* is the slot number.

- In System Software 8.2, add the connection with **addcon** using 7/8 coding even though the system internally uses 8/8 coding. This causes the system to reserve the additional bandwidth required for the TDM Transport feature.

Connecting a UVM to T1 Lines

Voice or data connections on a T1 line use the UVM front card and the BC-UVI-2T1EC back card. The procedure for connecting the T1 lines is as follows:

Step 1   Bring each cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit. Install optional Y-cables as needed. You can use the cable management feature to help route the cables.

Step 2   If the intended compression for voice channels is LDCELP and the number of channels on a T1 line exceeds 16, install cabling for pass-through. Note that the UVM does not pass-through t-type connections. For the steps that follow, refer to Figure 3-5 for an illustration of the possible UVM cabling arrangements. Note that, in Example B, the number of channels has not exceeded the UVM capacity, so pass-through is unnecessary.

- On port 1 of the primary UVM, connect the cable to the CPE.

- On port 2 of the primary UVM, connect the cable to port 2.

- Connect the cable from port 2 of the primary card to either port 1 or port 2 of the secondary UVM. Typically, if the secondary UVM is supporting the passed-through channels from only one primary UVM, you would connect the cable from port 2 of the primary card to port 1 of the secondary card. However, because the secondary UVM can receive 16 passed-through channels with LDCELP compression, you can pass 8 channels each from other UVMs.

- If the secondary UVM is supporting an additional 8 channels with LDCELP, connect the cable between the port 2 of the secondary UVM and the other primary UVM.

For a description of the pass-through feature, refer to the *Cisco IGX 8400 Series Reference*.

Record the back slot number and port number of each line. These numbers are necessary for configuring the system after you complete hardware installation.

Figure 3-5   **Pass-Through and Standard (External) UVM T1 Cabling**

A. External line — UVM

B. One pass-through line — UVM 1, UVM 2

C. Two pass-through lines — UVM 1, UVM 2, UVM 3
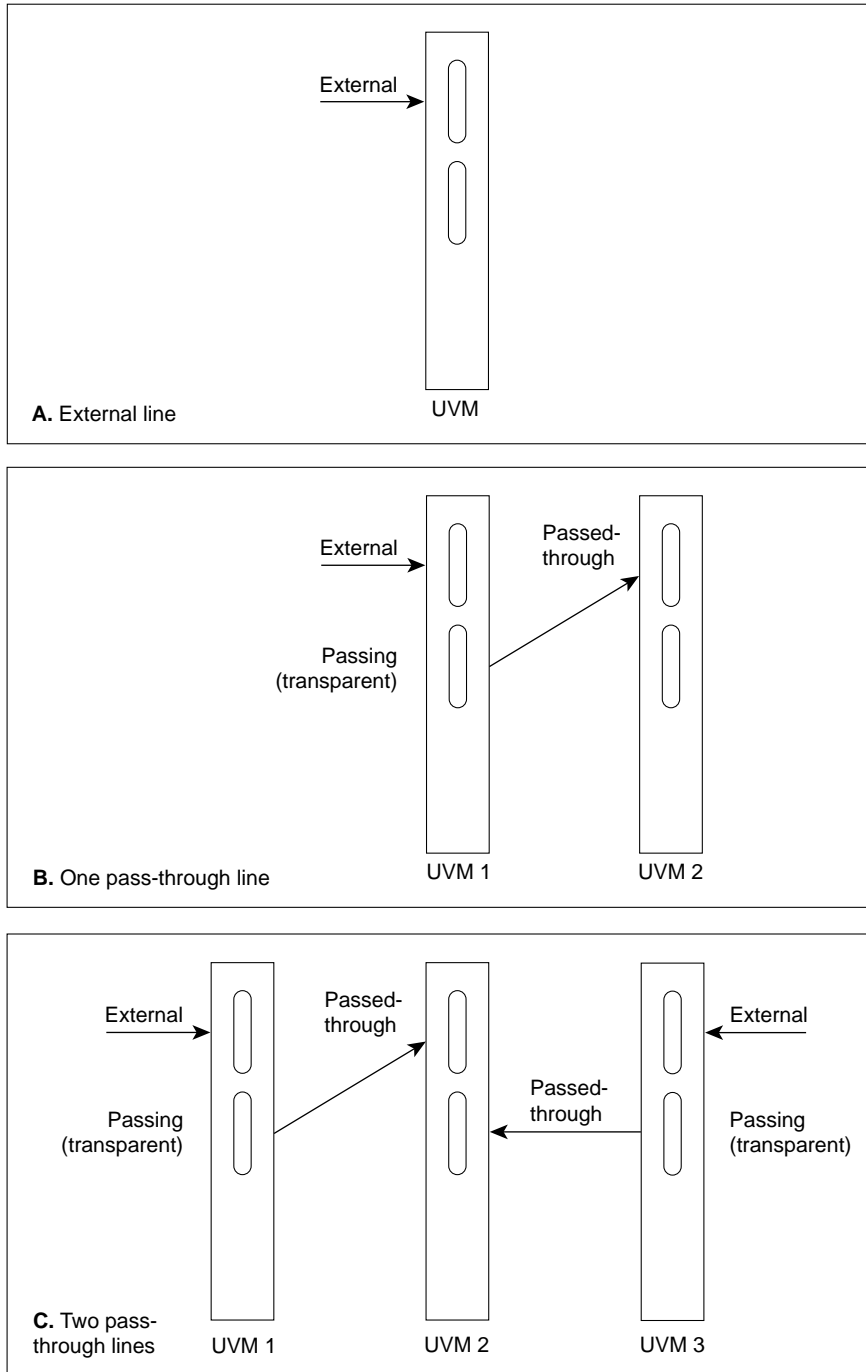
H9884

Connecting a UVM to E1 Lines

Voice or data connections on an E1 line use the UVM front card and the BC-UVI-2E1EC back card. The procedure for connecting the E1 lines is as follows:

Step 1   Bring each cable through the opening at the bottom of the cabinet (if applicable) and up the back of the unit. You can use the cable management feature to help route the cables.

Step 2   If you use the 120-Ohm, DB15 connectors, you must remove the nuts on the BNC connectors for the port even though the BNC has no attached cable.

Step 3   If you use the 75-Ohm BNC connectors in a balanced mode, you must remove the nuts from the BNC connector.

Step 4   Install optional Y-cables as needed.

Step 5   If the intended compression for voice channels is LDCELP and the number of channels on a E1 line exceeds 16, install cabling for pass-through. For the steps that follow, refer to Figure 3-6 for an illustration of the possible UVM cabling arrangements. Note that, in Example B, the number of channels has not exceeded the UVM capacity, so pass-through is unnecessary.

- On port 1 of the primary UVM, connect the cable to the CPE.

- On port 2 of the primary UVM, connect the cable to port 2.

- Connect the cable from port 2 of the primary card to either port 1 or port 2 of the secondary UVM. Typically, if the secondary UVM is supporting the passed-through channels from only one primary UVM, you would connect the cable from port 2 of the primary card to port 1 of the secondary card. However, because the secondary UVM can receive 16 passed-through channels with LDCELP compression, you can pass 15 channels each from other UVMs.

For a description of the pass-through feature, refer to the *Cisco IGX 8400 Series Reference*.

Figure 3-6   Pass-Through and Standard (External) UVM E1 Cabling

Pass-through

Passed-through

Passing
(transparent)

A. One pass-through line

UVM 1

UVM 2

External

B. External line

UVM
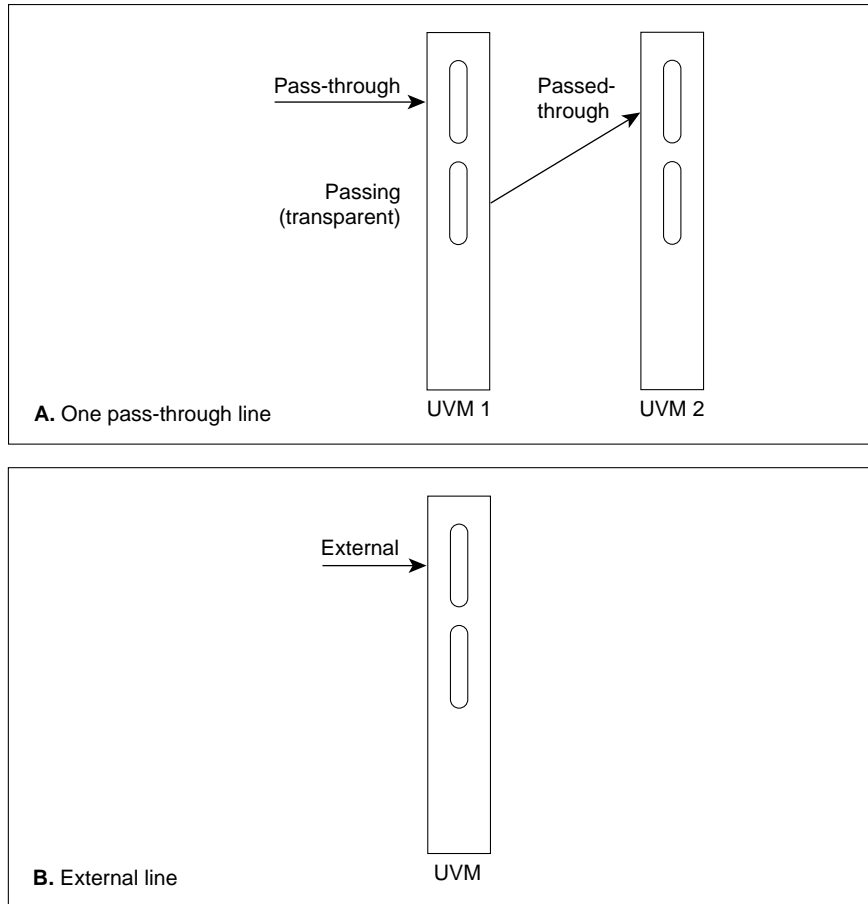
H9888

The back slot line numbers correspond to the slot number in which the BC-UVI-2E1EC card resides. Record the back slot number and port number of each line. These numbers are necessary for configuring the system after you complete hardware installation.

Connecting a UVM to J1 Lines

Voice or data connections on a J1 line use the UVM front card and the BC-UVI-2J1EC back card. The procedure for connecting the J1 lines is as follows:

Step 1   Bring each cable through the opening at the bottom or top of the cabinet (whatever is applicable) and along the back of the unit. You can use the cable management feature to help route the cables.

Step 2   Attach each cable according to the cabling requirement (pass-through, external, and so on).

If the intended compression for voice channels is LDCELP and the number of channels on a J1 line exceeds 16, install cabling for pass-through. For the steps that follow, refer to Figure 3-7 for an illustration of the possible UVM cabling arrangements. Note that, in Example B, the number of channels has not exceeded the UVM capacity, so pass-through is unnecessary.

- On port 1 of the primary UVM, connect the cable to the CPE.

- On port 2 of the primary UVM, connect the cable to port 2.

- Connect the cable from port 2 of the primary card to either port 1 or port 2 of the secondary UVM. Typically, if the secondary UVM is supporting the passed-through channels from only one primary UVM, you would connect the cable from port 2 of the primary card to port 1 of the secondary card. However, because the secondary UVM can receive 16 passed-through channels with LDCELP compression, you can pass 15 channels each from other UVMs.

For a description of the pass-through feature, refer to the *Cisco IGX 8400 Series Reference*.

Figure 3-7   **Pass-Through and Standard (External) UVM J1 Cabling**
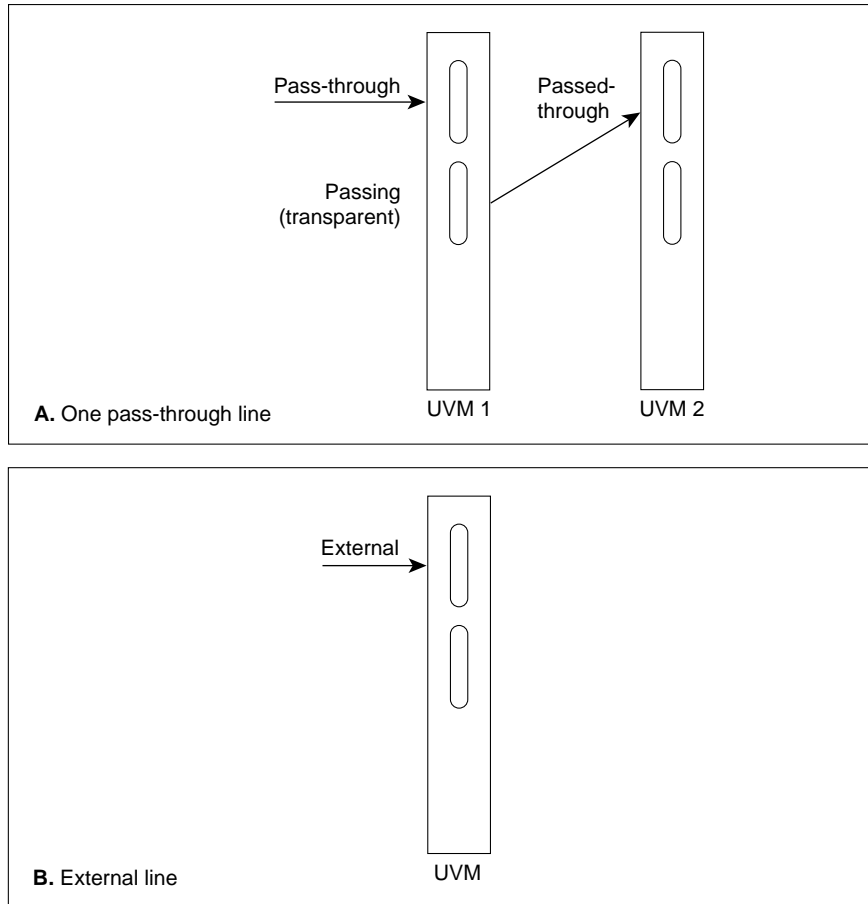
The back slot line numbers correspond to the slot number in which the BC-UVI-2J1EC card resides. Record the back slot number and port number of each line. These numbers are necessary for configuring the system after you complete hardware installation.

Making Serial Data Connections

The Low-Speed Data Module (LDM) and High-Speed Data Module (HDM) card sets provide serial data service. Each of these front cards uses a variety of back cards.

The LDM front card uses the 4-port or 8-port version of the Low-Speed Data Interface (LDI) back card for EIA/TIA-232C/D (V.24) connections. The connection ports are labeled PORT 1 through PORT 4 or PORT 1 through PORT 8. See Figure 3-8 for illustrations these back cards. For instructions on configuring an LDI port for DTE or DCE mode, refer to the forthcoming section titled Configuring the Mode of an LDI Port.

The HDM front card works with four types of Serial Data Interface (SDI) back cards. SDIs are available. These are V.35, EIA/TIA-449/422, EIA/TIA-232D, and EIA/TIA-232C (V.24). (X.21 uses EIA/TIA-449 plus an adapter cable.) Each type of SDI has four connection ports, which are labelled PORT 1 through PORT 4. An example SDI card appears in Figure 3-8.

When you connect an HDM or LDM port, use the shortest reasonable cable length for each port.

Figure 3-8   SDI and LDI Faceplates

Port 1
Port 2
Port 3
Port 4

Port 1
Port 2
Port 3
Port 4
Port 5
Port 6
Port 7
Port 8

SDI
(V.35 shown)

LDI 4 Port

LDI 8 Port

H8355
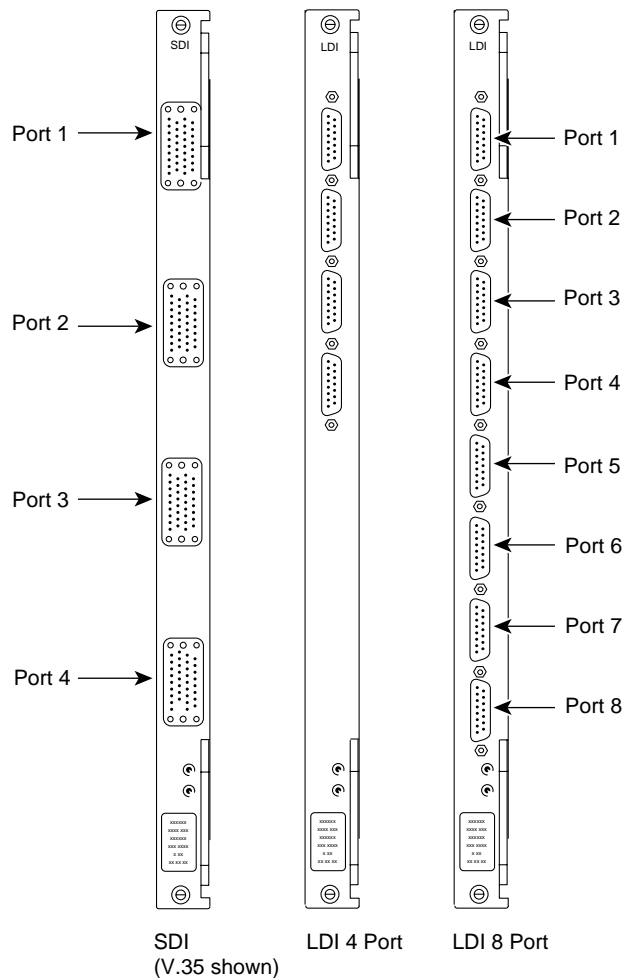
Configuring the HDM's Back Cards

Small jumper boards on the back card determine whether the mode of the port is DTE or DCE. The factory-set modes of the SDI ports alternate DCE with DTE. The steps that follow describe how to change the mode of the port. For the two modes, the rows on the back card jumper connector that are occupied by the jumper card are:

- DCE=1, 2, 4, and 5 (closest to the SDI faceplate)
- DTE=2, 3, 5, and 6 (1 row away from the SDI faceplate)

Note   A jumper board comes with an impedance of either 100 Ohms or 200 Ohms. For higher port speeds, the impedance is important if you have specified Y-cable redundancy. With Y-cable redundancy on a higher-speed connection, use the 200-Ohm jumper board. With no Y-cable redundancy or when the port speed is relatively low, the 100-Ohm jumper board is adequate.

To change the mode on a port to DTE, position the jumper board for that port as follows:

⚠ **Caution**   To prevent damage to the SDI cards, wear a wrist strap and clip the strap to the enclosure.

Step 1   At the back of the IGX node, remove the SDI card, as follows:

- Loosen the captive mounting screws on both ends of the faceplate.
- Operate the card extractors, then slide the card out.

Step 2   Move the jumper board one row of pins away from the SDI faceplate (Figure 3-9). For DTE mode, the jumper board should occupy rows 2, 3, 5, and 6.

If a port is in DTE mode and needs to be changed to DCE, plug the jumper board into the connector receptacle pin rows closest to the SDI faceplate (Figure 3-9). These rows are 1, 2, 4, and 5.

Figure 3-9   **Changing the Mode on an SDI Card**
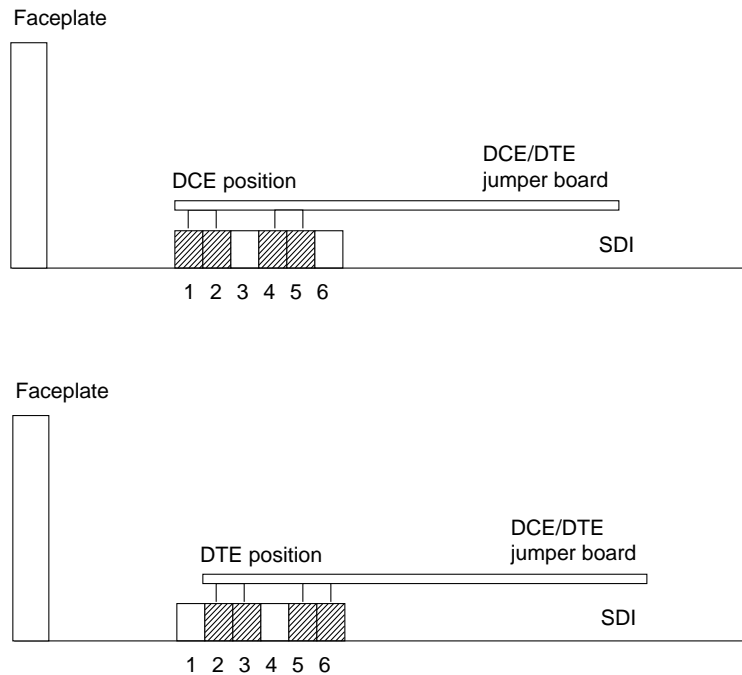
HDM and LDM Redundancy

Optional redundancy for HDM and LDM cards can be provided with a second front and back card set and a Y-cable connection on each port to the customer data equipment.

Note   A jumper board comes with an impedance of either 100 Ohms or 200 Ohms. For higher port speeds, the impedance is important if you have specified Y-cable redundancy. With Y-cable redundancy on a higher-speed connection, use the 200-Ohm jumper board. With no Y-cable redundancy or when the port speed is relatively low, the 100-Ohm jumper board is adequate.

Configuring the Mode of an LDI Port

Each port on an LDI card uses an adapter cable. For a list of LDI adapter cables, refer to the appendix titled "Cabling Summary." Each cable does the following:

- Determines whether the port operates in DCE mode or DTE mode

- Connects the port's 15-pin connector to a 25-pin D connector

- Converts to either a male or female pinout

See Figure 3-10 for an example. In Figure 3-10, the adapter cable makes the port a DCE port. Circuits on the card test certain pins on the cable then configure the port as DTE or DCE.

Figure 3-10   Connecting a DTE or DCE Adapter Cable to an LDI

RS232
cable

LDI

15 pin

DCE*

25 pin
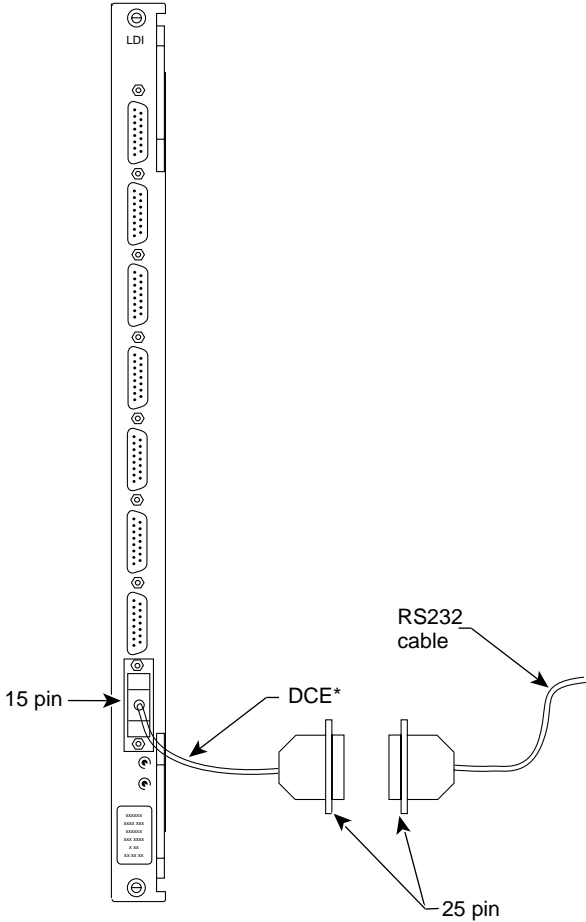
H8357

* Use DTE cable for DTE devices

Making Frame Relay Connections

This section outlines how to establish frame relay service by setting up a Universal Frame Module (UFM) or a Frame Relay Module (FRM). The information includes details for T1, E1, HSSI, V.35, and X.25 interfaces. Detailed descriptions of the frame relay commands appear in the *Cisco WAN Switching Command Reference*. For more details on Cisco frame relay service, refer to the *Cisco WAN Switching System Overview.* Cabling requirements for individual frame relay interfaces appear in the appendix titled "Cabling Summary." Specific cabling requirements for the UFI back cards on the UFM-U appear in the UFM-U description in the *Cisco IGX 8400 Series Reference*.

Maximum Connections Per Port With Signalling Protocols

For any frame relay card set that has a maximum frame length of 4510 bytes, the type of signalling protocol you may (optionally) specify with **cnffrport** results in a limit on the number of connections per physical or logical port. The maximum number of connections per port for each protocol is:

- For Annex A: 899

- For Annex D: 899

- For StrataLMI: 562

Neither **addcon** nor **cnffrport** prevents you from adding more than the maximum number of connections on a port. (You might, for example, use **cnffrport** to specify an LMI when too many connections for that particular LMI already exist.) If the number of connections is exceeded for a particular LMI, the LMI does not work on the port, the full status messages that result are discarded, and LMI timeouts occur on the port. A port failure results and also subsequently leads to a-bit failures in other segments of the connection path.

Setting Up Frame Relay on a UFM

Channelized and unchannelized versions of the UFM card sets exit. The channelized front cards UFM-4C and UFM-8C operate with T1 and E1 interfaces, and the unchannelized front card UFM-U operates with V.35, X.21, and HSSI interfaces.

The back cards have the following terminations:

- The UFI-8T1-DB15 has 8, female, sub-miniature DB15s.

- The UFI-8E1-DB15 has 8, female, sub-miniature DB15s.

- The UFI-8E1-BNC has 16 BNC connectors, 1 for each direction.

- The UFI-12V.35 has 6 low-force helix (LFH) connectors with 2 ports per connector.

- The UFI-12X.21 has 6 low-force helix (LFH) connectors with 2 ports per connector.

- The UFI-4HSSI has 4 connectors.

If the installation includes Y-cable redundancy, first read "Y-Cable Redundancy on the UFMs."

Y-Cable Redundancy on the UFMs

Redundancy for a frame relay port is possible with a second card set and the appropriate Y-cable. The card redundancy kit for UFM contains a second UFM/UFI card set and Y-cables to interconnect the ports on the two back cards. The forthcoming section titled "Setting Up Frame Relay Ports and Connections (UFM)" includes the step for configuring Y-cable redundancy.

Refer to the cabling description in the UFM-U section of the *Cisco IGX Reference* for descriptions and part numbers of all cables for unchannelized UFMs.

Figure 3-11 shows the Y-cable arrangement for standard cables that support one or two ports. The diagram for single-port cables applies to all back cards. The dual-port cables connect to only a V.35 or X.21 UFI. The Y-cable connects to the back card, and the standard cable runs between the access device or CPE and the base of the "Y."

Y-cable redundancy is not allowed between different line types, such as a UFI-8T1-DB15 and a UFI-8E1-DB15. The **dspyred** display shows any conflict in reverse video. (See the descriptions of the **upln** (or **upcln**) and **upfrport** commands in the *Cisco WAN Switching Command Reference*.)

The commands that relate to Y-cable redundancy are **addyred**, **delyred**, **dspyred**, and **ptyred**. After you have installed the cards in adjacent slots and connected the cables, use the **addyred** command to direct the node to recognize the card redundancy. See the *Cisco WAN Switching Command Reference* for descriptions of the commands.

Figure 3-11   Y-Cable Redundancy With Single and Dual-Port Cabling

UFI-4HSSI, UFI-12V.35, or UFI-12X.21

UFI-12X.21 or UFI-12V.35
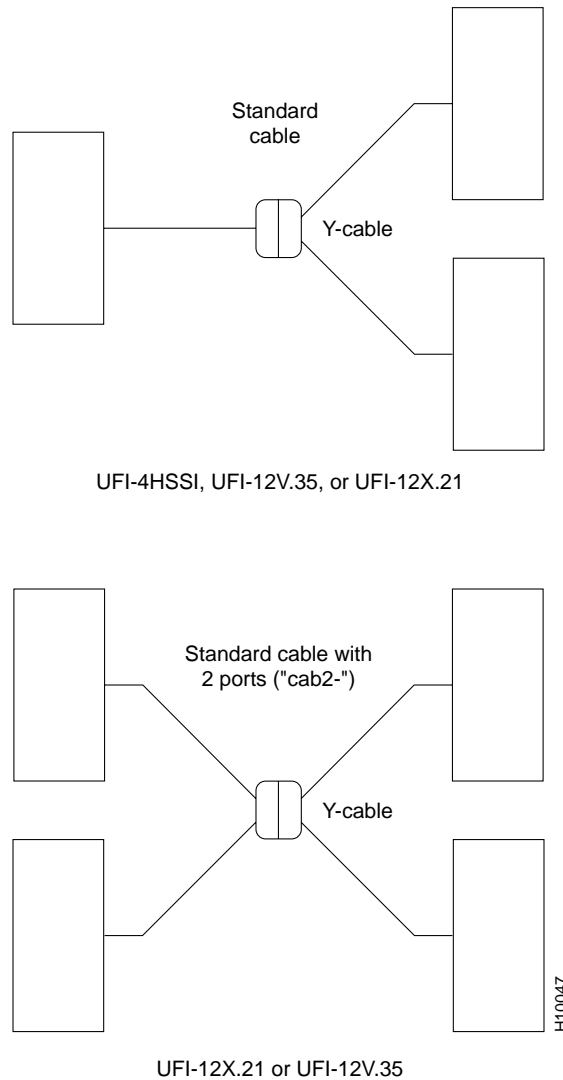
Connecting UFM Cabling

For important details on standard cables and Y-cables for the UFI back cards, refer to the cabling description in the UFM-U section of the *Cisco IGX Reference*.

Take the following steps after you have inserted the cards according to the information on installing cards in the section titled "Readying the Cards" earlier in this chapter. Connect the cables as follows:

Step 1 For the UFM-U/UFI card sets, make sure the cables are the correct DCE or DTE versions. For V.35 and X.21 connectors where both ports are to be used with two-port versions of the cable, the cable is either DCE or DTE. (You must specify both ports to be either DCE or DTE when you configure the port with the **cnffrport** command.)

Caution Do not connect two native DCE ports using a HSSI standard straight cable. Connecting two native DCE ports with a HSSI standard straight cable could permanently damage the interface.

Timesaver Interfaces on the UFI-4HSSI back card are already in DCE mode (default) so you can directly connect any DTE interface to the back card using a straight pin-to-pin HSSI standard cable.

Note The UFI-4HSSI back card can be configured in DTE mode by using the HSSI-DTE cable to connect back cards in DTE mode to DCE interfaces.

Step 2 Bring each cable through the opening at the top or bottom of the cabinet (if applicable) and along the back of the unit. If necessary, use the cable manager to help route the cables.

Step 3 Add optional Y-cables as necessary.

Step 4 Secure the cables to the connectors on the back cards that mate with the correct front card. If the front card is a UFM-4C, use only the first 4 lines. If you install Y-cable redundancy on a UFI-4HSSI card, only Port 1 is configurable for redundancy.

Step 5 Record the slot number of each line for configuration purposes after hardware installation.

Setting Up Frame Relay Ports and Connections (UFM)

This section outlines the steps for setting up and deleting frame relay ports, adding connections, and bundling connections. If a port has multiple PVCs, you can optionally *bundle* the connections. Bundling facilitates network meshing. You can specify connection bundling during parameter specification in the Add Connection (**addcon**) command: if you press Return without specifying a DLCI during port specification, the system prompts for bundling information. See the "Frame Relay Connections" chapter in the *Cisco WAN Switching Command Reference* for details.

Use either a Cisco StrataView Plus workstation an IGX control terminal to do the following tasks. For detailed command descriptions, see the *Cisco WAN Switching Command Reference*.

Step 1 If necessary, use the Display Cards (**dspcds**) command to verify the correct UFI back card and UFM front card. (Use the **vt** command to access other nodes.) The **dspcds** output shows any mismatch between firmware on the front card and firmware on the back card.

Step 2 If the card is a UFM-C, "up" (or activate) each line with the Up Line (**upln**) command. The range of lines for a UFM-4C is 1–4. The range of lines for a UFM-8C is 1–8.

A UFM-U does not require activation with the **upln** command.

Step 3   If the card is a UFM-C, assign logical frame relay ports to individual physical lines by using the Add Frame Relay Port (**addfrport**) command. A UFM-U does not require **addfrport**. An optional command you can use for a UFM-C either before or after **addfrport** is the Configure Line command (**cnfln**) command. Note that if you use **cnfln** to assign a DS0 to carry signalling, you cannot subsequently assign that DS0 for user-data with **addfrport**.

Step 4   If the card is a UFM-U, use the Configure Mode (**cnfmode**) command to configure the mode of the card if you do not use the default of mode 1. You must understand the ramifications of this step before you use **cnfmode**. If you do not understand the modes of the UFM-U, refer to the UFM-U description in the *Cisco IGX 8400 Series Reference*.

Step 5   For optional Y-cable redundancy, configure the two cards by using the **addyred** command. For Y-cable redundancy on a HSSI card, you must use port 1 of the cards for the primary and redundant ports. For important information about Y-cable redundancy on a UFM-U, see the description in the UFM-U portion of the *Cisco StrataCom IGX Reference*.

Step 6   Activate the ports using the Up Frame Relay Port (**upfrport**) command.

Step 7   Configure the port for DCE or DTE mode, speed, clocking, LMI type, and so on, by using the Configure Frame Relay Port (**cnffrport**) command. Alternatively, you can keep the default parameters. If you plan to bundle connections, use **cnffrport** to set the Port ID to the DLCI planned for the near-end connections before you add the bundled connections. The PortID is optional for non-bundled connections. Note that **cnfport** functions the same for Frame Relay as **cnffrport**.

Step 8   Add connections by using the **addcon** command. Adding connections requires the slot number, logical port number, and DLCI for each end of the connection. Frame relay is a purchased option. If you attempt to add connections but the system display states that frame relay is not available, call the TAC through Customer Engineering.

If you do not know the frame relay class intended for entry with the **addcon** command, determine which frame relay class number to use. Use the Display Frame Relay Classes (**dspfrcls**) command to see the parameters that each class specifies. To modify parameters in a class, use Configure Frame Relay Class (**cnffrcls**).

Step 9   Optionally—for an *individual connection—*you can configure bandwidth parameters or enabling ForeSight (if purchased) by using Configure Frame Relay Connection (**cnffrcon**).

Optionally, you can set the channel priority by using the Configure Channel Priority (**cnfchpri**) command. Normally, the system-default priority is adequate.

Commands for T1/E1 Frame Relay

To specify logical ports on a T1 or E1 interface, use **addfrport**. The **addfrport** command assigns a logical port number to a physical line and a range of 1 or more DS0s/timeslots. Use the logical port number to activate a port (**upfrport**), add connections (**addcon**), or display statistics (**dspportstats**). For example, after you *add* logical port 14.60 2.1-24 with **addfrport**, you *up* this logical port by entering "**upfrport** 14.60." The maximum number of logical port numbers on a UFM-C is 250. Use **dspfrport** to display logical ports.

Deleting a Frame Relay Port

Delete a logical port by executing the **delfrport** command. Executing **delfrport** dissolves any groups of DS0s/timeslots and unassigns all DS0s/timeslots on the logical port. (Note that, before you delete a frame relay port, you must delete any connections on the port with **delcon**.) After deleting a logical port with **delfrport**, you can deactivate the physical port with **dnport**.

Setting Up Frame Relay on an FRM

Four types of interfaces are available for the FRM. The back cards have the following terminations:

- The FRI-T1 has a female, sub-miniature DB15.

- The FRI-E1 has a single 120-ohm, DB15 connector for a balanced termination and two, 75-ohm BNC connectors for coaxial cables for an unbalanced termination. All connectors are female.

- FRI-V.35 has standard 34-pin female MRAC type connectors with a standard V.35 cable.

- FRI-X.21 has female DB15 sub-miniature connectors.

Cabling requirements for the frame relay interfaces are in the appendix titled "Cabling Summary."

Take the following steps after you have inserted the cards according to the general information on installing cards in the section titled "Readying the Cards" earlier in this chapter. To connect a cable:

**Step 1**   Bring each cable through the opening at the top or bottom of the cabinet (whichever applies) and along the back of the unit.

Step 2   If needed, use the cable manager to help route the cables.

Step 3   Secure the cables to the connectors on the cards that mate with the correct front card.

Record the slot number of each line. These numbers are necessary for configuring the system.

Port Mode Selection for V.35 and X.21

The position of a small jumper board at each port determines whether it is a DCE or a DTE.

Warning   Only qualified personnel should open the cabinet door.

Caution   To prevent damage to the FRI cards, ground yourself before handling IGX cards by clipping a grounding strap to your wrist, and clipping the wrist strap lead to the enclosure.

A small jumper card near each connector on the back card selects the port's mode. The factory-set modes alternate between DCE and DTE. The steps that follow describe how to change the mode of a port. The relation between back card row numbers and the port mode is as follows:

- DCE=1, 2, 4, and 5 (jumper card is closest to the FRI faceplate)

- DTE=2, 3, 5, and 6 (jumper card is one row away from the FRI faceplate)

Note   Jumper cards for selecting the mode of a V.35 or X.21 interface have an impedance of either 100 Ohms or 200 Ohms. At higher speeds on ports with Y-cable redundancy, the impedance is important. With Y-cable redundancy on a higher-speed connection, use the 200-Ohm jumper card. Without Y-cable redundancy or when the port speed is low, the 100-Ohm jumper card is adequate.

> **Note** Carefully choose the mode for each port. If you change a port mode after other ports on the card are carrying traffic, it disrupts service on the other ports.

To change the mode of an interface, reposition the jumper board for the port as follows:

Step 1 If the FRI is already in the node:

- Note its slot number.

- Loosen the captive mounting screws on both ends of the faceplate.

- Operate the card extractor levers and slide the card out.

Step 2 To change to DTE, move the jumper board one row of pins away from the FRI faceplate (Figure 3-12). For DTE mode, the jumper board should occupy rows 2, 3, 5, and 6.

To change to DCE, plug the jumper board into the connector receptacle pin rows closest to the FRI faceplate (Figure 3-12). The rows for DCE mode are 1, 2, 4, and 5.

Step 3 Insert the FRI card and gently slide it in all the way to the rear of the slot.

> **Note** The FRI card should slide in easily into the slot. Investigate any binding. Do not use force.

Step 4 Screw in the mounting screws.

Figure 3-12   Setting the Port Mode (DTE/DCE) on an FRI
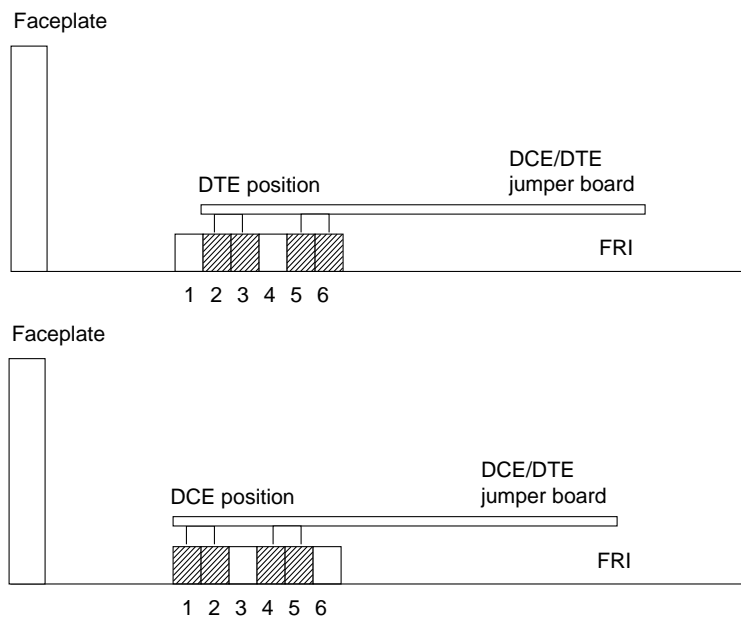
Frame Relay Card Redundancy

Optional redundancy on a frame relay port is possible with a second FRM/FRI card set and a Y-cable connection on each applicable port. The forthcoming section "Setting Up Frame Relay Ports and Connections (FRM)" includes the step for configuring Y-cable redundancy. The card redundancy kit

contains a second FRM/FRI card set, Y-cables to interconnect the ports on the two back card, and four, 200-ohm DCE/DTE jumper cards if the back cards are either FRI-V.35s or FRI-X.21s. (The DCE or DTE port applies to only V.35 or X.21 interfaces.) Make sure that the firmware revision of the FRM in the kit matches the firmware in the installed FRM. Model firmware supports V.35 and X.21 interfaces. Model E firmware supports T1 and E1 interfaces.

When you install a redundant card set with either a V.35 or X.21 interface, you must change the daughter cards on the existing FRI that specify DCE or DTE mode at each port. Install the higher impedance (200 Ohms) version cards that are in the Y-cable kit.

Y-cable redundancy is not allowed between inconsistent back card types, such as an FRI T1 and an FRI V.35. The **dspyred** display shows any conflict in reverse video. (Refer also to the descriptions of the **upcln** and **upfrport** commands in the *Cisco Command Reference*.)

After the hardware is installed, use the Add Y Redundancy (**addyred**) command to reconfigure the node to recognize the card redundancy. Refer to the *Cisco Command Reference* for more information on the commands **addyred**, **delyred**, **dspyred**, and **ptyred**.

Setting Up Frame Relay Ports and Connections (FRM)

This section outlines the steps for setting up and deleting frame relay ports, adding and configuring connections, and bundling connections. As the steps show, some commands apply to channelized connections (T1, E1, or J1) but not to unchannelized connections (V.35 or X.21). Use either the IGX control terminal or a Cisco StrataView Plus workstation to execute the commands. For parameters and other details on the commands, refer to the *Cisco WAN Switching Command Reference*.

If a port has multiple PVCs, you can optionally *bundle* the connections. Bundling facilitates network meshing. You can specify connection bundling during parameter specification in the Add Connection (**addcon**) command: if you press Return without specifying a DLCI during port specification, the system prompts for bundling information. See the "Frame Relay Connections" chapter in the *Cisco Command Reference* for details.

Step 1   If not already done, activate the applicable lines with the Up Line (**upln**) command.

Step 2   Use the Display Cards (**dspcds)** command to verify that all nodes have the correct FRI back card and FRM front card. (Use the **vt** command to gain access to other nodes.) The **dspcds** output shows the slot number of each card and any mismatch between firmware on the front card and firmware on the back card. Note the slot number of each FRM or UFM for subsequent commands.

Step 3   For V.35 and X.21 interfaces, check the mode (DCE or DTE) of each relevant port by using the Display Frame Relay Port (**dspfrport)** command. (For T1 and E1 lines, the mode is not applicable.) On an FRI-X.25 or FRI-V.35 back card, a jumper board near each connector determines the mode of the port. See "Port Mode Selection for V.35 and X.21" for details.

Note   Jumper cards for selecting the mode of a V.35 or X.21 interface have an impedance of either 100 Ohms or 200 Ohms. At higher speeds on ports with Y-cable redundancy, the impedance is important. With Y-cable redundancy on a higher-speed connection, use the 200-Ohm jumper card. Without Y-cable redundancy or when the port speed is low, the 100-Ohm jumper card is adequate.

Step 4   For optional Y-cable redundancy, configure the two slots for redundancy by using **addyred**.

For V.35 and X.21 interfaces, skip the next three steps.

Step 5   For T1, E1, and J1 interfaces, up the line using the Up Line (**upln**) command.

Step 6   For T1, E1, and J1 interfaces, configure the line using Configure Line (**cnfln**) command.

Step 7   For T1, E1, and J1 interfaces, add the *logical* frame relay port using the using the Add Port (**addport**) command.

Step 8   For all interface types, activate the port using the Up Port (**upport**) command.

Step 9   Configure the port for speed, clocking, LMI type, and so on, by using the Configure Frame Relay Port (**cnffrport**) command. Alternatively, you can keep the default parameters.

If you intend to bundle connections, use **cnffrport** to set the Port ID to the DLCI planned at the near-end connections. Setting the PortID is optional for non-bundled connections.

Step 10   Determine which frame relay class number to use when you add connections to a port. To see the parameters that a class specifies, use the Display Frame Relay Classes (**dspfrcls**) command. To modify parameters in a class, use Configure Frame Relay Class (**cnffrcls**).

Step 11   Add connections to the port by using the Add Connection (**addcon**) command. Enter the slot number and specify a DLCI for each end of the connection.

Step 12   For an *individual connection,* you can configure bandwidth parameters or enable ForeSight (if purchased) by using Configure Frame Relay Connection (**cnffrcon**).

Step 13   Optionally, you can set the channel priority by using the Configure Channel Priority (**cnfchpri**) command. Normally, the system-default priority is adequate.

Commands for T1/E1 Frame Relay

To specify logical ports on a T1 or E1 interface, use **addfrport**. The **addfrport** command assigns a logical port number to a group of one or more DS0s/timeslots. The slot number and the lowest number in the user-specified DS0/timeslot group form the *logical port number.* Use the logical port number to activate a port (**upfrport**), add connections (**addcon**), or display statistics (**dspportstats**). For example, after you *add* logical port 14.1-6 (6 DS0s/timeslots) with **addfrport**, you activate (or *up*) this logical port by entering "**upfrport** 14.1." Use **dspfrport** to display logical ports.

Deleting a Frame Relay Port

Executing **delfrport** dissolves any groups of DS0s/timeslots and unassigns all DS0s/timeslots on the logical port. To delete a logical port:

Step 1   Delete any connections on the port with **delcon**.

Step 2   Delete the *logical* port with **delfrport**.

Step 3   You can deactivate the logical port with **dnfrport**.

Step 4   You can deactivate the physical line with **dnln**.

Connecting a Cisco 3800 Series Access Device

You can add connections for a Cisco 3800 series access device at the FTM or FTC (IPX node) when the other end of the connection is on an FTC, FTM, FRP, or FRM. When the other end of the connection terminates at an FTC/FTM, the connected device must be a Cisco access device (not a FastPAD). Also, to add a voice connection, you must add the connection at the CDP or CVM. Note also that the signalling type for voice connection to a 3800 series device is CAS.

For descriptions of the Cisco 3800 access devices, see the *Cisco 3800 Series Software Configuration Guide and Command Reference* and *Cisco Access Products 3800 Series Installation Guide*.

Cisco Access Device Syntax

The syntax for identifying a connection on a Cisco access device is *slot.port.connection_ID*, where *connection_ID* has the usual DLCI range. This syntax applies for all commands that relate to a connection on an access device and at all termination points of the connection. For example, if you add a voice connection at a CVM, the near end connection identifier would be *slot.channel*, and the far end identifier would be *slot.port.connection_ID*.

Cisco Access Device Connections to the FTM

Cisco access device connections use the FTM front card and an FPC back card. The back card versions are FPC T1, FPC E1, FPC V.35, and FPC X.21.

The T1 card has a DB15 for RX/TX. The E1 connections are the same except for additional BNC connectors for unbalanced connections and BNC connectors for RX/TX MONITOR.

For V.35 and X.21 connections, the cable-type determines whether the access device functions in DTE or DCE mode. Also, once you have specified the mode by your choice of cable, you must use the IOS command for specifying the clock rate and clock source at the access device terminal.

For an X.21 interface, the cable 72-1304-xx makes the access device DTE. The cable 72-1304-xx makes the access device DCE.

For a V.35 interface, the cable 72-1311-xx makes the access device DCE. The cable 72-1302-xx makes the access device DTE.

The cabling requirements are the same as for the corresponding frame relay interface and are detailed in the appendix titled "Cabling Summary."

Installation of the FTM/FPC card set follows the same steps as other card sets. The FPC plugs directly into the FTM card. The FTM and FPC can reside in any slot not reserved for the NPM and SCM, respectively.

Making FastPAD Connections

The types of FastPAD interfaces are T1, E1, V.35, and X.21.

Note For descriptions of the FastPAD commands and detailed information on the FastPAD, refer to the *FastPAD User's Guide.* Refer also to the *StrataView FastPAD User's Guide.*

FastPAD connections use the FTM front card and an FPC back card. The back card versions are FPC T1, FPC E1, FPC V.35, and FPC X.21.

The T1 card has a DB15 for RX/TX. The E1 connections are the same except for additional BNC connectors for unbalanced connections and BNC connectors for RX/TX MONITOR.

A V.35 connection uses a standard 34-pin female MRAC-type connector with a standard V.35 cable. The FPC-X.21 has female DB15 sub miniature connectors.

The cabling requirements are the same as for the corresponding frame relay interface and are detailed in the appendix titled "Cabling Summary."

Installation of the FTM/FPC card set follows the same steps as other card sets. The FPC plugs directly into the FTM card. The FTM and FPC can reside in any slot not reserved for the NPM and SCM, respectively.

Each of the four ports on the FPC V.35 and X.21 versions can be configured as a DCE or as a DTE by selecting the position of a jumper board on the FPC. These ports are factory-configured as DCE interfaces. (Although the default is for DCE, check the boards before starting up the system.)

Note A jumper board comes with an impedance of either 100 Ohms or 200 Ohms. For higher port speeds, this is important when Y-cable redundancy is specified. With Y-cable redundancy on a higher-speed connection, use the 200-Ohm jumper board. Without Y-cable redundancy or when the port speed is relatively low, the 100-Ohm jumper board is adequate.

Caution To prevent damage to the FTM and FPC, put on a ground strap and clip the wrist strap lead to the enclosure.

To change a port's interface configuration on the FPC V.35 or FPC X.21, reposition the jumper board for the port as follows:

Step 1 At the back of the IGX cabinet, identify the slot where the FTM/FPC card resides.

Step 2 Loosen the captive phillips screws at both ends of the faceplate.

Step 3 Rotate the card extractor levers and slide the card out.

Step 4 For each port that is being changed to DTE, move the jumper board to the row of connector pins that is one row away from the FPC faceplate. Figure 3-13 shows positions for both DTE and DCE.

Step 5 To change a port to DCE, plug in the jumper board so that the row of connector pins that is closest to the FPC faceplate is occupied. See Figure 3-13.

Note Check for bent pins before installing the card. The FPC card should easily seat. Investigate any binding. In addition to bent pins, warped or bowed connectors could cause difficulty in seating the card. Do not try to force the card into place.

Step 6 Reinsert the FPC card and gently slide it in all the way to the rear of the slot.

Step 7 Screw in the mounting screws.

Figure 3-13   Positioning a DTE/DCE Block on a FPC-X.21

Faceplate

DCE/DTE
jumper board

DTE position

FPC

1 2 3 4 5 6

Faceplate

DCE/DTE
jumper board

DCE position

FPC

1 2 3 4 5 6
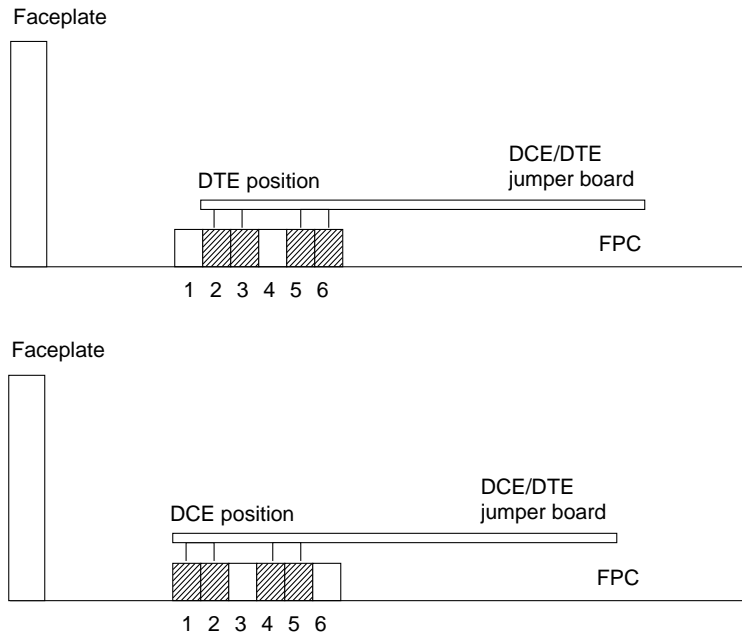
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Making Alarm Relay Output Connections

To install an Alarm Relay Module (ARM) card set, do the following:

Step 1   At the back of the IGX node, identify the slot where the ARI card is to reside.

Step 2   Install the ARM in the front slot and use the card extractors to help secure card.

Step 3   Install the ARI in the corresponding back slot. Use the extractor handles to help secure the card then tighten the captive screws by hand.

Step 4   Note that the FAIL LED on the ARM is off. The ACTIVE LED is also off.

Step 5   Attach a 22 or 24-gauge cable with the appropriate number of pairs to a male DB-37 connector at one end. Typically, a 12-pair cable is adequate. Connect this cable to the DB37 connector on the ARI and tighten the captive screws.

See also "Initial Startup of the IGX," when the system is ready for power.

The steps that follow show how to set up an ARM card set after the physical installation is complete. This is done from the IGX control terminal or Cisco StrataView Plus workstation. For details on each command used, refer to the *Cisco WAN Switching Command Reference.*

Step 1   Verify that the node is equipped with the proper ARM front card and ARI back card by using the Display Cards (**dspcds)** command. This will show in which slot they are located.

Step 2   From a control terminal or a Cisco StrataView Plus NMS workstation, **vt** to the node and enter the **addalmslot** command followed by the slot number where the ARM is located. This will activate the alarm reporting from the card.

Step 3   Observe that the ACTIVE LED on the ARM card is on.

Step 4 Testing the operation of the alarm outputs requires you to create an alarm and note the resulting alarm output. This test is easy on a node that is not connected to the network but difficult on a node in a fully operational network. The best time to create a major alarm an operational network is during a low traffic period. If you create an alarm, go to Step 5. Otherwise, stop here.

Step 5 Create an alarm by disconnecting a trunk cable from the connector on a back card.

Step 6 Observe that a lit MAJOR LED appears on the front of the ARM.

Step 7 Using a voltage/ohm meter (VOM), make sure continuity exists between pins 16 and 17 and between pins 35 and 36 at the DB37 connector on the ARI card.

Step 8 Reconnect the cable that was disconnected in Step 5.

Step 9 With the VOM, check that the reading between pins 16 and 17 and pins 35 and 36 are open and the MAJOR LED is not on.

Alarm output connections are made at the DB37 connector on the ARI card. The connector pin assignments with the alarm signal names are listed in Table 3-1. (Also see the "Cabling Summary" appendix.*)*

Table 3-1   ARI Alarm Connector Pin-Outs

Pin #	Alarm Type	Alarm Name	Alarm Description
1	both	CHASSIS	Protective ground
3	Network	NWMAJA	Major—normally open contact
22	Network		Major—normally closed contact
4	Network	NWMAJC	Major—common contact
10	Node	MNVISA	Minor Visual—normally open contact
11	Node		Minor Visual—normally closed contact
12	Node	MNVISC	Minor Visual—common contact
16	Node	MJAUDC	Major Audible—common contact
17	Node	MJAUDA	Major Audible—normally open contact
23	Network	NWMINA	Minor—normally open contact
24	Network		Minor—normally closed contact
25	Network	NWMINC	Minor—common contact
29	Node	NWAUDA	Minor Audible—normally open contact
30	Node		Minor Audible—normally closed contact
31	Node	NWAUDC	Minor Audible—common contact
35	Node	MJVISC	Major Visual—common contact
36	Node	MJVISA	Major Visual—normally open contact

Table 3-2 shows the unassigned connector pins.

Table 3-2   Unassigned Connector Pins

Pin #	Alarm Type	Alarm Description
7	Relay 2	common contact
8	Relay 2	normally closed contact
9	Relay 2	normally open contact

Table 3-2   Unassigned Connector Pins (Continued)

Pin #	Alarm Type	Alarm Description
26	Relay 4	common contact
27	Relay 4	normally closed contact
28	Relay 4	normally open contact

Making External Clock Connections

The DB15 connector labeled Ext Clocks on the faceplate of the SCM connects two external sources for a high-stability clock (primary and redundant). These inputs are 1.544 MHz for T1 systems and 2.048 MHz for CEPT systems. In addition, one of the trunk or circuit line inputs may also serve as a source of timing for the node. If you do not select a clock source, the clock source is the internal IGX clock.

Two separate clock inputs exist. The primary clock source is A, and the secondary clock source is B. One or both of these can be either 1.544 Mbps or 2.048 Mbps. For a list of connector pin assignments, see the appendix titled "Cabling Summary."

Attaching Peripherals

A network must have at least one control terminal (or Cisco StrataView Plus workstation if you wish to collect statistics) attached, along with a network printer for printing out the status of the system. The SCM has three ports for attaching peripherals to an IGX node. These ports are CONTROL TERMINAL, LAN AUI, and AUX PORT.

For the Cisco TAC to perform remote troubleshooting, a modem must connect to the network. This is a requirement for all Cisco service plans. The following sections provide procedures for attaching peripherals to the IGX node. Be sure to read the manufacturers' literature to ensure that the equipment is ready before attempting to connect it to the IGX node.

Connecting a Single Network Management Station

To use network management, at least one node in a Cisco network running Release 7.2 or higher software must have a Cisco StrataView Plus workstation connected. The workstation connects to the AUI Ethernet LAN port on the SCM.

The Cisco StrataView Plus workstation may be used to configure and maintain all nodes in a network. For instructions on using the Cisco StrataView Plus workstation, see the *Cisco StrataView Plus Operations Manual*.

If only a single NMS station is connected and the network is relatively small, you can use a serial EIA/TIA232 port—the CONTROL TERMINAL port.

Appendix B lists the control terminals supported by the IGX 8410 node and the configuration settings. The appendix titled "Cabling Summary" has the pin assignments for the IGX 8410 control terminal port.

Attach the control terminal to the SCM as follows (see Figure 3-14).

Step 1   From the back of the cabinet, run the control terminal EIA/TIA-232/V.24 cable through the opening at the bottom and up to the SCM card in back slot 1.

Step 2   Locate the CONTROL TERMINAL connector on the SCM and attach the control terminal EIA/TIA-232/V.24 cable to it.

Figure 3-14   Connecting the Control Terminal
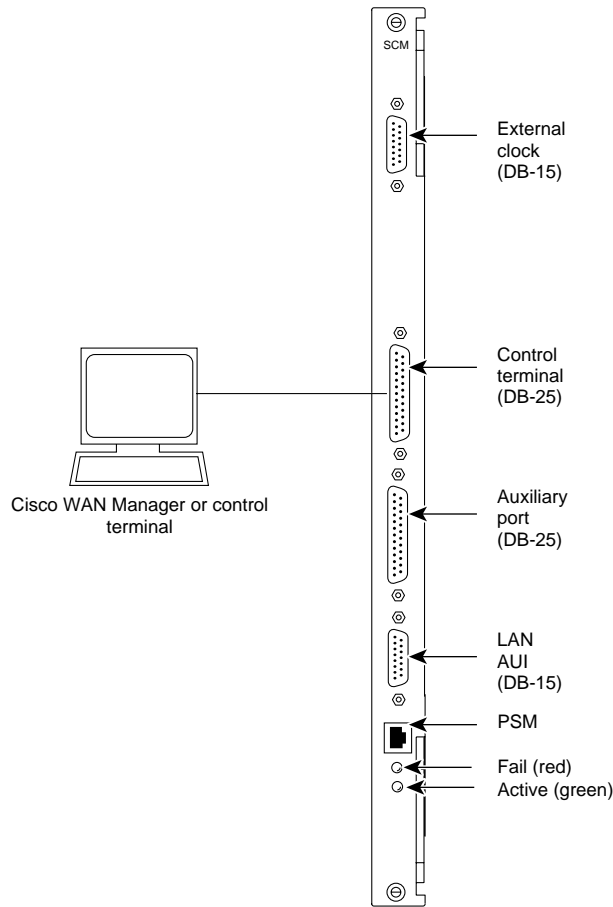
Step 3 Tighten the EIA/TIA-232 connector screws to firmly attach the cable to the CONTROL TERMINAL connector.

Step 4 Plug the control terminal power cord into the appropriate wall receptacle.

Step 5 Set the port function for VT100 (#5) using the **cnftermfunc** command.

Step 6 Make sure the AUXILIARY port and the terminal are set to the same baud rate and check the other communication parameters using the **cnfterm** command.

Note When you power up a node, it enters boot mode. Its control terminal communicates at a default rate of 9600 bps. If the rate for the node's control port previously was 19,200 bps, the first messages appears garbled because the control port (in boot mode) is temporarily running at 9,600 bps. When the transition to on-line occurs, the speeds match, so the display becomes readable.

LAN Connection for the Network Management Station

If the network is large or extensive network statistics are needed, an Ethernet port (LAN port) should be used. Larger networks produce a greater flow of statistics data between the node and the Cisco StrataView Plus workstation, so a higher speed Ethernet port is suitable. Figure 3-15 illustrates this connection. Accessing a node over an Internet connection requires the operator to use **cnflan** to enter the Internet Protocol (IP) address, IP subnet mask, TCP service port, and gateway IP address.

Figure 3-15   LAN Connection to SCM
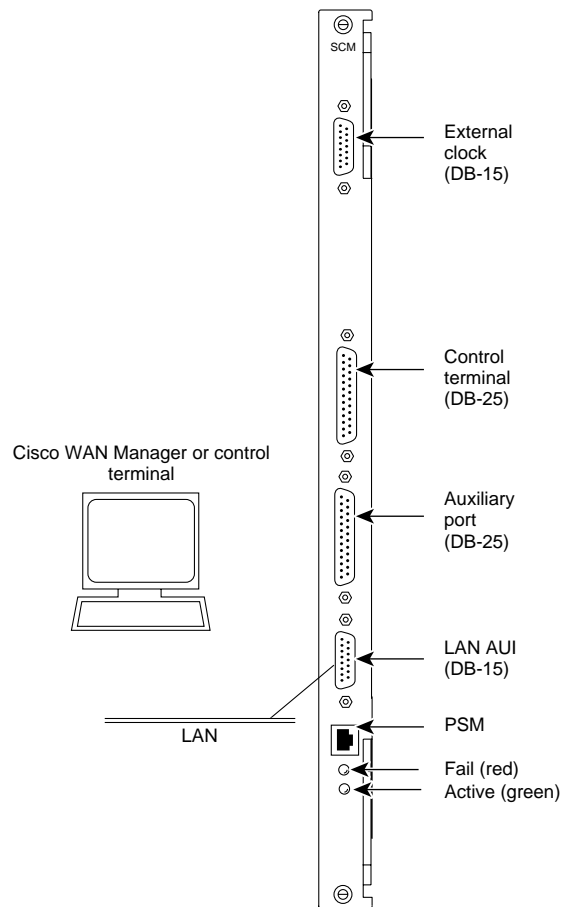
Configuring the LAN Port

Note   Configure the LAN parameters before connecting it to a LAN.

Note   Refer to the *Cisco StrataView Plus Operations Manual* and the *Cisco Command Reference* publication for additional information

Step 1   Contact a System Administrator to obtain IP addresses for the workstation and for the IGX node.

Step 2   Normally, the System Administrator updates the NIS database, as applicable (if an NIS is used), and adds the IP addresses for the workstation and node to the NIS database. Refer to the *Cisco StrataView Plus Operations Manual* for instructions on configuring the StrataView Plus workstation.

- The addresses shown are examples. Use the addresses obtained from the System Administrator. (This example is for a workstation named "hedgehog" at address 192.187.207.200. It also assumes that the IGX node LAN port for node "sanfran" has been assigned an IP address of 192.187.210.30 and a hostname of "sanfran.")

```
192.187.207.200 hedgehog

192.187.210.30 sanfran
```

Note If an NIS is being used (in a corporate network, for example), consult with the System Administrator.

Note 5120 is used for the LAN ports on all IGX ports.

Step 3   Configure the LAN port on the IGX node using a dumb terminal or an EIA/TIA-232 connection via the workstation (using the **vt** command, as applicable) to enter the appropriate **cnflan** parameters.

The **cnflan** command configures the node's communication parameters so that the node can communicate with a StrataView Plus terminal over an Ethernet LAN using the TCP/IP protocol. The parameters contain address information about the Ethernet TCP/IP network that is used to connect the StrataView Plus workstation to an IGX node. The values used must conform to those of the network and should be supplied by the Ethernet network administrator.

The **cnflan** command has the following parameters:

- **IPAddr** is the Internet Protocol address of the node used in the TCP/IP protocol.

- **IPSubnetMask** is a 32-bit mask. The default for a Class C LAN network is 255.255.255.0.

- **TCPServicePort** is the IGX LAN port number entered in the **/etc/service** file on the workstation. It is 5120 for all IGX nodes.

- **GatewayIPAddr** is the Internet gateway address. This is the gateway that traffic is routed through if the IGX node and workstation are on different networks. If they are on the same network, the gateway is not used. The default "none" is displayed in this case. If a gateway IP is entered and later you want to remove it, enter 192.0.0.0 opposite the prompt and "none" will again be displayed.

A **cnflan** screen is shown in Figure 3-16. The active IP address for the workstation has been entered as the IP address selected previously for the node, 192.187.207.21. The IP Subnet mask is entered as 255.255.255.0 for a Class C LAN network. The TCP service port is entered as 5120. Since the workstation and node are on different networks in this example, a gateway address of 192.187.207.1 has been entered. If the workstation and node are both on the same network, no gateway address is needed. The "Maximum LAN Transmit Unit" and "Ethernet Address" parameters are not configurable by the **cnflan** command. The "Ethernet Address" is a hardware address ("burned into the NPM card") that is unique to each NPM card.

Figure 3-16   Configuring Parameters on an IGX LAN Port

```
D2.cb1          LAN    superuser IGX 8   8.5 Feb. 27 1996 14:23 PST


Active IP Address:                     192.187.207.21
IP Subnet Mask:                        255.255.255.0
TCP Service Port:                      5130
Default Gateway IP Address:            192.187.207.1

Maximum LAN Transmit Unit:             1500
Ethernet Address:                      00.55.43.00.04.55

Control Socket - Ready
Base Socket Descriptor - 1

Socket Closed




Last Command: cnflan


Next Command:
```

Step 4   StrataView Plus workstation and the IGX node to a LAN network. Examples are shown in Figure 3-17 and Figure 3-18. The LAN port on the IGX node provides a DB-15 connector that can be connected to a Y-cable which in turn is connected to an AUI as shown in Figure 3-18.

Step 5   To make sure a LAN connection on the IGX LAN port is good, an example hostname of "sanfran" entered in the **config.sv** file, enter the following at the StrataView Plus workstation:

   ping sanfran

Step 6   Once the workstation and IGX node interface has been set up, StrataView Plus can be started. Figure 3-19 shows the **dsplan** screen after StrataView Plus has started and the communication sockets are active.

Note   "Sockets" is the BSD UNIX name for connections between processes and typically applies to network communication.

Figure 3-17   SV+ LAN Connection via Router to an IGX Node

Backbone

192.187.207.1

Router

192.187.207.11

192.187.207.21

192.187.207.200

Router

AUI

192.187.210.1

SV+

192.187.210.30

SCM
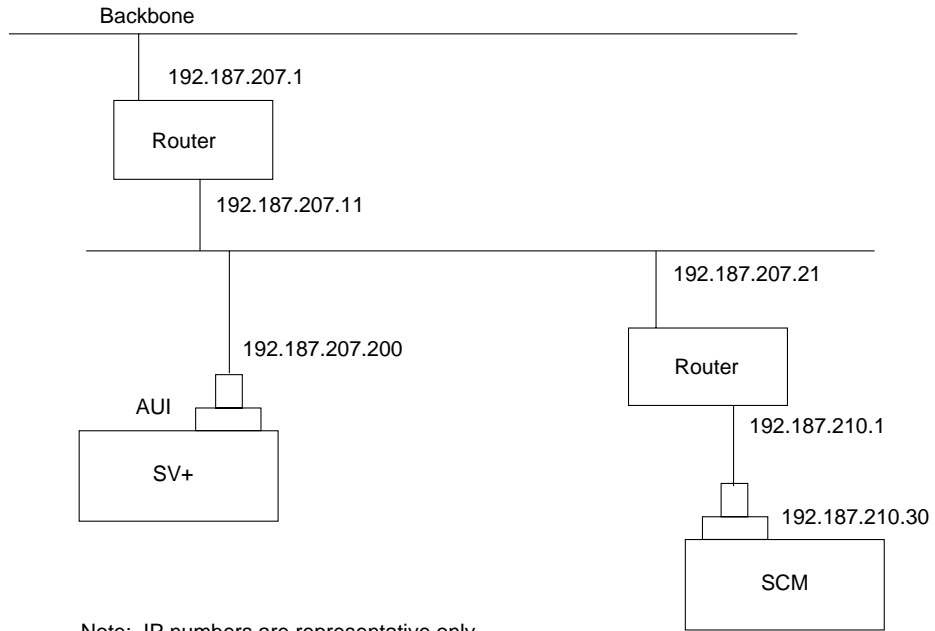
Note: IP numbers are representative only.

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Figure 3-18   SV+ LAN Connection to an IGX Node (no gateway)

192.187.207.200

AUI

SV+

192.187.207.30

SCM
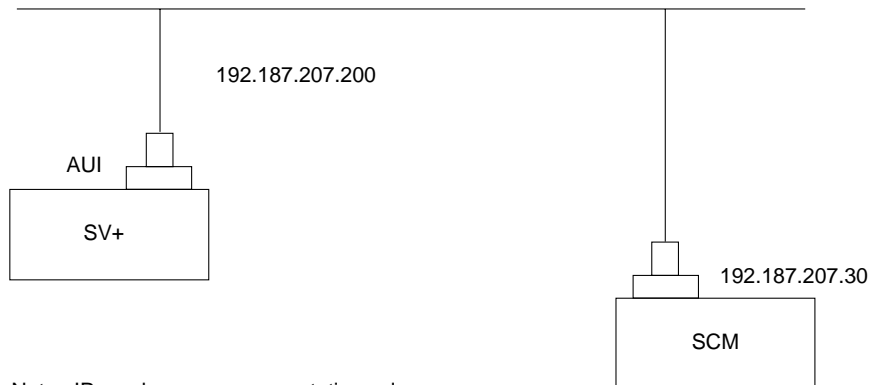
Note: IP numbers are representative only.

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Figure 3-19   dsplan after SV+ Startup

```
D2.cb1          LAN   cisco IGX 8    8.5 Feb. 27 1996 14:27 PST


Active IP Address:                192.187.207.21
IP Subnet Mask:                   255.255.255.0
TCP Service Port:                 5130
Default Gateway IP Address:       192.187.207.1

Maximum LAN Transmit Unit:        1500
Ethernet Address:                 00.55.43.00.04.55

Control Socket - Ready
Base Socket Descriptor - 1

Open Socket Descriptor - 2



Last Command: dsplan


Next Command:
```

Note   Before switching on the StrataView Plus workstation, refer to the *Cisco StrataView Plus Operations Guide.*

Step 7   Switch on the control terminal (or Cisco StrataView Plus workstation). Adjust the terminal's configuration, if necessary, to match the default settings of the control terminal port in the IGX node. See the appendix, "Peripherals Specifications," for the required settings. See the *Cisco StrataView Plus Operations Guide* for settings and operating instructions for the workstations.

Connecting a Network Management Station to Multiple Networks

When a network management station has more than one serial port, ports may connect to different networks. When the number of workstation serial ports is less than the number of networks to be managed, a terminal server is necessary to obtain a communications link to the separate networks. This subject is covered in the *Cisco StrataView Plus Installation Guide*.

Connecting the Printer

At least one node in the network should have a printer connected. The printer connects to the AUX PORT on the SCM.

The printer is used to display information about network operation. It can be configured to print maintenance information on a regular basis, and it can print specific diagnostic information when necessary. Instructions on using the printer for this purpose are in the *Cisco Command Reference* (Appendix A in the *Cisco Command Reference* lists all commands. The printer-related commands have the characters "prt" somewhere in the command mnemonic).

Attach the printer to the IGX node as follows:

Step 1   Check the printer EIA/TIA-232/V.24 cabling pinout and, if required, adjust the DIP switches to the settings indicated for the type of printer to be connected to the IGX node. See Appendix B for EIA/TIA-232/V.24 cable pinout and DIP switch settings.

Step 2   At the back of the cabinet, run the printer EIA/TIA-232/V.24 cable through the opening at the bottom and up to the SCM card in back slot 1.

Step 3   Locate the AUX PORT connector on the SCM and attach the printer EIA/TIA-232/V.24 cable to it. See Figure 3-20.

Figure 3-20   Connecting a Network Printer
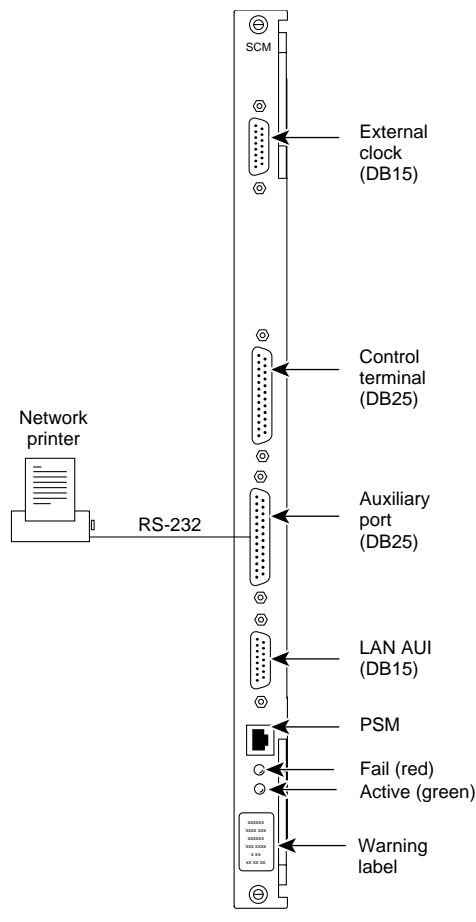
Step 4   Tighten the EIA/TIA-232/V.24 connector screws to firmly attach the cable connector to the AUX PORT connector.

Step 5   Plug the printer power cord into the appropriate wall receptacle.

Connecting a Modem

Two modems may be connected to the IGX node to provide access for remote troubleshooting and for remote alarm logging (see Figure 3-21). Each connection between the SCM and a modem requires a special cable and setup procedure. Refer to Appendix B, "Peripherals Specifications," for instructions on connecting and setting up the modems.

The modem that provides access for remote troubleshooting from the Cisco TAC office (TAC-to-IGX modem) connects to the CONTROL TERMINAL port on the SCM. Typically, the modem connects to the telephone wall jack with a direct-dial line. You can reach TAC through Cisco Customer Engineering.

The modem that is used to provide remote alarm logging (IGX-to-TAC modem) is connected to the AUX PORT on the SCM. This modem connects to a wall jack using a standard telephone line.

Figure 3-21   Connecting Modems to the IGX
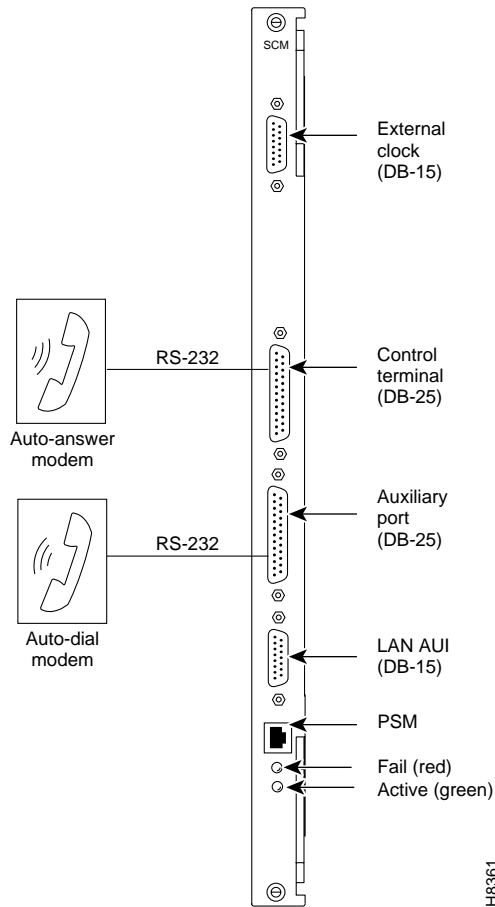
Connecting the Power Supply Monitor

The Power Supply Monitor (PSM) is a connector with outputs that signal an AC power supply alarm. Cisco provides no equipment that connects to the PSM connector, so user-supplied equipment is necessary. Refer to the *Cisco IGX Reference* publication for a description of the PSM outputs.

Initial Startup of the IGX

This section describes checkout procedures to follow after the hardware is in place and ready to receive power. The section "IGX Configuration Summary," later in this chapter summarizes the steps and lists the commands for bringing up the system.

Before using the IGX node, be sure the following procedures are complete:

Step 1   If the IGX node uses AC, make sure the node is connected to the correct AC receptacle. For a DC-powered unit, make sure it connects to the correct, dedicated DC source.

Step 2   Check the record for the correct switch status for switch W6 on the SCM. See the recommendation in the section "Readying the Cards." If the switch position was not previously verified, do so now. W6 sits above component U7P on the SCM. To indicate to the controller card that the system is an IGX 8430 node, remove the jumper. To indicate that the system is an IGX 8420 node, leave the jumper on the card. For an IGX 8410 node, Cisco sets the switch positions to indicate the node type.

Step 3 The full complement of cards for the node are mounted in the correct slots, correctly seated, and secured with screws.

Step 4 The T1 cables are attached to the correct BC-T1, BC-UVI-2T1EC, or UFI-8T1 card.

Step 5 The E1 cables are attached to the correct BC-E1, BC-UVI-2E1EC, or UFI-8E1 card.

Step 6 The Fractional E1 or T1 connections are attached to the BC-E1 or BC-T1 card connector if the IGX node is providing Fractional E1 or T1 service.

Step 7 The Subrate connections connect to the BC-SR card if the IGX node is providing Subrate E1 or T1 service.

Step 8 E3 cables connect to the correct AIT-E3 or BC-UAI-1E3 card.

Step 9 T3 cables connect to the correct AIT-T3 or BC-UAI-1T3 card.

Step 10 The data connections are attached to the appropriate SDI/LDI cards.

Step 11 For frame relay connections from a FastPAD, make sure the Frame Relay User Device Connections connect to the appropriate FPC card connectors.

Step 12 A control terminal connects to the CONTROL TERMINAL port on the SCM in back slot 1, or a StrataView Plus workstation connects to the AUI port, and the power cord plugged into the appropriate AC receptacle.

Warning If the FAN 2 connector on the PE-BC is unused, be sure not to plug the control terminal cable into FAN 2.

Step 13 If specified, a printer connects to the AUX PORT on the SCM in back slot 1, and the power cord is plugged into the appropriate AC receptacle.

Step 14 If specified, one or more modems connect to the CONTROL TERMINAL port or AUX PORT, as applicable, on the SCM in back slot 1, and any modem power cords plug into the appropriate AC receptacle.

Step 15 At the back of the unit, turn the circuit breakers to the ON position. In a system using a DC source, attach the cable guard (AC should already have the cable guard in place). After initial powerup, DC systems can be switched off and on either at the PEM or at the building site's resident circuit breaker. Use the building's DC circuit breaker only if all cables are clearly marked; if the building's dedicated circuit breaker has an actual switch and not just a fuse; and if controlling power at the building's circuit breaker actually provides an advantage over removing the cable guard.

Step 16 Observe that, after you turn on the IGX node, the cards run diagnostic self-test.

- The standby NPM red "FAIL" light flashes until self-testing and configuration updates are completed. The other NPM immediately becomes active but also performs self-testing and configuration updating. The process can take several minutes.

- The remaining cards show "FAIL" for a few seconds then become active or standby.

- The AC and DC "Okay" LEDs immediately turn on.

- Alarms may be indicated. Alarms may be present on trunks that have not been physically connected. The alarms disappears when those trunks are downed.

Step 17 If an alarm exists for a T1 or an E1 line that is physically connected to the IGX node, try reconnecting the line to make sure there is a good physical connection. If the alarm condition continues, a valid T1 or E1 problem may exist.

NPM Startup Diagnostic Test

The IGX software contains a group of diagnostic tests that run on the system's hardware at power-up. The startup diagnostic either passes or fails the NPM(s). The test result is displayed on the control terminal screen as pass or fail (Figure 3-22 or Figure 3-23).

Figure 3-22   Power-Up Diagnostic Screen—Passed

```
*****************************************************************************************
Release 7 Boot power up diagnostics starting.

68000 Internal Registers test passed.
68000 clock test passed.
Static RAM test passed.
TDM memory test passed.
Fast RAM test passed.
BRAM test passed.
Dynamic RAM test from Hex Address 400000 to Hex Address 9FFFFF

Release 7 Power up diagnostics complete.
*****************************************************************************************
```

Figure 3-23   Power-Up Diagnostic Screen—Failed

```
*****************************************************************************************
Release 7 Boot power up diagnostics starting.

68000 Internal Registers test passed.
68000 clock test passed.
Static RAM test passed.
TDM memory test passed.
Fast RAM test passed.
BRAM test failed.
Remove and reinsert this NPM to see if it fails again.
*****************************************************************************************
```

If an NPM fails the power-up diagnostic (Figure 3-23), the boot process does not finish. If this failure occurs, do the following:

Step 1   Remove the failed NPM from its slot.

Step 2   Install the NPM in the same slot again.

Step 3   Wait for the power-up diagnostic to run.

Step 4   If the NPM fails the power-up diagnostics again, replace it with an NPM that is known to be good. For card replacement procedures, refer to the "Troubleshooting" chapter.

Card Self Test

IGX software includes internal diagnostic routines that periodically test the cards' performance. Self-test diagnostics automatically start and run in background and do not disrupt normal traffic. If a failure is detected during the self-test, the faceplate red FAIL LED is turned on. You can also view the status at the control terminal by executing the Display Card (**dspcd**) command.

A report of a card failure remains until cleared. Clear a card failure by the Reset Card (**resetcd**) command. The two types of resets are *hardware* and *failure*. The reset-failure clears the event log of failures detected by the card self-test but does not disrupt operation of the card. A reset of the card firmware occurs with a hardware reset: it reboots the firmware and momentarily disables the card. If a redundant card is available, the hardware reset causes a switch over to the standby card.

Inspecting Status Lights

Check the status lights on the system unit cards. Table 3-3 shows the normal status of each light, assuming n+1 redundancy for NTM and CVM cards

Table 3-3   Component Status after Power-Up

Card	Active Status	Standby Status[1]	Alarms
NPM	1	1	–
CVM	–	–	–
UVM	-	-	-
NTM	–	all	–
BC-T1/E1	–	all	–
BC-SR (Subrate)	–	all	–
AIT-T3/E3	–	all	–
HDM/LDM	–	all	–
SDI/LDI	–	all	–
FRM	–	all	–
UFM	-	all	-
SCM	1	0	–
ALM/A	-	all	-
ALM/B	–	all	
BTM	–	all	
ARM	1	–	–
Power Supplies	All	–	–

1. Standby status is indicated by no lights on.

- If any card **FAIL** light is on steady, or if there is no **ACTIVE** card when there should be for that type, try removing and inserting the same card. Also, check the EEPROMs on the card to make sure they are all seated properly (press down on the ICs to ensure proper seating).

- If a power supply AC Okay LED or DC Okay LED is off, try removing and inserting the power supply. If any LED remains off, refer to Chapter 4, "Troubleshooting."

Checking the Power Supplies (AC Systems)

The means for verifying the correct power supply voltages are the DC Okay and AC Okay LEDs on each power supply. If either of these LEDs is off, a problem exists in relation to that supply. Power supplies are not field-adjustable. If a power supply voltage is out of tolerance, replace the supply with one known to be within tolerance. Refer to the section on AC power supply replacement in Chapter 4, "Troubleshooting."

Note In an IGX node, no test points are available in either the AC power supplies or any circuit board for checking voltages.

IGX Configuration Summary

This section outlines the steps and names the commands for configuring a network. This section is not an exhaustive presentation. For detailed descriptions of the commands, refer to the *Cisco Command Reference* or the *Cisco Command Reference*. For detailed descriptions of the networking concepts, refer to the *Cisco System Overview.*

You can configure the IGX node through commands you enter at the control terminal or, if you have access, at a Cisco StrataView Plus Network Management Station. Note that certain features are paid options, which TAC personnel must enable before you add the corresponding connections. Examples of paid options are Frame Relay, ABR with ForeSight, and so on.

For IGX configuration, the control terminal has system access either through a local control port (over an EIA/TIA-232 or Ethernet TCP/IP link) or from a control terminal screen on a Cisco StrataView Plus Network Management Station (NMS). Remote control terminal access is possible using a Virtual Terminal (vt) command if the node has been configured with a name (**cnfname**) and at least one trunk has been established to the network.

The basic tasks to configure an IGX node are as follows:

- For setting up the node.

    — configure the node name (**cnfname**).

    — configure the time zone (**cnftmzn**).

    — configure the LAN interface (**cnflan**).

    — configure the auxiliary or terminal ports to support any necessary external devices such as a local printer, an autodial modem, or an external multiplexer attached to the unit (**cnfprt**, **cnfterm**, **cnftermfunc**).

- For setting up the trunks.

    — verify the correct cards are in both the local and remote node (**dspcds**).

    — up the trunk at each node (**uptrk**).

    — configure any parameters required for the trunk at each node (**cnftrk**).

    — set up optional y-cable redundancy if you require it (**addyred**)

    — set up optional trunk redundancy if you require it (**addtrkred**).

    — set up any subrate trunk interface control templates if desired (**cnftrkict**).

- For setting up voice lines.

    — Activate the line (**upcln** or **upln**).

> — Configure the line (**cnfcln** or **cnfln**).
>
> — Configure redundancy (**addyred**).

- For setting up data lines and ports.

    > — Activate the line (**upcln**).
    >
    > — Configure the line (**cnfcln**).
    >
    > — Configure redundancy (**addyred**).

- Set up frame relay lines and ports. (See the section "Setting Up Frame Relay Ports and Connections (UFM)" or "Setting Up Frame Relay Ports and Connections (FRM)" for a description.)

    > — Activate each port (**upfrport**).
    >
    > — Specify a mode for the card as needed if the card is a UFM-U (**cnfmode**). To determine the current mode of a particular UFM-U, use **dspmode**.

- Set up FastPAD lines and ports. For descriptions of the FastPAD commands and detailed information on the FastPAD, refer to the *Cisco StrataView FastPAD User's Guide.*

    > — Activate the line (**upln**).
    >
    > — Activate the ports (**upftcport**).
    >
    > — Configure FastPAD control connection (**addfp**).

- For setting up ATM lines and ports.

    > — Activate the line (**upln**).
    >
    > — Configure the line (**cnfln**).
    >
    > — Activate the ports (**upport**).
    >
    > — Configure the ports (**cnfport**)

- For setting up voice connections.

    > — Add the connections (**addcon**). If voice connections terminate at the far end on an access device (such as a Cisco 3800 series device), add connections at the CVM, not the FTM.
    >
    > — Configure connection parameters (**cnfvchadv**, **cnfchdl**, **cnfchec**, **cnfchgn**, **cnfcond**, **cnfcondsc**, **cnfrcvsig**, **cnfsmtsig**, **cnfvchtp**, **cnfchutl**)
    >
    > — For only the UVM, additional configuration commands you can use are: (**cnfuvmchparm**, **cnfchfax**, **cnflnpass**. (Use **dsplncnf** to check whether the port is configured for External, Pass-through, Blocking, or Inserting.)

- For setting up data connections.

    > — Add the connections (**addcon**).
    >
    > — Configure connection parameters (**cnfdclk**, **cnfcldir**, **cnfict**).

- For setting up frame relay connections

    > — Add the connections (**addcon**).
    >
    > — Configure connection classes (**cnfcls**).
    >
    > — Configure control templates, channel utilization, and channel priorities (**cnfict**, **cnfchutl**, **cnfchpri**).

- For setting up connections to a Cisco access device (3800 series):

- — Up the interface port to the access device (**upftcport**)

- — Add the device to the node (**addad**). (The default bandwidth parameters are normally sufficient. To change parameters, use **cnfadcon**. Otherwise, begin adding connections).

- — Add connections at the FTC/FTM (**addcon**). Note that if the other end of the connection is a CDP or CVM, you must add the connection at the CDP or CVM.

- — Optionally, you can configure the Congestion Management Timer (**cnfadcmtmr**).

- — You can display information about each access device on the node by using **dspads**.

- For setting up FastPAD connections.

  - — Add the connections (**addcon**).

  - — Configure the FastPAD for switched or permanent voice connections (**cnfchgn**, **cnfchutl**, **cnfvfpchtp**).

  - — Configure FastPAD data connections (**cnfcondsc**, **cnfdclk**, **cnfict**, **cnfchutl**).

- For setting up ATM connections (see also the paragraph that follows this list for information on connections using ATM-to-frame relay interworking).

  - — Add connections (**addcon**).

  - — Configure a connection type (**cnfcontyp**).

- Optimize network routing and bandwidth (**cnfchutl**, **cnfpref**, **cnfcos**).

Interworking Connections in a Tiered Network

Two approaches are available for establishing a frame relay-to-ATM interworking connection in a *tiered* network (see the *Cisco WAN Switching System Overview* for a description of tiered networks). The simplest approach is to use the Connection Manager in StrataView Plus. When you specify a connection to an FRSM on an MGX 8220 interface shelf, StrataView Plus directs the node to establish the correct end-to-end connection type. This connection type is either *atfr* (ATM-to-frame relay interworking) or *atfst* (ATM-to-frame relay interworking with ForeSight.) The other approach is to use the command line interface on the IGX node or other routing node to execute **addcon** and related commands (such as **cnfcon**) to establish the connection between routing nodes. A network interworking connection requires that you specify each individual segment of the connection. (Establishing the connection between the FRSM on the MGX 8220 shelf and the BPX 8620 node requires you to execute the **addchan** command on the MGX 8220 shelf.)

Configuring an IGX To Be an Interface Shelf

An *interface shelf* is a non-routing, concentrator shelf that communicates ATM cells to and from a BPX 8620 or IGX 8400 series routing hub in a tiered network. (An interface shelf is also known as a feeder shelf.) An interface shelf is either an IPX or IGX node configured as an interface shelf or an MGX 8220 shelf. IGX/AF is the designation of an IGX node serving as an interface shelf.

For an IPX or IGX node to serve as an interface shelf, personnel in the TAC must first configure the node for that purpose because tiered network capability is a purchased option. In an IGX node, the BTM is the only card that can support a trunk to the routing hub.

You can add an interface shelf from StrataView Plus or the command line interface (CLI), The steps for adding a new interface shelf to a network are:

Step 1   Activate the trunk between the interface shelf and routing hub. On the CLI, use **uptrk**. (Note that you do not subsequently use **addtrk** for the interface shelf.)

Step 2   Configure the trunk for STI cell headers and BPX Addressing Mode (BAM). On the CLI, the command to use is **cnftrk**.

Step 3   Add the new interface shelf node to the network (after the TAC has enabled this feature). On the CLI, use **addshelf**. You add the shelf from the routing hub. Repeat **addshelf** for each shelf connected to the hub.

Figure 3-24 illustrates the sequence of using **addshelf** either locally or remotely to add one or more interface shelves. To delete an interface shelf, use **delshelf** after you delete connections and the active interfaces. To view status of an interface shelf, execute **dspnode** at the routing hub. (The **dspnw** command shows an alarm on a node but does not specify an interface shelf.)

Figure 3-24   **Add an Interface Shelf From the Hub**
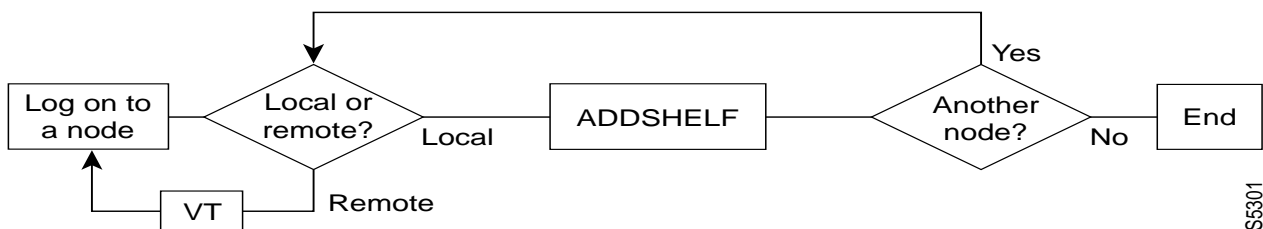
Adding Connections in a Tiered Network through the CLI

Adding a connection in a tiered network requires that you add local segments and a network segment. The following steps illustrate the setup for each segment for an interworking connection:

Step 1   For segment 1:

        addcon *slot.port.DLCI local_nodename slot.vpi1.vci1*

        where the first slot has a Frame Relay card, and the second slot has a BTM. (In an IGX interface shelf, the only card that supports the trunk to the hub is the BTM.)

Step 2   The network segment:

        addcon *slot.port.vpi1.vci1 remote_nodename slot.port.vpi2.vci2*

        where the card in *slot* is a BNI.

Step 3   For segment 2:

        addcon *slot.vpi2.vci2 local_nodename slot.port.DLCI*

        where the first slot is a BTM, and the second slot is a Frame Relay card.

Note that the VPI and VCI need to match only at the segment on the local interface shelf. Apart from this requirement, the *vpi.vci* on segment 1 can also be the *same* as the *vci.vpi* on segment 2.

Converting a Routing Node to an Interface Shelf

To convert a routing node to an interface shelf, first remove the routing node from the network by deleting all connections then deleting and downing all lines and trunks. Refer to StrataView Plus documentation or the *Cisco Command Reference* for instructions. In the command reference, check

the chapters by topic (ATM connections, Frame Relay connections, trunks, and so on) for the applicable command descriptions. Next, you need to add the node as an interface shelf. Refer to the preceding section titled "Configuring an IGX To Be an Interface Shelf" for instructions.

IGX Management

You can monitor, manage, and troubleshoot the IGX node using the Cisco StrataView Plus Network Management Station. Issue commands to an IGX node through the Node Administration window. Display and monitor the network's topology using the Network Overview and Network Topology windows. Alarms are reported and logged into the Event Log window. Statistics are collected and displayed through the Cisco StrataView Plus Statistics window.

Note   When a Cisco StrataView Plus workstation is directly connected to an IGX node, a unique icon appears for the IGX node in the Network Topology window. When the Cisco StrataView Plus workstation is attached to an IPX or BPX 8620 node, the same style icon appears for both IGX and IPX nodes. To identify an IGX node, Cisco Systems suggests that the name of an IGX node include the letters "IGX," (IGXalpha, for example).

Troubleshooting

This chapter describes how to diagnose problems. When a troubleshooting table in this chapter recommends replacement, refer to the procedures in Chapter 5, "Repair and Replacement."

The IGX operating system software does most of the IGX monitoring and maintenance. The only action that qualifies as preventative maintenance is checking the power supplies.

Checking the AC Power Supplies

You cannot directly measure voltages on the AC power supplies in an IGX node. If a problem exists with one of the supplies, one or both the DC and AC LEDs turns off. Refer to the chapter on repair and replacement for instructions on re-seating or replacing an AC power supply.

After you install new or additional cards in the node, check the LEDs on the power supplies to make sure the cards have not put an excessive load on the power supplies.

Troubleshooting an IGX Node

This section describes elementary troubleshooting procedures and briefly describes the commands used when troubleshooting an IGX node. (These commands are described in detail in the *Cisco WAN Switching Command Reference*.) This set of procedures is not exhaustive and does not take into account any of the diagnostic or network tools available to troubleshoot the IGX node.

⚠ **Caution**   Do not perform any disruptive tests or repairs to the IGX node without first calling Cisco Customer Engineering. Cisco personnel can help isolate the fault and provide repair information. Within the United States, call 1-800-553-6387, 6:00 AM to 6:00 PM, Pacific Time, Monday through Friday. Outside the U.S., call 1-(408)-526-4000.

This section contains the following topics:

* Troubleshooting tables for the IGX node.

* System hardware status (configuring and displaying), including circuit cards, system buses, and power supplies.

* CGA relay and forced yellow signal group channel additions.

* Channel loopback and connection tests.

* Alarm thresholds for statistical line errors, and line error display reporting.

* External test equipment, such as a BERT.

General Troubleshooting Procedures

The IGX node regularly runs self-tests to ensure proper function. When the IGX node finds an error condition that affects operation, it downs the affected card or line. It then selects a standby card or redundant line if one is available (in the non-redundant system no alternate cards are available for the CVM, NTM, FRM, UFM, ALM/B, BTM, BC-T3, BC-E3, ARM, BC-E1, BC-T1, HDM, SDI, LDM, LDI and NPM, so the system goes down if a failure occurs on any of these cards.)

> ⚠️ **Caution** A lit FAIL LED on a card indicates that an error was detected. Try resetting the light with the **resetcd f** command. If the FAIL LED lights up again, use Table 4-1 to find the cause and call the Cisco TAC to obtain information on isolating the problem and possibly replacing a component, or for information on how to return defective components.

Table 4-1   **General Troubleshooting**

Symptom	Probable Cause	Remedy
1. No indicators on IGX boards lit-console screen blank. LEDS on power supplies not lit.	1. IGX circuit breakers off.	1. Switch on power switch.
		2. Switch off, then switch on the power switch to reset the breaker. Check to see if any overload condition exists (shorted connections, crow-barred power supplies).
	2. IGX power cord dislodged from plug.	3. Reconnect power cord to AC receptacle.
	3. Power supplies not functioning.	4. Replace power supplies
2. Front card FAIL indicator lit	1. Front card experienced an error: • CVM card • NPM card • ARM card • NTM card • HDM card • LDM card • FRM card • UFM card • ALM card	1. Indicates an error occurred. Resetting the card with the **resetcd f** command is suggested first. If the LED comes on again, call the Cisco TAC. NOTE: If an NPM fails in a non-redundant IGX system the system must be rebooted.
3. Front card indicator lit—replacement card does not fix problem.	1. Defective backplane is possible.	1. If a new card does not fix problem, the backplane may be suspect (very uncommon failure). Contact the Cisco TAC.
4. SDI card FAIL indicator lit.	1. SDI card failed: • SDI (RS232) card • SDI (RS449) card • SDI (V.35) card	1. Indicates an error occurred. Check alarm status of card. Re-seat card. Resetting the card with the **resetcd f** command is suggested first. If the LED comes on again, call the Cisco TAC.
5. ALM, BTM,UFM, ARM, CVM, LDI, BC-E1 or BC-T1 FAIL indicator lit-replacement card does not fix problem.	1. Defective backplane is possible (very uncommon).	1. If new card does not fix the problem, contact the Cisco TAC. NOTE: All cards plug into the system backplane, and if this backplane is defective, it could cause a fault to appear on any card.

Table 4-1   General Troubleshooting (Continued)

Symptom	Probable Cause	Remedy
	2 Blown backplane fuse (very uncommon)	1 See backplane fuse section in the chapter titled "Repair and Replacement."
6. Power Supply AC *or* DC Okay LED off.	1. Possible power supply defect.	1. Re-seat supply per instructions in the chapter titled "Repair and Replacement." Remove and replace power supply if defective.
	2. PE-BC wiring or card defective.	1. If power supplies output check out, then PE-BC wiring connections or card is suspect.
		2. Make sure the plug connection to the PE-BC card is secure; tighten if it is not.
		3. If the plug connection is secure and the Power Supply Monitor FAIL indicator is still lit, then remove and replace the SCM card.
7. Command line display incorrectly shows wrong IGX system type.	1. Jumper switch W6 in wrong position. (See installation chapter)	1. To indicate an IGX 16 node, the jumper must be in place. To indicate an IGX 32 node, the jumper must be absent.
	2. SCM circuitry that reads W6 setting may be defective.	1. Verify SCM circuitry with a known good SCM.
8. Neither of the Power Supply "Okay" LEDs are lit.	1. Defective fan or fans in cooling assembly is allowing the temperature in the enclosure to rise above 40° C.	1. Verify fan tray fans are working. If not, replace tray according.
	2. Defective power supply fan in power supply allowing the power supply temperatures to rise above 40° C.	1. If the system cooling fan assembly is functioning correctly, then a power supply fan is suspect. Remove cover over power supplies to determine if fan is rotating. Replacing a power supply fan is not a field repair. Replace the supply.
		2. Issue a dsppwr command at the control terminal to check to see if the power supply fans are rotating, if not, remove and replace the power supply with the defective fan.
		3. If power supply fans are functioning, then the power supply temperature sensor is defective. Remove and replace the temperature sensor
	3. Defective SCM card	1. If both the enclosure fan assembly and the power supply fans are working correctly (see symptom 6, probable causes 1, 2 and 3), then the SCM card is suspect.
		2. Remove and replace the SCM card.

		Table 4-1		General Troubleshooting (Continued)	

Symptom	Probable Cause		Remedy	
9. Console screen blank, IGX indicator lights lit.	1.	Control terminal switched off.	1.	Switch on the control terminal.
	2.	Control terminal power cord disconnected.	2.	Reconnect the control terminal power cord to 208/240 vac power outlet.
	3.	RS-232 cable loose or disconnected from the Control Terminal port on the SCM, or from the control terminal.	3.	Reconnect the RS-232 cable to Control Terminal port on the SCM back card or to the control terminal itself.
	4.	Control terminal malfunctioning.	4.	Refer to the control terminal manufacturer's manual.
10. Printer not functioning	1.	Printer switched off.	1.	Switch on the printer.
	2.	Printer out of paper.	2.	Renew the paper supply.
	3.	Printer power cord disconnected.	3.	Reconnect the printer cord to 208/240 vac power outlet.
	4.	RS-232 cable loose or disconnected from the Control Terminal port on the SCM, or from the printer.	4.	Reconnect RS-232 cable to the Control Terminal port on the SCM back card or to the printer itself.
	5.	Printer malfunctioning.	5.	Refer to the printer manufacturer's manual.
11. Modem not functioning.	1.	Modem switched off	1.	Switch on the modem.
	2.	Modem power cord disconnected.	2.	Reconnect modem power cord.
	3.	RS-232 cable loose or disconnected from the Control Terminal port on the SCM, or from the modem.	3.	Reconnect the RS-232 cable to the Control Terminal port on the SCM back card or the modem itself.
	4.	Telephone hookup cable disconnected.	4.	Reconnect the telephone hookup cable.
	5.	Modem malfunctioning.	5.	Refer to the modem manufacturer's manual.
	6.	DIP switches not set correctly.	6.	Refer to the modem manufacturer's manual.
12. DFM is not functional.	1.	DFM has been not been enabled by Cisco.	1.	Contact the Cisco TAC.
13. DFM has been enabled but still does not function.	1.	DFM only runs on speeds up to 64Kbps.	1.	Readjust the speed.
14. Background noise or music sounds choppy.	1.	VAD problem.-VDP needs sensitivity adjustment	1.	Contact the Cisco TAC.
15. High speed modem drops to low speed.	1.	ADPCM is taking over.	1.	Contact the Cisco TAC.
16. Bundled (Frame Relay) connections have failed.	1.	One or more bundled connections have failed.	1.	Contact the Cisco TAC.

Troubleshooting the IGX Console Alarms

The initial mode of troubleshooting the IGX node uses the console alarms displayed on the console screen. Table 4-2 provides you with a procedure for isolating the alarms and thereby isolating the fault. Any repair to the IGX node must be performed by Cisco-qualified personnel.

> ⚠️ **Caution** When using Table 4-2 for troubleshooting, call the Cisco TAC before performing any disruptive testing, or attempting to repair the IGX node, to ensure that you have isolated the correct problem area, and also to enable Cisco personnel to provide you with assistance in performing the necessary procedures.

Table 4-2   Troubleshooting the IGX Console Alarms

Symptom	Probable Cause	Remedy
MAJOR/MINOR alarm flashing on affected console screen.	• Failed connection • Failed circuit lines • Failed trunks • Failed cards • Unreachable node • High error rate on circuit lines or trunks.	1. Use **dspnw** command to identify the node(s).
		2. Use **vt** command to place yourself at the affected node, and use **dspalms** to identify the alarm type.
		a.If the alarm display indicates a **failed connection**, go to probable cause 1.
		b.If the alarm display indicates a **failed circuit line**, go to probable cause 2.
		c.If the alarm display indicates a **failed trunk**, go to probable cause 3.
		d.If the alarm display indicates a **failed card**, go to probable cause 4.
		e.If the alarm display indicates an unreachable node, go to probable cause 5.
	1. Failed connection.	1. Use the **dspcons** command to identify which connections have failed and to determine the remote end connection assignments.
		2. Use the **dsplog** command to determine the cause of failure of the connections. These failures could consist of failed circuit lines, trunks cards, or clock over speeds.
		a. If the connections have failed due to a circuit line failure, go to probable cause 2.
		b.If the connections have failed due to a packet line failure, go to probable cause 3.
		c. If the connections have failed due to a card failure, go to probable cause 4.
		d. If connections have failed due to a clock over speed condition, go to probable cause 5.
	2. Failed circuit line.	1. Use the **dspclns** command to identify the circuit line number and failure type.
		a.If the failure is a circuit line local CGA (no pulses received at the local end of circuit line) go to probable cause 2a.

Table 4-2   **Troubleshooting the IGX Console Alarms (Continued)**

Symptom	Probable Cause		Remedy	
			b.If the failure is a circuit line remote CGA (no pulses received at the remote end of circuit line), go to probable cause 2B.	
			c.If the failure is circuit line frame slips (indicating excessive frame slips on the T1 between the IGX node and the PBX) go to probable cause 2C.	
			d.If the failure is circuit line bipolar errors (indicating excessive bipolar errors on this circuit line) go to probable cause 2D.	
	2A	Circuit line local CGA.	1.	Use the **dsplog** command to determine date, time of day, and the duration of the CGA alarm.
			2.	Determine if the PBX T1 subrate or the PBX E1 interface went down at the time the CGA alarm was logged by the IGX node.
			3.	Check cabling between IGX node and the PBX and make necessary repairs if defective.
			4.	Make a note of the steps taken and call the Cisco TAC.
	2B	Circuit line remote CGA.	1.	Refer to remedies for probable cause 2A.
	2.	Circuit line frame slips.	1.	Use the **dsplog** command to determine date, time of day, and duration of the frame slip alarm. Also determine if the clock source for this line has changed due to line failure in the network.
			2.	Use the **dspclnerrs** command to quantify frame slips and rate information.
			3.	Use the **dspclnhist** command to obtain historical information on frame slips.
			4.	Use the **dspcurclk** command to identify the current clock source and path to the current clock source.
			5.	Use the **clrclnalm** command to clear the circuit line alarms
			6.	Make a note of the steps taken, and call the Cisco TAC.
	2	Circuit bipolar errors.	1.	Use the **dsplog** command to determine when the bipolar error threshold was exceeded, and the duration of the alarm.
			2.	Use the **dspclnerrs** command to quantify the bipolar errors.
			3.	Use the **dspclnhist** command to obtain historical information on bipolar errors.
			4.	Check cabling between IGX node and the PBX for loose connections, and tighten it if it is loose.
			5.	Use the **clrclnalm** command to clear line alarms.
			6.	Make a note of the steps taken, and call the Cisco TAC.
	3.	Failed trunk.	1.	Use the **dsptrks** command to identify the remote end node name, trunk numbers at each end, and the type of failure.

Table 4-2   Troubleshooting the IGX Console Alarms (Continued)

Symptom	Probable Cause	Remedy
		a. If the display shows a communication failure, go to probable cause 3A.
		b.If the display shows a local CGA, go to probable cause 3B.
		c.If the display shows a remote CGA, go to probable cause 3C.
		d.If the display shows a bipolar error, go to probable cause 3D.
		e.If the display shows a frame slip error, go to probable cause 3E.
		f.If the display shows an out-of-frame error, go to probable cause 3F.
		g.If the display shows a time-stamped packet drop error, go to probable cause 3G.
		h.If the display shows a non time-stamped packet drop error, go to probable cause 3H.
		i.If the display shows a loop-back, go to probable cause 3I.
	3A Communication Failure.	1. Use the **dsplog** command to determine when the communication failure or CGA occurred, and identify connections which may have failed due to lack of bandwidth on an alternate route.
		2. Use the **dsptrkerrs** command at each end of the packet line to quantify errors, and determine if they are unidirectional or bidirectional.
		3. Call telephone carrier and request span testing. Ask the carrier to perform BER tests using multiple test patterns, including standard quasi, all 1, and 3 and 24 patterns.
		4. Make a note of the steps taken, and call the Cisco TAC.
	3B Local CGA—indicates no pulses at the local end of the trunk.	1. Refer to probable cause 3A remedies.
	3C Remote CGA—indicates no pulses at the remote end of the trunk.	1. Refer to probable cause 3A remedies
	3D Bipolar errors—indicates excessive bipolar errors on this trunk.	1. Use the **dsplog** command to determine the date, time of day, and the duration of the alarm.
		2. Use the **dsptrkerrs** command at each end of the trunk to quantify errors, and determine whether they are unidirectional, or bi-directional.
		3. Use the **dsptrkhist** command at each end of the trunk to collect historical information on line errors.
		4. Use the **clrtrkalm** command to clear trunk alarms.
		5. Call the Cisco TAC for assistance. Cisco personnel can monitor line errors, and may advise disruptive testing to be scheduled with telephone carrier.

Table 4-2   Troubleshooting the IGX Console Alarms (Continued)

Symptom	Probable Cause		Remedy	
			6.	Call telephone carrier and request span testing. Ask the carrier to perform BER tests using multiple test patterns, including standard quasi, all 1, and 3 and 24 patterns.
			7.	If telephone carrier is unable to isolate the problem on the span, contact Customer Support for assistance.
	3E	Frame slip errors indicates excessive frame slips on this trunk	1.	Refer to probable cause 3D remedies.
	3F.	Out-of-frame errors—indicates excessive out-of-frame errors on the trunk.	1.	Refer to probable cause 3D remedies
	3G	Time-stamped packet drops— indicates time-stamped packet drops have exceeded the threshold for generating an alarm.	1.	Use the **dsplog** command to determine when the dropped packet alarm threshold was exceeded, and determine the duration of the alarm.
			2.	Use the **dspload** command alarm. to determine the current loading of this trunk.
			3.	Make a note of steps taken and call Customer Support. Refer to probable cause 3G remedies.
	3H	Non time-stamped packet drops—indicates that non time -stamped packet drops have exceeded the threshold for generating an alarm.		Refer to probable cause 3G remedies.
	3I.	Loop-back.	1.	Determine if company personnel are performing span tests with CSU loop-backs, demarc, or DSX panel.
			2.	If company personnel are performing loop-back tests, ask them to indicate when they have completed testing, and monitor the system to ensure that the loop-back indication disappears when testing is complete.
			3.	If company personnel are not performing loop-back tests, telephone carrier most likely has the E1 span in loop-back mode.
			4.	Call telephone carrier to verify that they are testing the E1 span, and ask them to indicate when they have completed their tests. Monitor the system to ensure that the loop-back indication disappears when testing is completed.
			5.	Make a note of the alarm steps taken, and call Customer Support.
	4.	Failed cards—indicates the number of cards that have failed.	1.	Use the **dspcds** command to determine which card has failed, along with its status (active or standby).
			2.	Use the **dsplog** command to determine time of day the card failed and whether or not any connections using this card are also in a failed condition.

Table 4-2   Troubleshooting the IGX Console Alarms (Continued)

Symptom	Probable Cause	Remedy
		3. If the failed card is an HDM or LDM card, use the **dspbob** command at each end of the connection using this card to verify that data is passing. For a CDP, CVM, or UVM, use the **dspchstats** command.
		4. If a card has failed, make a note of the steps taken, and call Customer Support.
	5. Unreachable node—shows the number of unreachable nodes in the network.	1. At any node, use the **dsplog** command to determine the date and time of day that the node became unreachable. A node is usually unreachable due to a trunk failure or a power outage.
		2. Contact personnel at that node to determine whether or not there was a power failure at the time logged by the IGX node.
		3. If there was a power failure, check that NPM comes up and run diagnostics.
		4. If there was not a power failure, call Customer Support.
	6. Clock Overspeed.	1. Use the **dspbob** command to determine the incoming baud rate for this connection.
		2. Use the **dspcon** command to verify that the console incoming baud rate is the same as the configured baud rate.
		3. Reconfigure the incoming baud rate to match the configured baud rate.
		4. Make a note of the steps taken, and call Customer Support.

Displaying a Summary of Alarms

The first step in troubleshooting the IGX node is to check the condition of the system. This is done by displaying alarm conditions throughout the system. In order to see a summary of all of the alarms present on an IGX node, use the **dspalms** (display current node alarms) command is used. The alarms summary includes the following:

- Number of failed connections.

- Number of major and minor alarms.

- Number of failed cards.

- Power monitor failures.

- Bus failures (either failed or needs diagnostics).

- Number of alarms on other nodes in the network.

- Number of unreachable nodes in the network.

Note   You cannot include the **dspalms** command in a job.

To display alarms enter the command **dspalms**.

If the screen indicates a failure, refer to the commands in Table 4-3 to further isolate the fault.

Table 4-3　　　Fault Isolation Commands

Failure	Diagnostic Commands
Connections	**dspcons** (display connections)
Line Alarms	**dspclns** (display circuit lines)
	dsptrks (display trunks)
Cards	**dspcds** (display cards)
Power Monitor/Fans	**dsppwr** (display power supply status)
Remote Node	**dspnw** (display network)
Unreachable Nodes	**dspnw** (display network)
Remote Node Alarms	**dspnw** (display network)

Displaying the Status of Cards

When a card indicates a failed condition on the alarm summary screen, use the **dspcds** command to display the status of the cards on a node. The information displayed for each card type includes the slot number, software revision level, and the status of the card. (Note that you cannot use the **dspcds** command in a job.)

Note　If **dspcds** or any other command incorrectly states the IGX model (for example, stating that an IGX 8420 node is an IGX 8430 node), check the jumper switch W6 on the SCM. A jumpered W6 indicates an IGX 8420 node. An open W6 indicates an IGX 8430 node. The chapter titled "Card Installation and Node Startup" documents this aspect of the SCM.

All the possible status descriptions for each card type appear in Table 4-4.

Table 4-4　　　Card Status

Card Type	Status	Description
All card types (including CVM)	Active	Active card
	Active—F	Active card with non terminal failure.
	Standby	Standby card
	Standby—F	Standby card with non terminal failure.
	Standby—T	Standby card performing diagnostics.
	Standby—F–T	Standby card with non terminal failure performing diagnostics.
	Failed	Card with terminal failure.
	Unavailable	Card is present but it may be in any of the following states:

Table 4-4   Card Status (Continued)

Card Type	Status	Description
		1. The node does not recognize the card (may need to be re-seated).
		2. The card is running diagnostics.
	Down	Downed card.
	Empty	No card in that slot.
	Active—T	Active card performing diagnostics.
NPM	Same status as for all card types, plus:	
	Updating	Standby NPM downloading the network configuration from an active NPM.
		NOTE: Red FAIL LED flashes during updating.
	Cleared	NPM is preparing to become active.
	Loading Software	There are downloader commands that appear when the system is down-loading software to the NPM.

Note   Cards with an **F** status (non terminal failure) are activated only when necessary (for example, when there is no card of that type available). Cards with a failed status are never activated.

Note   The **dspcds** command cannot be included in a job.

To display cards enter the following command:

    dspcds

Refer to the *Cisco WAN Switching Command Reference* for more information.

User-Initiated Tests

Several user-tests are available to diagnose the state of the IGX. The commands for activating these tests are as follows:

- **tstcon** for voice connections

- **tstcon** for data connections

- **tstport** for data and frame relay ports

For detailed information on these commands, see the troubleshooting chapter in the *Cisco WAN Switching Command Reference*.

Loopback Tests

Loopback tests are available to help diagnose the state of the IGX system. The commands for activating these tests are as follows:

- CVM/NTM for implicit internal loopback.

- Voice: **addloclp, addrmtlp**

- Data: **addloclp, addrmtlp**

- Frame relay: **addloclp**

For detailed information on these commands, see the *Cisco WAN Switching Command Reference*.

Card Testing with External Test Equipment

The HDM/SDI or LDM/LDI card set can be tested as a pair at the local node using external test equipment such as a Bit Error Rate Tester (BERT). This can be useful in isolating "dribbling" error rates to either the cards, the frame relay data input, or the transmission facility. This test checks the data path from the electrical interface at the port through the card set to the CELLBUS in both directions of transmission.

Note This is a disruptive test. Notify your network administrator before performing this test.

To perform this test, proceed as follows:

Step 1   Disconnect the data cable connection to the SDI or LDI and connect the BERT in its place.

Step 2   Set up an internal loopback on the frame relay port to be tested using the Add Local Loopback (**addloclp**) command.

Step 3   Turn on the BERT, make sure it indicates circuit continuity, and observe the indicated error rate.

Step 4   If there are any errors indicated, first replace the back card and retest. If the errors remain, then replace the front card and retest.

Step 5   When the test is complete, disconnect the BERT and reconnect the data cable. Release the local loopback by using the Delete Loopback (**dellp**).

Step 6   Repeat at the node at the other end of the connection if necessary.

Repair and Replacement

This chapter covers the tasks of replacing a single card, a power supply, or a complete node.

Moving a Node

The requirements for moving a node depend on the distance involved. In all cases however, the node must be disconnected from the network by:

- Removing connections (**delcon**).

- Downing trunk lines (**deltrk, dntrk**) downing circuit lines (**delcln, dncln**).

- Removing all data cables.

- Turning off power. For DC-powered systems, do this at the building site's dedicated branch circuit breaker(s) rather than the PEM circuit breaker.

- Removing any bolts holding the cabinet to the floor or any other structure.

The remainder of the task is the physical move of the unit. Use the pallet and box that came with the original packing to move the node a long distance. For shorter moves of a stand-alone unit, screw the feet up into the unit to expose the wheels then roll the unit.

Caution   When moving a STRATM cabinet, do not push the cabinet at its sides. Instead, grip the cabinet at the front or back edges to maneuver it to the new location.

Replacing Front Cards

This section describes how to perform a hot replacement of a front card. Read the following list before proceeding with front card replacement:

- The FRM and NTM frond cards come in either a one or two-piece version. The versions are interchangeable, but nevertheless make sure sufficient parts are available.

- Before you replace an NPM with an NPM B version, make sure the system software supports the B version. Check the Release Note that comes with this manual to see the required version, or call Customer Engineering.

- When a system has only one NPM and you need to remove it, you should first insert the new NPM and place it in standby so that, when you remove the old NPM, the standby NPM becomes active. In this way, connections remain intact.

- With one exception, any front card can be replaced without the requirement of first deleting logical connections. The exception is when the card type is changed (for example, when an HDM replaces an FRM: in this case, applicable ports are downed then deleted before connections are deleted with the **delcon** command).

- Use a 5/32" Allen wrench to open the front door. Also, front card faceplate screws require a No. 1 Phillips screwdriver or the Cisco combination tool (P/N 218705).

Caution Before you handle a card, attach an electrostatic preventive wrist strap. The IGX 8 has an attached electrostatic preventive wrist strap at both the front and back of the cabinet. For an IGX 16 or IGX 32, you must attach the wrist strap. Handling a card without an electrostatic preventive wrist strap may result in electrostatic damage to the card.

To replace a card with the power on:

Step 1   If necessary, delete relevant connection with the **delcon** command.

Step 2   Loosen the two phillips captive screws in the faceplate.

Step 3   Operate the extractor handles to disconnect the card from the backplane.

Step 4   Pull the card out of the card cage.

Caution Correct alignment between connector pins and receptacles is *extremely* important. Before inserting a card, make sure all backplane pins are straight. Make sure the connectors on the card and backplane are aligned. Insert the card gently.

Step 5   Installing a front card requires the card to be inserted into the card track and pushed firmly but gently into the connector on the back card (or the backplane connector if the card is an NPM).

Step 6   Hold the extractor handles in the open position until they contact the shelf supports and then rotate them into the closed position.

Step 7   Tighten the captive screws on the card's faceplate just enough to secure the card.

Replacing Back Cards

This section describes how to remove and replace a back card.

Step 1   Except for an SCM or a case where the type of back card is being replaced (such as an AIT-T3 added and an FRI removed), a failed back card can be removed without deleting connections. Before replacing an SCM or changing card types, delete either all connections (SCM) or only card-specific connections (as in the FRI example) with the **delcon** command.

Step 2   Identify and mark any cable locations before removing cables from a back card.

Note Before you handle a card, attach a wrist strap. The IGX 8410 node has an attached wrist strap at both the front and back of the cabinet. For an IGX 8420 or 8430 node, you must attach the wrist strap.

Step 3   Loosen the captive screws on the top and bottom of the faceplate of the card.

Step 4   Operate the extractor levers then slide the card out of the cabinet.

Step 5   Before installing a replacement back card, make sure that the pins are straight.

Warning Correct alignment between connector pins and receptacles is *extremely* important. Before inserting a card, make sure the pins on the front card are straight. Make sure the connectors on the card and the backplane align with each other. Insert the card gently.

Warning High voltages and currents are present within the IGX. Be **extremely** careful when working within reach of equipment to which electric power is applied.

Step 6   Insert the card into the card track in the card cage and gently seat the card in the connector on the front card (or the backplane if the card is an SCM). If significant resistance occurs, the connectors may not be aligning with each other due to warpage in the card. In this case, removing other cards to provide room for manually aligning the card may be necessary. In this case, all precautions should be taken when placing a hand inside a hot card cage.

Step 7   Tighten the captive mounting screws on the top and bottom of the faceplate of the back card. Connect all cables to their proper location and secure them with the mounting screws on the connector.

Replacing a DC Power Entry Module

A DC Power Entry Modules (PEM) contains few active components, so it rarely needs replacement. To replace a PEM, refer to Figure 5-1 and proceed as follows:

Step 1   Remove the cable guard: loosen the captive screw at its base and, holding the cable guard at its top and bottom, swing the guard away from the system at the base.

Step 2   Switch the circuit breaker on the PEM to the OFF position.

Step 3   Grasp the pluggable terminal block and disconnect it from the module.

Step 4   Remove the wiring from the strain relief mechanism.

Step 5   Loosen the captive screws that secure the PEM in the PE-BC.

Step 6   Pull the power entry module out of the Power Entry Back Card (PE-BC).

Step 7   Slide in the replacement module until it seats in the D-connector on the PE-BC.

Step 8   Tighten the screws to secure the PEM in the PE-BC.

Step 9   Place the wiring within the strain relief mechanism.

Step 10   Plug in the terminal wiring block into the DC receptacle.

Step 11   Switch the circuit breaker on the PEM to the ON position.

Step 12   Re-attach the cable guard after confirming correct system operation.

Figure 5-1   PEM Faceplate Features and Surrounding Area

Connector (fan 2)

Redundant

Primary

Circuit breaker

DC receptacle
for pluggable
terminal block

Pluggable terminal block

Customer-supplied wiring

Strain relief mechanism

Connector (fan 1)

H8303
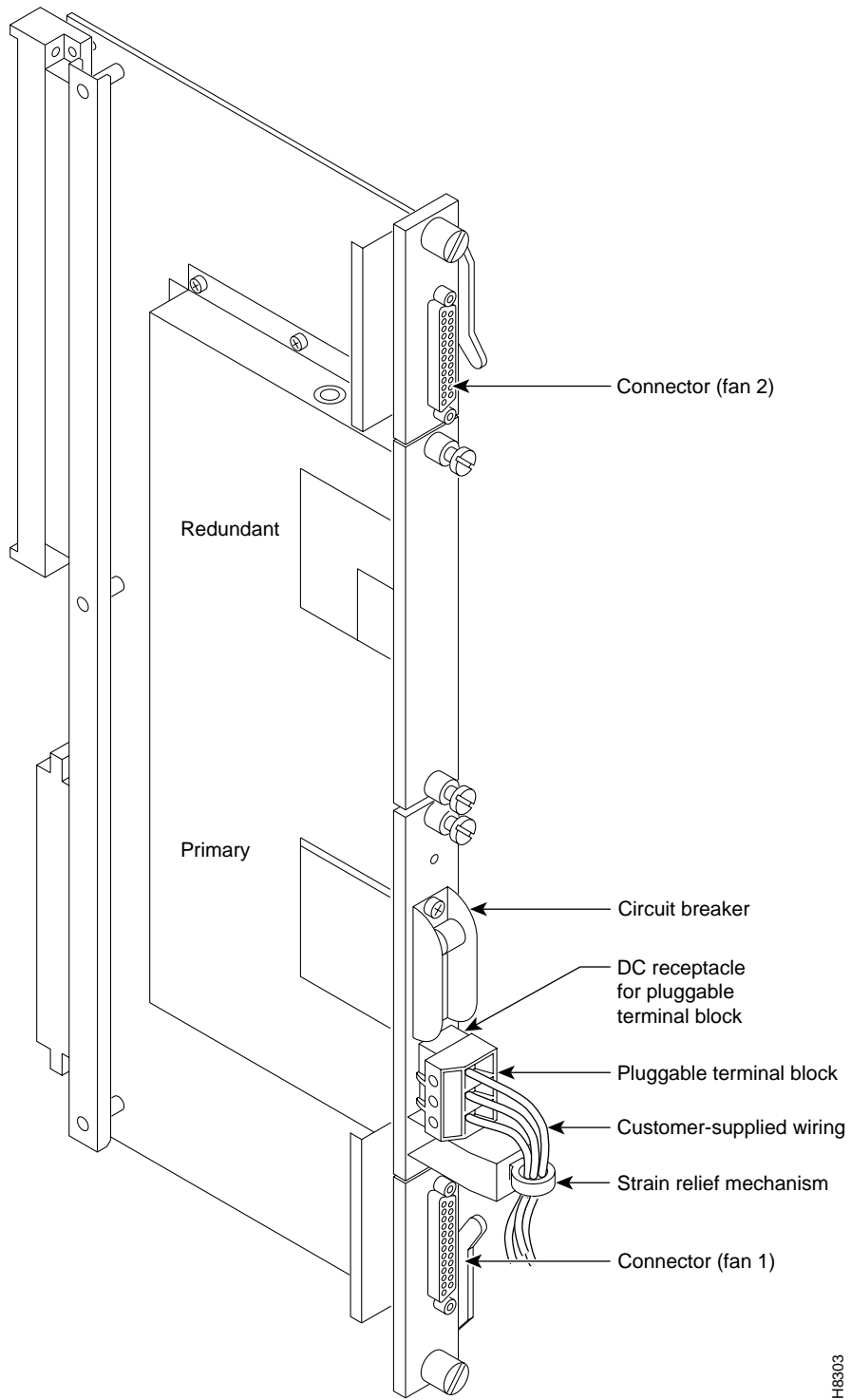
Replacing an AC Power Supply

This section contains separate descriptions for replacing an AC power supply in an IGX 8410 node and in either an IGX 8420 or IGX 8430 node.

Replacing an AC Power Supply in an IGX 8410 Node

When a power supply has failed, a red FAIL light on the SCM turns on and one or more "Okay" LEDs on the power supply turn off. Before replacing a power supply, see if it needs only to be reseated. The following describes first how to reseat, then how to replace, a supply.

Step 1 Loosen the captive screws and remove the AC power cover plate. See Figure 5-2.

Step 2 Identify the power supply that needs replacement.

Step 3 Grip the hinged handle on the supply, slightly pull out the supply, then reseat it. This resets the supply's internal power-monitoring circuit. See Figure 5-3.

Step 4 Check the supply-monitoring circuit on the SCM. First, enter the command **resetcd 0** at the control terminal (this resets the power supply monitor on the SCM). After waiting about 10 seconds or more, enter **dsppwr** and see if the FAIL indicator for the supply turns on. Note which power supply has failed.

Note If the DC and AC Okay LEDS do not turn on or the command **dsppwr** still indicates a failure, proceed with the replacement.

Step 5 Pull out the power supply with one hand under the supply.

Figure 5-2   Replacing an AC Power Supply

Cover plate
over power
supplies

Captive
screws (2)

Clamping
rings

AC inputs

Circuit
breakers

PS D

PS C

PS B

PS A

H8392
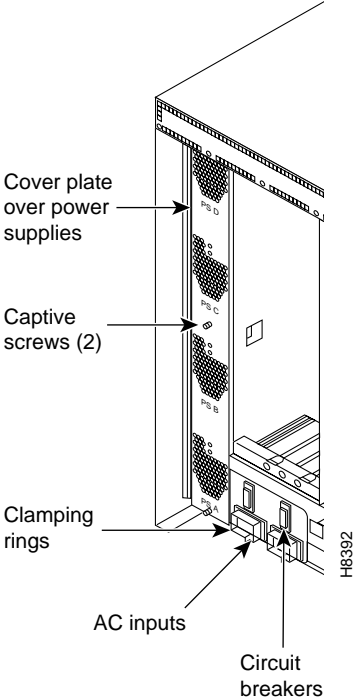
Figure 5-3   Power Supplies
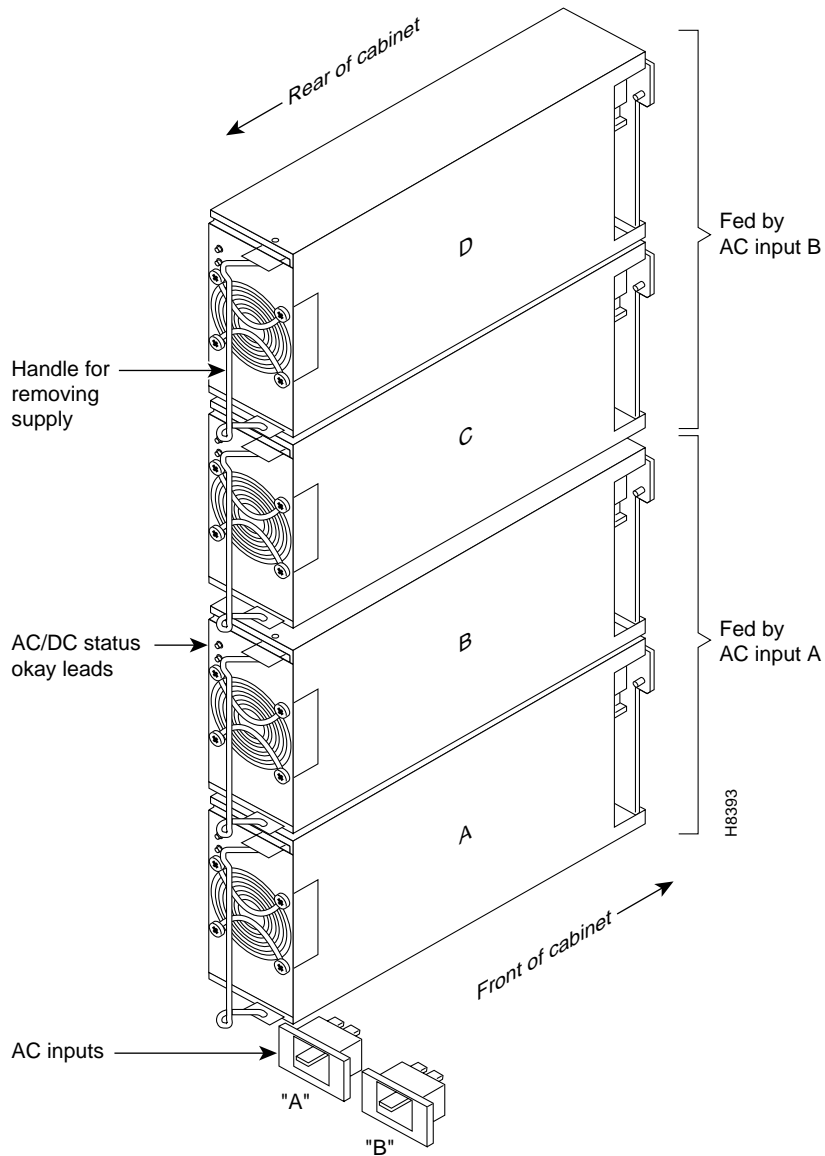
To install a power supply, perform the following steps:

Step 1   Slide a replacement power supply into the power supply tray and push it to the back. When a supply reaches the end of the slot in the tray, a slight resistance is encountered. Push the power supply slightly farther in to seat the supply correctly.

Step 2   Install the power supply cover plate.

Step 3   Tighten the captive screws on the cover plate until finger-tight.

Step 4   Use the **dsppwr** command to check the status and output voltage of the replacement power supply. Make sure that the status is OK and the output voltage is 50 V ±2 V.

Replacing an AC Power Supply in an IGX 16/32

When a power supply has failed, a red FAIL light on the SCM turns on. Before replacing a power supply, check to see if it needs only to be reseated. The following steps describe how to reseat a supply then how to replace it.

Step 1   To remove the Air Inlet Grille, locate the small access hole at its the top and center.

Step 2   Insert a flat-bladed screwdriver in the access hole.

Step 3   Rotate the screwdriver to release the spring latch holding the Air Intake Grille (see "Release" in Figure 5-2).

Figure 5-4   **Replacing an AC Power Supply**
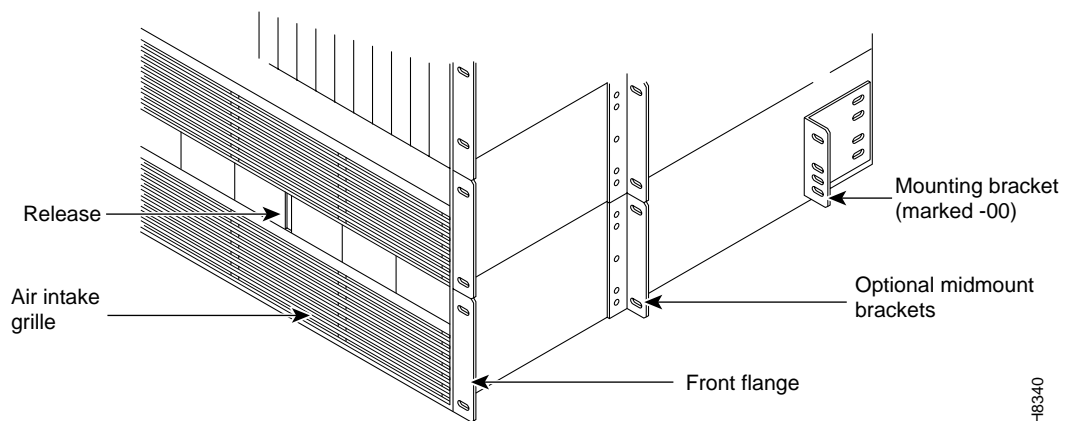
Step 4   Tilt the air inlet grille down to approximately a 45° angle, then lift if out and set it aside. This exposes the power supply retainer bracket (a hinged door).

Step 5   With a flat-bladed screwdriver, unscrew the retainer screw in the center of the hinged door and tilt the door down.

Step 6   Identify which power supply needs replacement. The power supply lettering begins with A on the far left and continues through F on the far right.

Step 7   Loosen the captive screw at the front/bottom of the power supply. See Figure 5-5.

Step 8   Move the supply slightly out then reseat it and tighten the captive screw. This resets the supply's internal power-monitoring circuit.

Step 9   Check the supply-monitoring circuit on the SCM. First, enter the command **resetcd 0** at the control terminal (this resets the power supply monitor on the SCM). After waiting about 10 seconds or more, enter **dsppwr** and see if the FAIL indicator for the supply comes on again. Note which power supply has failed.

Figure 5-5   **875-Watt Power Supply**

DC okay LED

AC okay LED

Handle
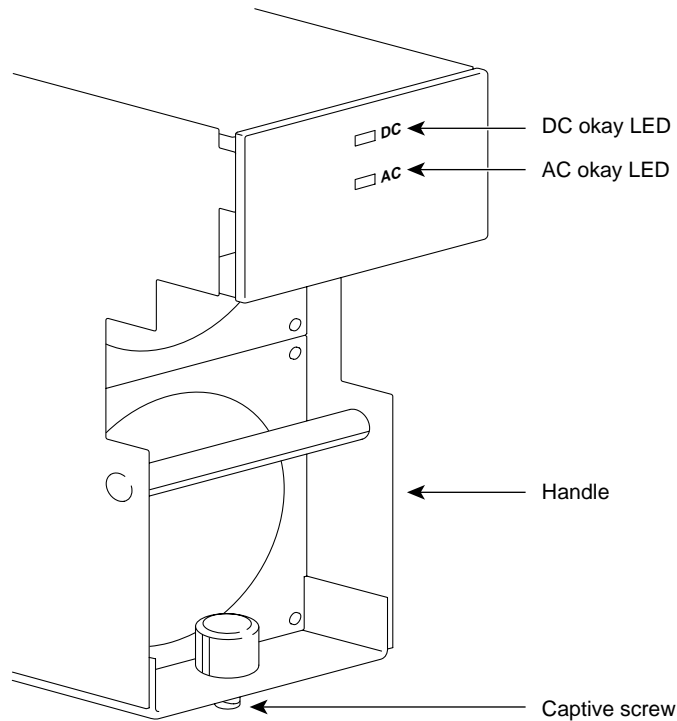
Captive screw

H8341

Note   If the DC and AC Okay LEDS do not turn on or the command **dsppwr** still indicates a failure, proceed with the replacement.

Step 10   Loosen the captive screw that secures a supply to the power supply tray.

Step 11   Pull out the power supply with one hand on the handle and one hand under the supply.

To install a power supply, do the following:

Step 1   Slide a replacement power supply into the power supply tray and push it to the back. When a supply reaches the end of the slot in the tray, a slight resistance is encountered. Push the power supply slightly farther in to seat the supply correctly.

Step 2   Tighten the captive screw until it is finger-tight.

Step 3   Close the hinged door and tighten its retaining screw.

Step 4   Install the Air Intake Grille and press firmly on the top, then center of the Air Intake Grille until the latch snaps into place.

Step 5   Use the **dsppwr** command to check the status and output voltage of the power supply. Make sure the status is OK and the output voltage is 50 V ±2 V.

Replacing a Fan Assembly

This section contains separate descriptions for replacing the cooling units in an IGX 8410 node and in either an IGX 8420 or IGX 8430 node.

Replacing a Fan Assembly in an IGX 8410 Node

The cooling unit resides below the card cage. A Fan Assembly has four fans. Individual fans cannot be replaced, so the whole assembly must be replaced when a failure occurs. See Figure 5-6.

Cooling fan trays are hot-swappable. However, the operation must proceed swiftly to keep the system cool enough. Otherwise, the system power must be off. Having the replacement fan tray and tools in the immediate vicinity of the system help ensure that the procedure goes quickly. The required tools are a flat blade screwdriver and a phillips screwdriver.

Figure 5-6   Fan Tray Assembly

Fan power connection
(below, not visible)

5A fast blow
fuse (8 total)

H8394
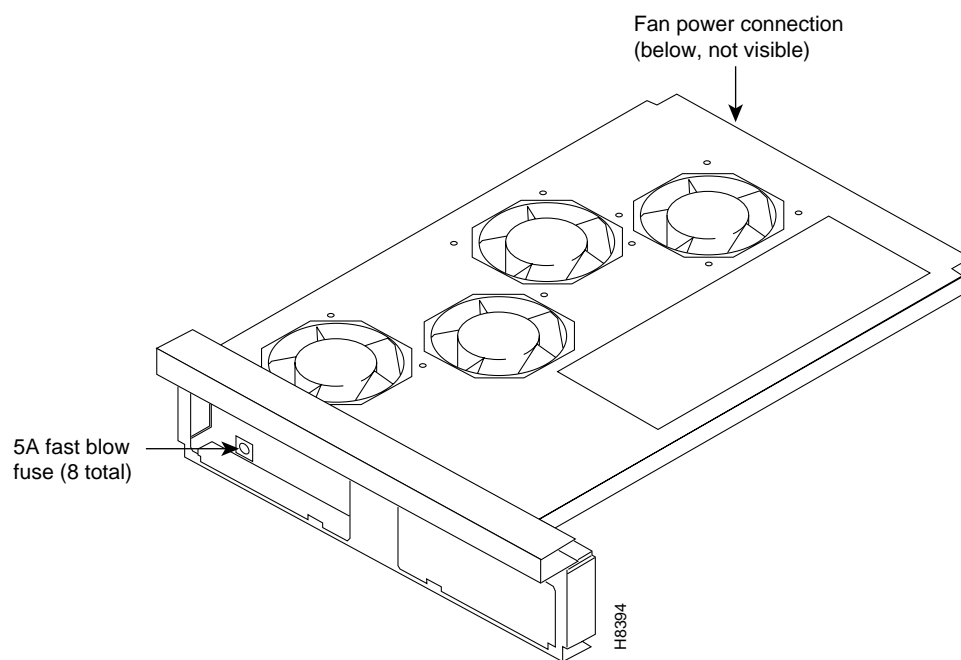
To replace the cooling unit assembly:

Step 1   Have the replacement fan try and tools ready.

Step 2   Remove the air intake grille at the front of the system by operating the toggle latch at the top-center of the grille with a screwdriver, tilting the grille forward, and lifting it out.

Step 3   Examine the front and back of the fan tray to be familiar with the setup. Note the power connectors attached to the fan tray: the connectors at the fan tray itself are to be disconnected rather than the D-connector at the PE-BC. Also note that the captive screws that hold the fan tray in place are at the front of the fan tray.

Step 4   Loosen the captive screws.

Step 5   At the back of the IGX 8410 node, remove the clamp that secures the power cable for the fans to the chassis.

Step 6   Use a small screw driver or fingertip in this step. For each of the fan power connectors, press in the small plastic latch that locks the connector halves together. With the other hand, grip the part of the connector that is attached to the fan tray and separate the cord from the fan tray. The fan tray now has no power.

Step 7   Push a finger or thumb through the square holes in the chassis to start the fan tray toward the front of the system. Go to the front of the system.

Step 8   Remove the cooling unit and slide in the replacement unit.

Step 9   Plug the power connectors into the fan tray.

Step 10   Make sure all fans are operating.

Step 11   Secure the fan tray assembly by tightening the captive screws.

Step 12   Attach the clamp for the fan power cord to the chassis.

Step 13   After fan tray replacement, install the air intake grille.

Replacing a Fan Assembly in an IGX 8420 or an IGX 8430 Node

An IGX 8420 node has one cooling unit. An IGX 8430 node has two cooling units. In an IGX 8420 node, the single cooling unit resides immediately below the card cage. In an IGX 8430 node, one unit resides below the lower card cage (Fan Tray 1). The *booster* unit (Fan Tray 2) resides above the upper card cage. If a fan failure occurs, the whole assembly must be replaced.

Fan trays are hot-swappable. However, the swap must go swiftly to keep the system cool. Replacement must take less than two minutes, and this is relatively easy. Otherwise, system power must be off. In an IGX 8430 node, the fan tray that remains while the other tray is out helps keep the system cool. Have the replacement fan tray and tools nearby to help the swap go quickly. The required tools are a flat blade screwdriver and Phillips screwdriver.

Figure 5-7   **Fan Tray Assembly**
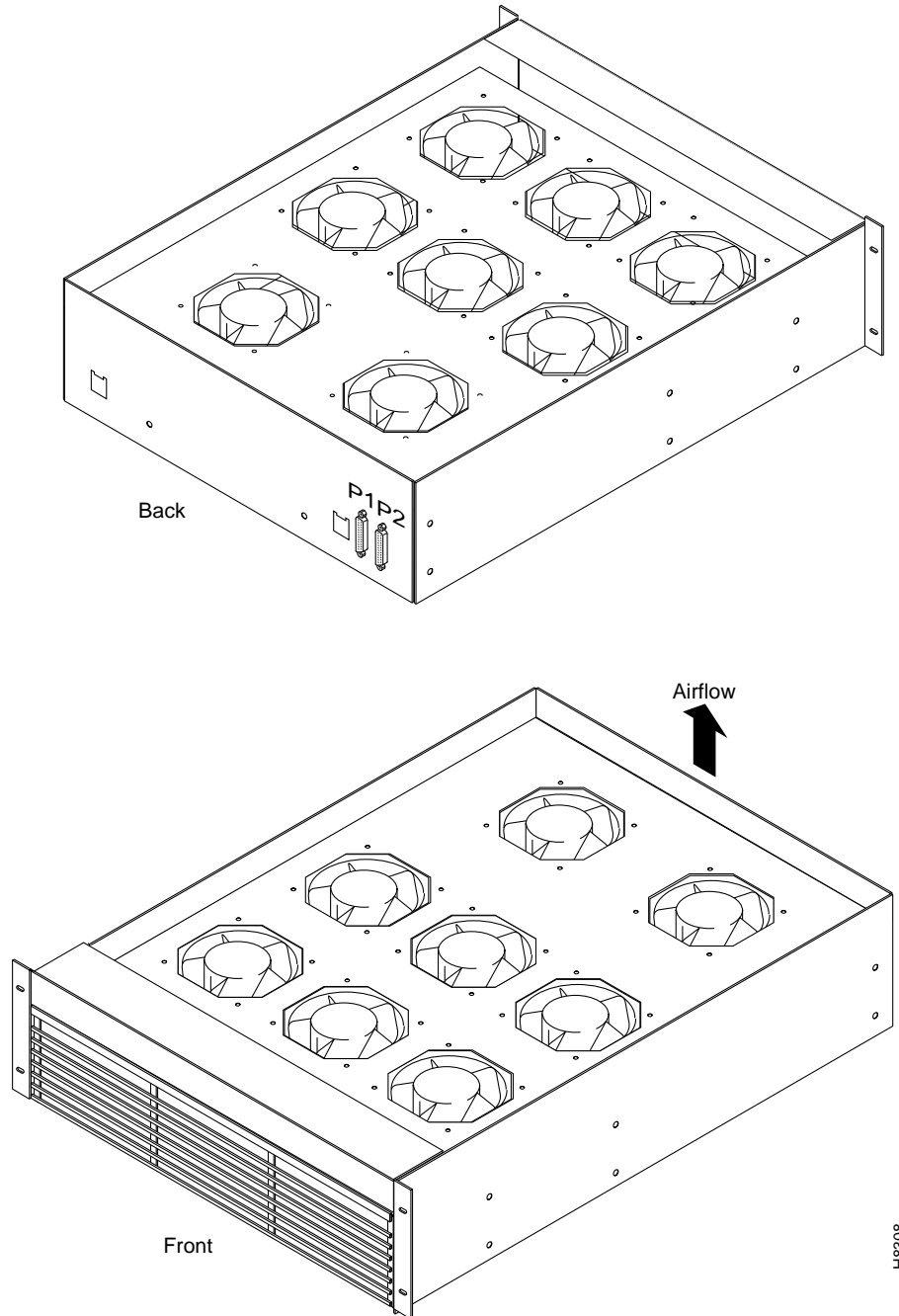
To replace the cooling unit assembly:

Step 1   Have the replacement fan tray and tools ready and located near the front of the node.

Step 2   For the bottom fan tray, remove the air intake grille at the front of the system by turning the internal screw at the top-center of the grille a quarter turn, tilting the grille forward, and lifting it out. (Fan Tray 2 at the upper end of an IGX 8430 node does not have an air intake grille.)

Step 3   Examine the front and back of the fan tray to be familiar with the setup. Note the power connectors attached to the fan tray: the connectors at the fan tray itself are to be disconnected rather than the D-connector at the PE-BC. Also note that the captive screws that hold the fan tray in place are at the front of the bottom fan tray (Fan Tray 1) and at the back of the booster fan tray (Fan Tray 2) in an IGX 8430 node.

Step 4   Loosen the captive screws.

Step 5   At the back of the IGX, remove the clamp that secures the power cable for the fans to the chassis.

Step 6   Use a small screw driver or fingertip in this step. For each of the fan power connectors, press in the small plastic latch that locks the connector halves together. With the other hand, grip the part of the connector that is attached to the fan tray and separate the cord from the fan tray. The fan tray now has no power.

Step 7   Push a finger or thumb through the square holes in the chassis to ease the fan tray towards the front of the system. Go to the front of the system.

Step 8   Remove the cooling unit and slide in the replacement unit.

Step 9   Plug the power connectors into the fan tray. Make sure plug P1 connects to connector P1, and plug P2 connects to connector P2.

Step 10   Do a visual check to make sure all fans are operating.

Step 11   Use the **dsppwr** command to see if system software recognizes correct operation.

Step 12   Secure the fan tray assembly by tightening the captive screws.

Step 13   Attach the clamp for the fan power cord to the chassis.

Step 14   After lower fan tray replacement, return the air intake grille.

Backplane Fuses

Backplane fuses rarely, if ever, need replacement. Backplane fuses are intended to prevent catastrophic damage to the backplane in the event of accidental shorting of –48 VDC on the backplane to chassis ground. This type of event could be caused by bent backplane pins, contact of conductive elements (EMI Cans, EMI Gaskets, etc.) to power pins. These events would most likely happen during a factory build or initial system installation.

Because of design constraints, these fuses need to be in sockets on the backplane and are therefore not readily accessible. A special tool (Cisco P/N 218090-00) and set of instructions are required for fuse replacement. Cisco recommends that only factory-trained personnel do the procedure.

If a bad card slot is verified, call Cisco TAC. If a card with an open fuse is verified, return it to Cisco.

In the IGX 8410 node, backplane fuses exist only on the back of the backplane. In an IGX 8420 or 8430 nodes, the location of the fuse depends on the version of the backplane. In older IGX 8420 and 8430 backplanes, the fuses reside on the front. Figure 5-8 shows the location of each fuse in an IGX 8410 backplane. The fuse numbers are F1–F8. Two spare fuses are also present. Figure 5-9 and Figure 5-10 show current and early backplane fuse locations in the IGX 8420 backplane.

Figure 5-8   **Backplane Fuse Locations**
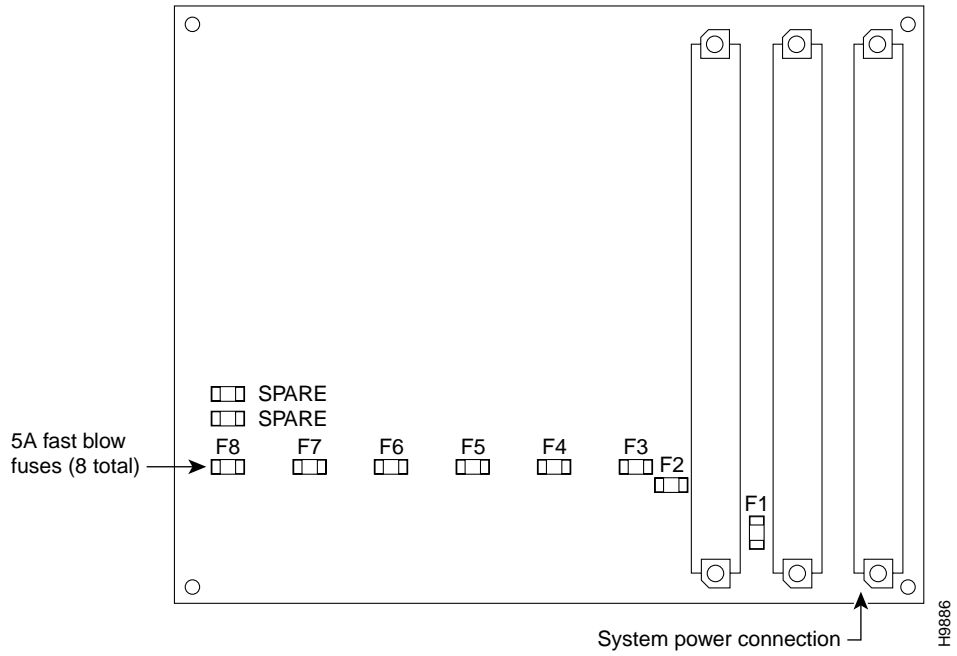
> ⚠ **Warning**   Replacing a fuse requires only Cisco personnel using a special tool with the power off.

Figure 5-9   IGX 8420 and 8430 Fuse Locations, Back of Current Backplane

System power
connection
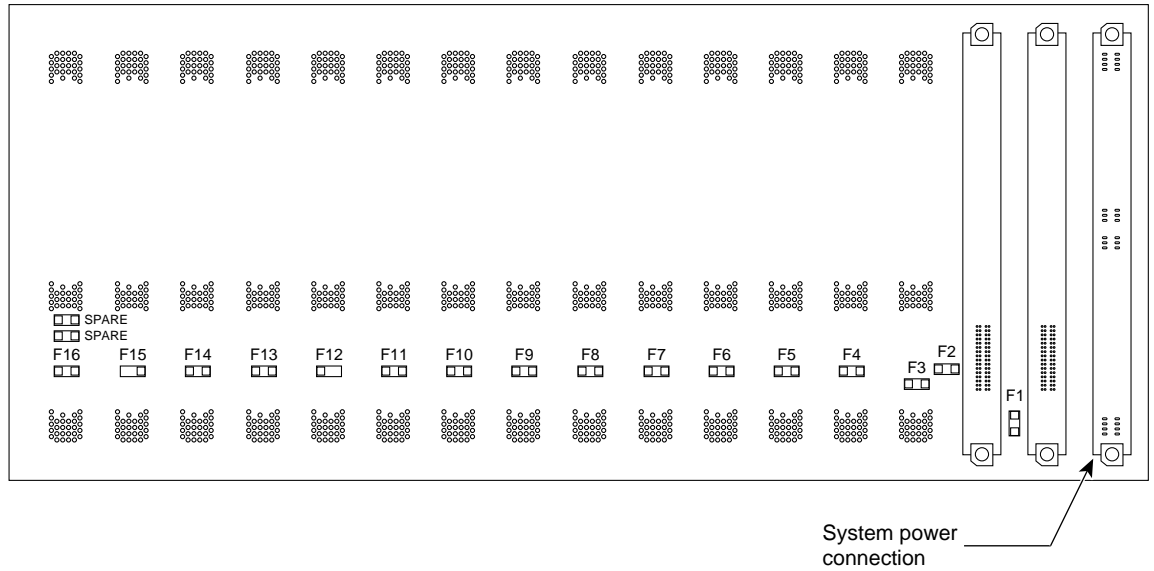
Figure 5-10   IGX 8420 and 8430 Fuse Locations, Front of Early Backplane

Fuses

1   2   3   4   5   6   7   8   9   10   11   12   13   14   15   16
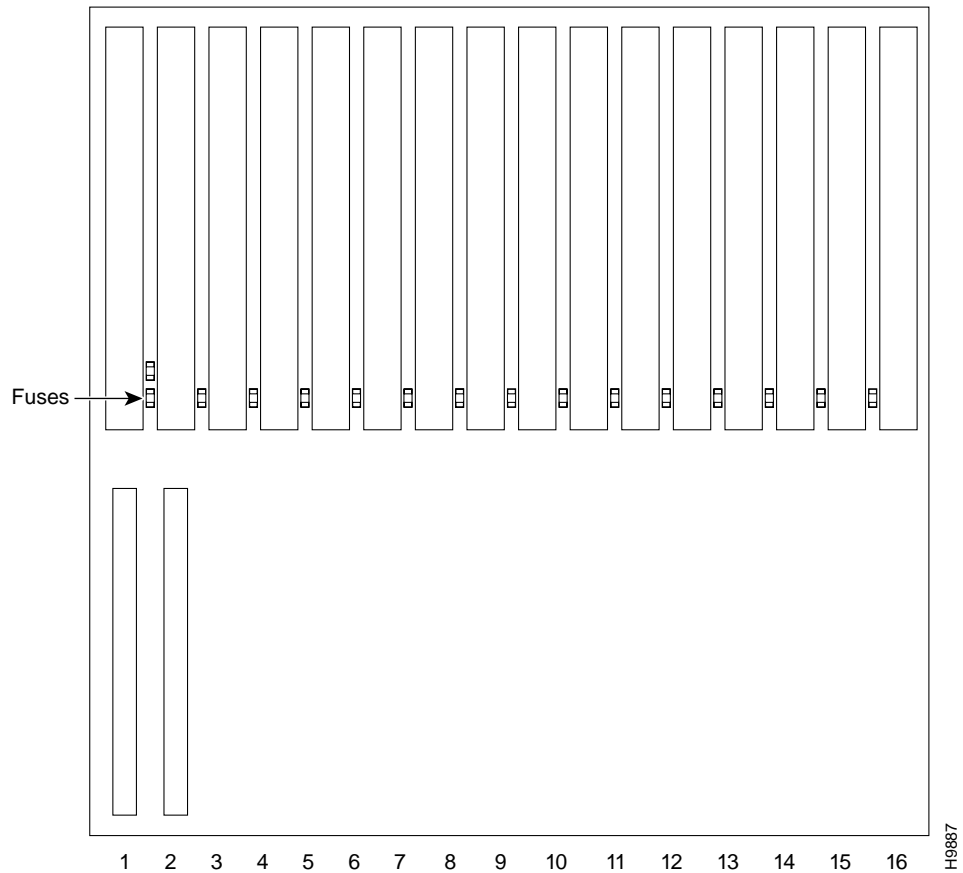
Upgrading Rack-Mounted Nodes

This chapter describes how to convert a rack-mounted IGX 8420 switch to a rack-mounted IGX 8430 switch. The descriptions include steps for AC-powered and DC-powered systems. The steps begin after you have removed all PVCs and turned off power to the node. To do this upgrade, you should have at least basic experience with IGX installation procedures. The topics in this chapter include:

*   Review tools and precautions

*   Disconnecting and removing the IGX 8420 components

*   Installing the IGX 8430 modules at the front of the rack with or without a mechanical lift

*   Connecting the backplane on the upper and lower card cages

*   Connecting the fan power cables

*   Connecting power to the node

*   Installing cards and card cabling

Note   For an AC-powered system, the part number of the upgrade kit is IGX16-32-RM-AC-UPG. For a DC-powered system, the part number of the upgrade kit is IGX16-32-RM-DC-UPG.

Before you begin removing connections, check the parts list against the actual contents of the upgrade kit. For upgrading an AC-powered system, make sure the appropriate number of additional AC power supplies are in the kit. (Upgrading an AC-powered system requires at least one additional AC power supply.) If you are unsure of the number of required AC supplies, refer to the section titled "Installing the AC Power Supply Assembly" in the chapter titled "Enclosure and Power Installation."

The tools for the upgrade are:

*   Medium and small flat-bladed screwdrivers.

*   A number 1 phillips screwdriver.

*   A 5/32-inch Allen wrench for the latch on the door to the card cage.

The upgrade kit comes with a tool that has both a number 1 phillips head screwdriver and a 5/32-inch Allen wrench.

Warning The following safety requirements must be observed:

- Only authorized personnel should have access to the IGX node.

- Make sure power to the node is off. For a DC-powered system, you must remove the cable guard to have access to circuit breakers on the Power Entry Modules (PEMs).

- Handle and store the cards so that you protect the pre-power pins from bending. Correct alignment of connector pins with connectors is vitally important. Before you insert a card, make sure the pins are straight and the connectors on the card and the backplane align with each other.

- For the IGX node and peripheral equipment to function correctly, use only the power cords, cables, and connectors that are specified for the equipment, and make sure they are in good condition.

- Wear a wrist strap when you are touching the cards.

Figure 6-1 shows AC-powered and DC-powered nodes in a Cisco-supplied cabinet. Frequently, the components sit higher in the rack than the position in Figure 6-1. Figure 6-2 shows the IGX 8430 node in a Cisco-supplied cabinet.

Figure 6-1   Rack-Mounted IGX 16

Exhaust plenum

IGX switch

Cooling unit

8.75

DC-powered
IGX 8420 switch

Exhaust plenum

IGX switch

Cooling unit

AC power supply

8.75

AC-powered
IGX 8420 switch

H8364
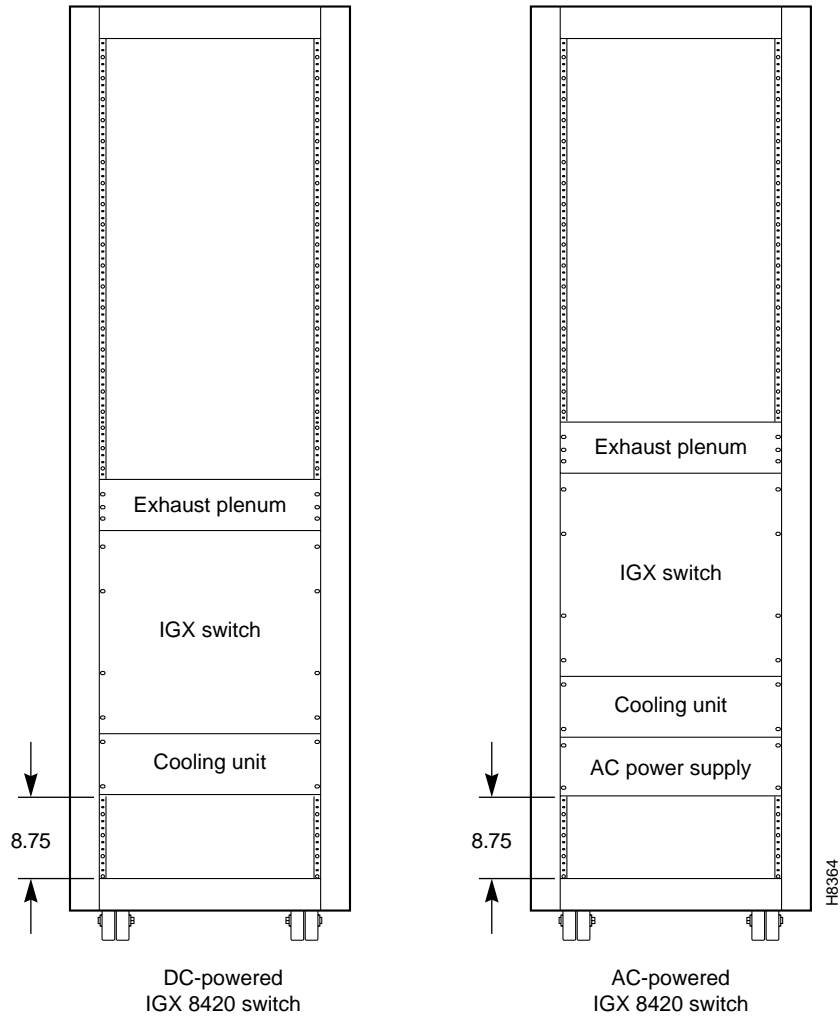
Figure 6-2   Rack-Mounted IGX 32

| DC-powered
IGX 8430 switch | AC-powered
IGX 8430 switch |
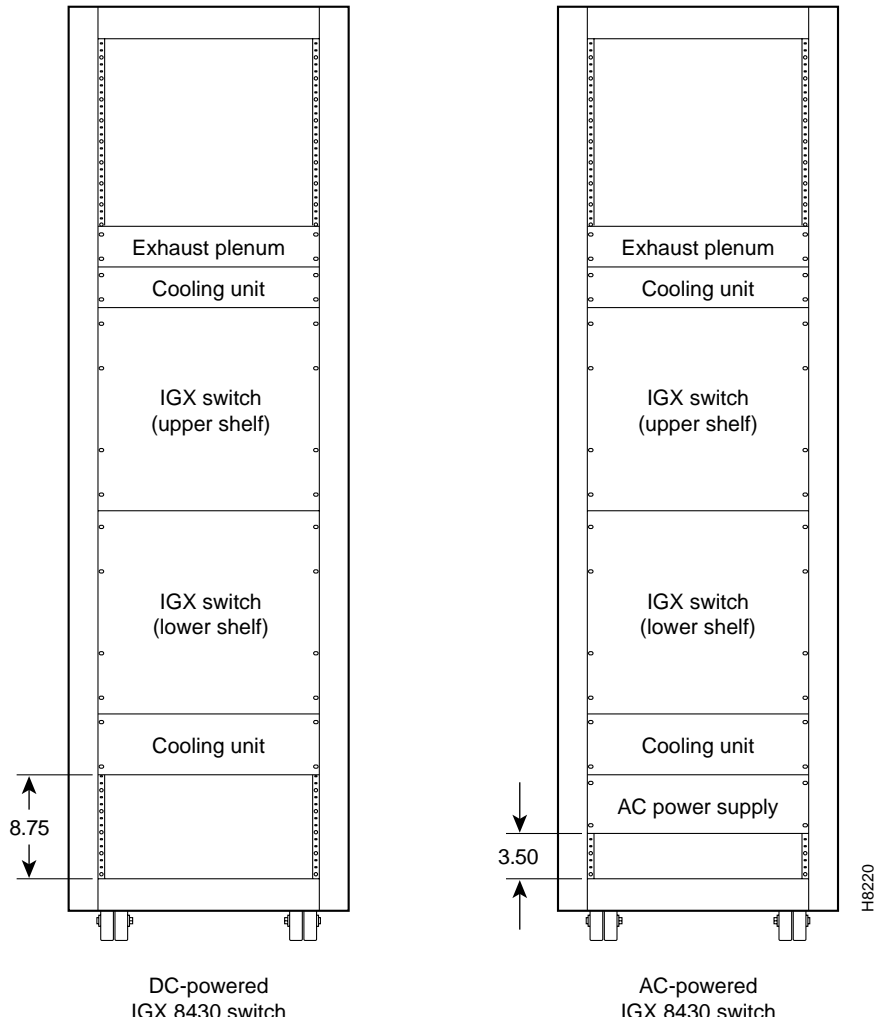
Removing and Installing Components

The instructions in this section describe installation with and without a lift. One person alone can complete the upgrade procedure. However, moving the components is easier when you have a mechanical lift capable of holding and maneuvering all components that make up the IGX 8430 node.

Common Steps for All Configurations

Whether or not you have a mechanical lift, the following procedures apply to AC and DC systems:

- Mark all cables and cards as needed before you remove them from the IGX 8420 enclosure.

- Remove and discard the IGX 8420 cable guard. The kit contains a new cable guard. To remove the cable guard, loosen the captive screw at its base and, holding the cable guard at its top and bottom, swing the guard away from the bottom of the frame.

- Remove each card and store it in such a way that the pre-power pins cannot be bent. Note that, when you re-install the Nodal Processor Modules (NPMs) and System Clock Module (SCM), these cards must go in the upper card cage.

Note If you are working alone, remove enough cards to make the card cage maneuverable. You must remove the cards near slot 1 to have access to the card cage hole and its coverplate.

- On the SCM, remove the jumper on switch W6. W6 sits above component U7P (near the top of connector P2). The *absence* of this jumper indicates an IGX 8430 node to the control card.

- Remove the plate that covers the *card cage hole* at the bottom of the upper card cage and the top of the lower card cage. The ribbon cable that extends the back plane from the upper card cage to the lower card cage runs through these holes. You can remove the plate from the lower card cage before you install the card cage, but for the upper card cage (slots 1–16), you must first remove cards to gain access to the plate. You can see the card cage hole in Figure 6-3 and Figure 6-4.

- Remove and discard the short fan power cable attached to the fan tray in the IGX 8420 node.

Upgrading the Components Without a Lift

This section describes how to re-locate the IGX 8420 components and install the shelf-components in the kit. Figure 6-2 illustrates the result.

Step 1 For an AC-powered system:

- If the IGX 8420 switch is mounted at the bottom of the rack, leave the AC power assembly and the fan tray in place.

- If the IGX 8420 node is *not* at the bottom of the rack, move the AC power assembly close enough to the bottom of the rack to let all components fit in the rack. Remove the AC power supplies to make the assembly maneuverable. (If you do not know how to remove a power supply, see to the power supply replacement steps in Chapter 5.) The space from the bottom of the AC power tray to the floor of a STRATM cabinet should be at least 3.50 inches (8.89 cm or 2 rack mount units). If you need the height of individual Cisco components, see the appendix "STRATM Cabinet Dimensions."

  For a mid-mount rack only: attach the tray to the mounting brackets with the head of each mounting screw on the inside of the tray and each associated nut on the outside of the bracket.

Note The vertical spacing between all components must be in the range 0.047 inches–0.077 inches (0.119 cm to 0.196 cm). You can adjust the distance when you install the components.

Step 2 Reinstall the fan tray (if necessary) so it sits near the bottom of the rack. (If the node is DC-powered and the rack is in a STRATM cabinet, leave at least 3.50 inches of space (8.89 cm or 2 rack mount units) between the bottom of the fan tray and the floor of the cabinet.)

Step 3 Remove the IGX 8420 card cage. Remove as many cards as necessary to make the card cage maneuverable, starting with slot 1. Empty at least front slots 1–3 so you have access to the plate that covers the card cage hole.

Step 4   Remove the cover plate over the card cage hole.

Step 5   Install the lower card cage (slots 17–32). The part number for the lower cage ends with -01. If the IGX 8420 card cage was positioned low in the rack, the mounting brackets are already in place, otherwise you must first install the brackets from the kit.

Do not install the cards until you have installed the upper card cage and the ribbon cable. The section titled "Connecting the Upper and Lower Card Cages" describes how to install the ribbon cable.

Step 6   Install the upper card cage (slots 1–16). The part number for the upper cage ends with -00.

Step 7   Install the upper (booster) fan tray.

Step 8   Install the exhaust plenum.

Step 9   If the rack configuration uses rear-mount rails, you can move the rear mounting brackets to the opposite side of the node than the normal position. In the new position, the flange on the bracket creates an anchor to hold down the exhaust plenum.

Step 10   Go to the section titled "Connecting the Upper and Lower Card Cages."

Rearranging Components With a Lift

This section describes the portions of the upgrade you can facilitate by using a mechanical lift. This section has two parts: the first part describes the order for disconnecting the existing components and stacking these components along with the new components on the lift. The second part describes the order for installing the components on the lift.

Arranging the Components on a Lift

When the text in the following steps instructs you to place a component on the lift, it means you place the component on top of any other components that are already on the lift.

Step 1   For an AC-powered system:

- If the node is *not* mounted at the bottom of the rack, remove the AC power assembly and place it on the lift, then remove the cooling unit and place it on the lift. Also, if the node has an attached cable manager, remove it first.

- If the node is mounted at the bottom of the rack, leave the AC power assembly and the fan tray in place. If a cable manager is present, leave it attached.

Step 2   Place the new card cage (with slots 17–32) on the lift. This card cage has a part number ending in -01.

Step 3   Place the card cage with slots 1–16 on the lift (on top of the card cage with slots 17–32). The card cage with slots 1–16 has a part number ending in -00.

Step 4   Place the booster fan tray on the lift.

Step 5   Place the exhaust plenum on the lift.

Counting from the bottom to the top, the order of the components on the lift should be as follows (item 1 in the list is the bottom item, item 2 sits on top of item 1, and so on):

1 Optional AC power assembly

2 Main (lower) cooling unit

3 Lower card cage (slots 17–32). The part number of the lower card cage ends with "-01."

4 Upper card cage (slots 1–16). The part number of the upper card cage ends with "-00."

5 Upper cooling unit (also called booster fan unit)

6 Exhaust plenum

At this point, the components that make up an IGX 8430 node are ready for you to install.

Moving the Components From the Lift to the Rack

The distance between the bottom of the rack and the bottom of the lowest component depends on user-requirements, such as the presence of an AC power assembly or other components in the rack. Also, for a STRATM cabinet, the distance between the bottom of the lowest component and the floor of the cabinet should be at least 3.50 inches (8.89 cm. or 2 rack mount units). The height of each Cisco component appears in the appendix titled "STRATM Cabinet Dimensions."

Note The vertical spacing between all components must be in the range 0.047 inches–0.077 inches (0.119 cm to 0.196 cm). You can adjust the distance when you install the components.

Step 1 If you have not already done so, lower the lift to a height suitable for the configuration.

Step 2 Attach the exhaust plenum to the rack. Lower the lift only enough to install booster.

Step 3 Attach the booster fan tray to the rack. Lower the components enough to provide room for lifting the next component into position.

Step 4 Attach the upper card cage to the rack. Lower the components enough so the top of lower card cage is flush with the bottom of upper cage.

Step 5 Attach the lower card cage to the rack. Lower the components enough to provide room for lifting the next component into position.

Step 6 Maneuver lift so the main fan tray is flush with the card cage and so the screw holes align.

Step 7 If present, attach the AC power assembly. For a *mid-mount* rack only, attach the tray to the mounting brackets with the head of each mounting screw on the inside of the tray and each associated nut on the outside of the bracket.

Step 8 If the system is AC-powered, install the new power supplies from the kit.

Step 9 Attach the new door from the kit to the bottom card cage.

Step 10 Go to the section titled "Connecting the Upper and Lower Card Cages."

Connecting the Upper and Lower Card Cages

To extend the backplane from the upper card cage to the lower card cage, install the folded ribbon cable as the following steps describe. The ribbon cables pass through the *card cage holes*. The cables connect to two, 100-pin connectors on the front of each backplane.

The order of the tasks in the following steps provides the easiest way for you to install the ribbon cable. Refer to Figure 6-3 and Figure 6-4 as you proceed.

Step 1 If you have not done so, remove the cover plates that cover the card cage holes. The holes are at the bottom of the upper card cage to the left of slot 1 and at the top of the lower card cage to the left of slot 17.

Step 2 While you hold the cables in the space above the card cage hole in the upper card cage, drop the connectors for the bottom card cage through the card cage holes. Let the lower connectors hang until you have connected the upper connectors (the next step).

Step 3 Screw in the connectors for the upper card cage, as follows:

Attach the top connector of the *upper* cable.

Attach the top connector of the *lower* cable.

Step 4 Screw in the connectors for the lower card cage, as follows:

Attach the bottom connector of the *upper* cable.

Attach the bottom connector of the *lower* cable.

Step 5 A two-piece conduit called the *card cage tunnel* surrounds the ribbon cables and sits in the card cage hole. Figure 6-4 shows the card cage tunnel installed and, in the expanded view, prior to installation. Fit the pieces of the card cage tunnel around the ribbon cables and screw this unified piece into the card cage hole.

Step 6 Use the fastener clamps to secure the ribbon cables:

Remove the plastic back of each fastener clamp just before you attach it to the cable.

Slip the ribbon cables through the fastener clamps.

Attach the fastener clamps to the side of the card cage.

Figure 6-3 Side-View of Installed Backplane Extension Cable
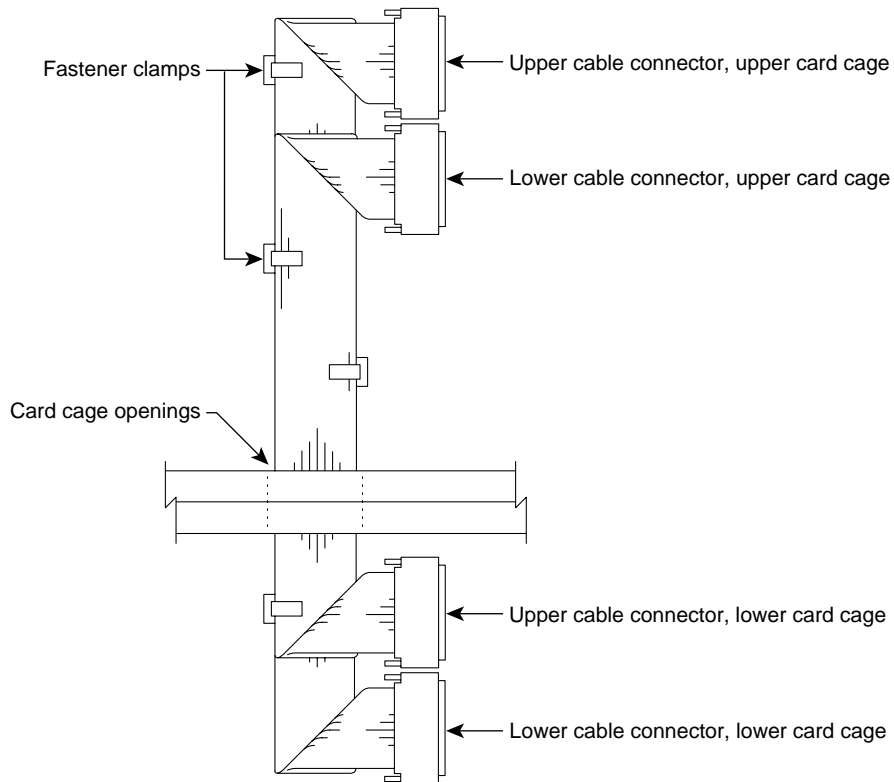
Figure 6-4   Ribbon Cable for Extending the Backplane

Fastener clamp,
ribbon cable

Card cage tunnel
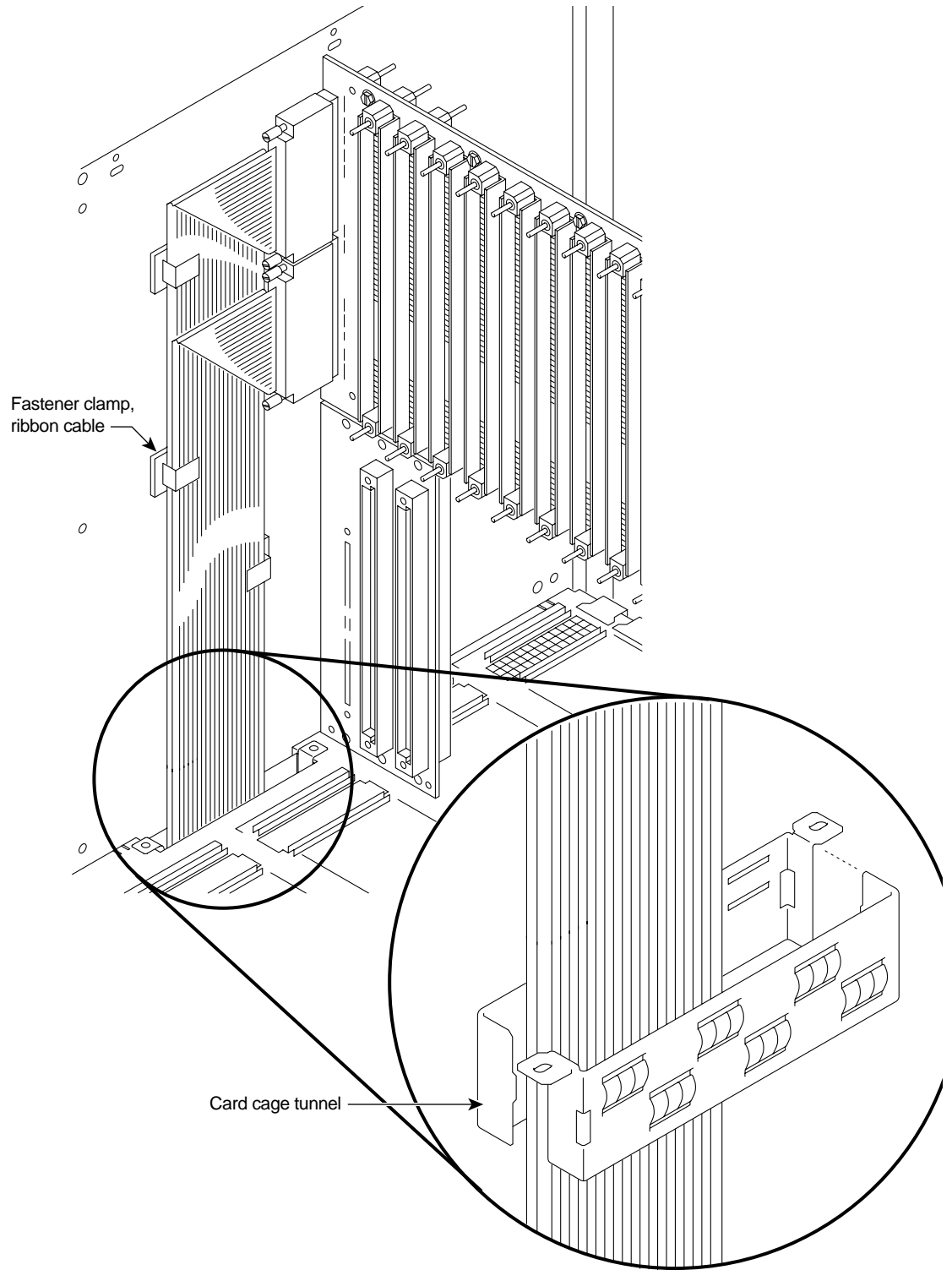
Connecting Power to the Fan Trays

This section describes how to connect power cables for the fan trays. Figure 6-5 shows the fan power cables and their connection points. The booster fan tray in the kit comes with the power cable connected to it, so you need only to connect the cable to the upper Power Entry Back Card (PE-BC). The cable for the main (lower) fan tray has a Y-configuration with a short branch and a long branch.

Figure 6-5   IGX 8430 Back View
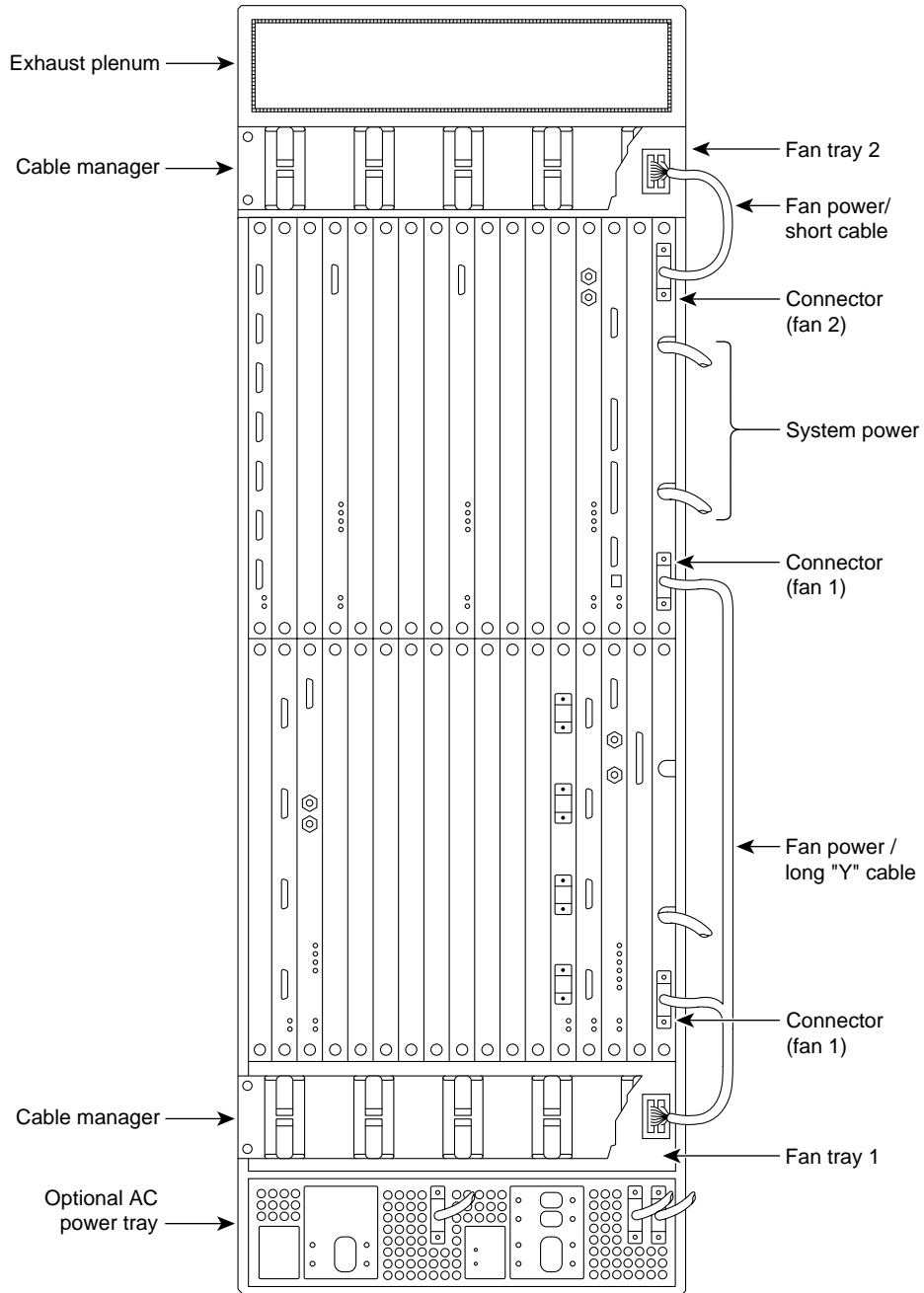
Step 1   If you have not already done so, discard the old fan power cable that connected power to the IGX 8420 fan tray (now the lower fan tray).

Step 2   Connect the booster fan cable to the upper fan power connector on the PE-BC. See Figure 6-5. The booster fan power connector on the upper PE-BC is labeled "fan 2." The cable comes already attached to the fan tray in the kit.

Step 3   At the main fan tray, attach connector P1 on the cable to connector P1 on the fan tray. Attach connector P2 on the cable to connector P2 on the fan tray. These connectors are keyed and have a built-in latch. See Figure 6-6 for front and back views of the main fan tray. Note that the booster fan tray in the kit has no grille.

Step 4   Attach the clamp on each fan tray clamp to the chassis.

Step 5   Connect the main fan power cables to the fan power connectors labeled "fan 1" on the upper and lower PE-BCs. See Figure 6-5.

Step 6   For the main fan tray, attach the air intake grille.

Note   When you later turn on the power, make sure all fans are running.

Step 7   Attach the optional cable managers if appropriate. The kit contains a new cable manager.

Step 8   If the system is AC-powered, go to the section titled "Connecting AC Power."

Step 9   If the system is DC-powered, go to the section titled "Connecting DC Power."

Figure 6-6 **Fan Tray Assembly**
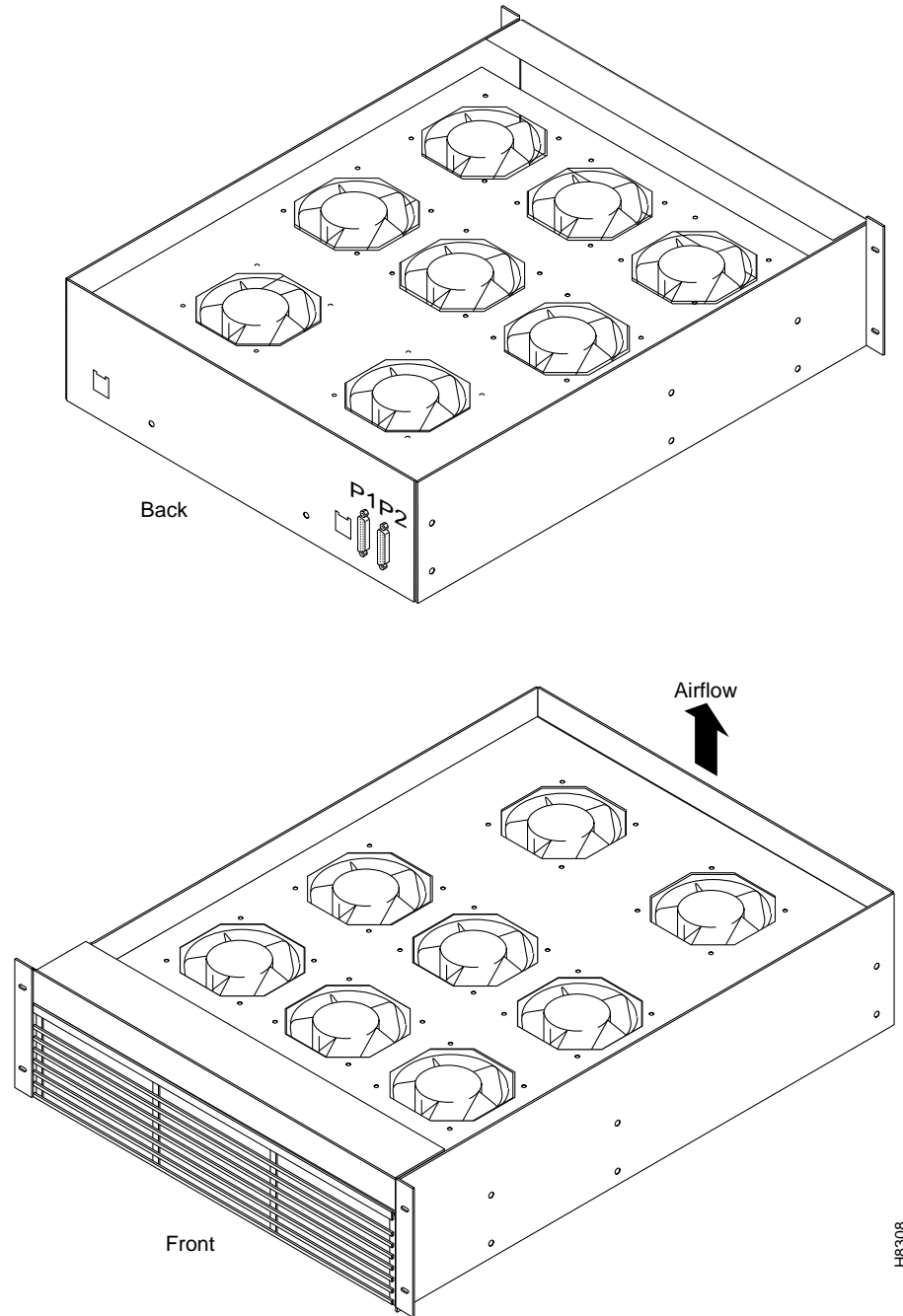
Connecting AC Power

This section describes how to set up AC power. At this point, you have already installed the AC power supplies and the new PE-BC, so the steps begin by describing how to connect the system power cables. Use Figure 6-7 to see the cable arrangements according to the AC power configuration.

Step 1   Attach each system power cable at the AC power assembly. Figure 6-8 shows the connectors for each shelf at the back of the AC power assembly.

Step 2   Insert each system power connector to its designated receptacle. Figure 6-9 shows both used and unused connectors. Secure the power connector with the captive screw.

Step 3   On the PE-BCs, attach the blank faceplates to cover any unused connectors. Figure 6-9 shows a blank faceplate over an unused connector.

Step 4   Connect the appropriate number of AC power cords.

Note   If the IGX 8420 power configuration had redundant AC sources, extra cables are left over.

Step 5   After you have turned on the power and verified that the AC Okay and DC Okay LEDS are lit, turn off the power and proceed to the section titled "Installing Cards and Cables."

Figure 6-7   **Wire Diagrams for Different Power Configurations**

Cabling for PS to PE-BC for
IGX 8430, single or dual AC
input, 3 or fewer supplies

Cabling for PS to PE-BC for
IGX 8430, single or dual AC
input, 4 or more supplies

S6388
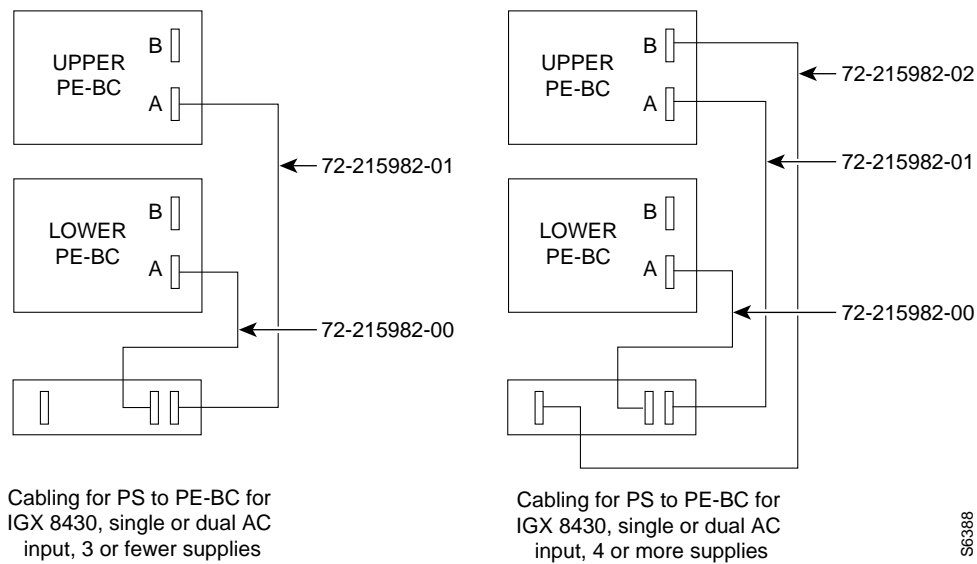
Figure 6-8   **AC Power Supply Shelf Back View**

B 1-16   17-32   A 1-16

8343
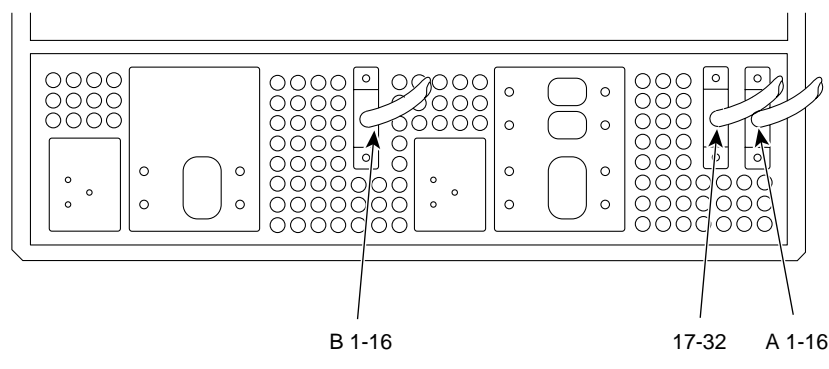
Figure 6-9   **Inserting System Power Connector to E-Card, AC-Powered System**

Connector (fan 2)

Power connector

Plate for unused connection

Power connector

System power

Connector (fan 1)

H8302
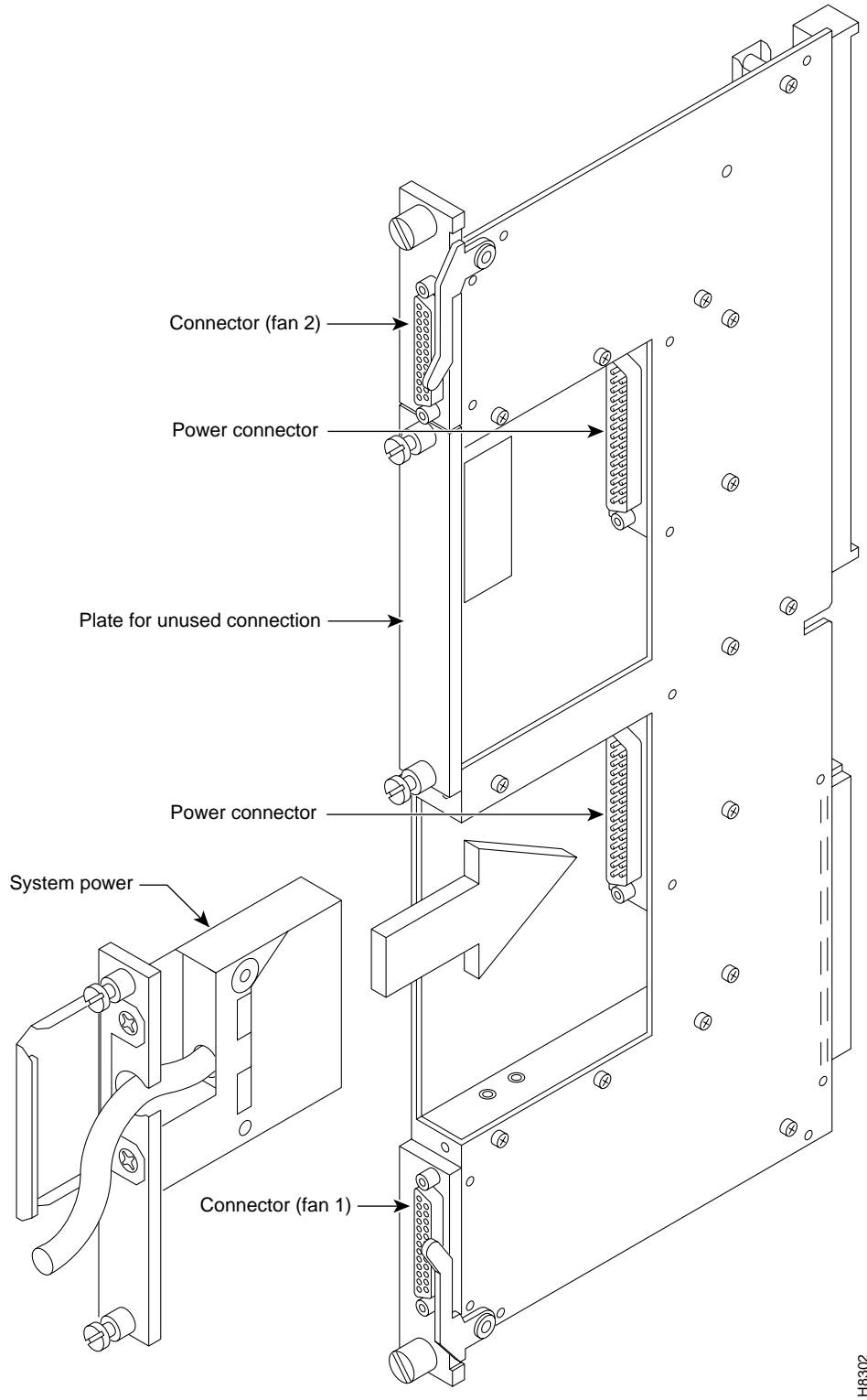
Note   If either "Okay" LED on a supply fails to light, go to the "Repair and Replacement" chapter.

Connecting DC Power

This section describes the steps for adding the Power Entry Modules (PEMs) to the new Power Entry Back Card (PE-BC). Refer to Figure 6-10 for the steps that follow. If you are not sure if the site can provide the necessary DC current, refer to the sections on DC power in the chapter titled "Enclosure and Power Installation."

Step 1   Make sure all the circuit breakers on the PEMs are in the OFF position.

Step 2   Install the new PE-BC.

Step 3   Slide in each new PEM until it seats in the D-connector on the new PE-BC.

Step 4   Tighten the screws to secure the PEM in the PE-BC.

Step 5   Place the wiring within the strain relief mechanism.

Step 6   Plug in the terminal wiring block into the DC receptacle.

Step 7   Attach a blank coverplate over any unused connector.

Step 8   Switch the circuit breaker on the PEM to the ON position.

Step 9   Verify correct system voltage levels.

Step 10   Turn off power until you have installed the cards and cabling as described in the forthcoming section titled "Installing Cards and Cables."

Figure 6-10   PEM Faceplate Features and Surrounding Area

Connector (fan 2)

Redundant

Primary

Circuit breaker

DC receptacle
for pluggable
terminal block

Pluggable terminal block

Customer-supplied wiring

Strain relief mechanism

Connector (fan 1)

H8303
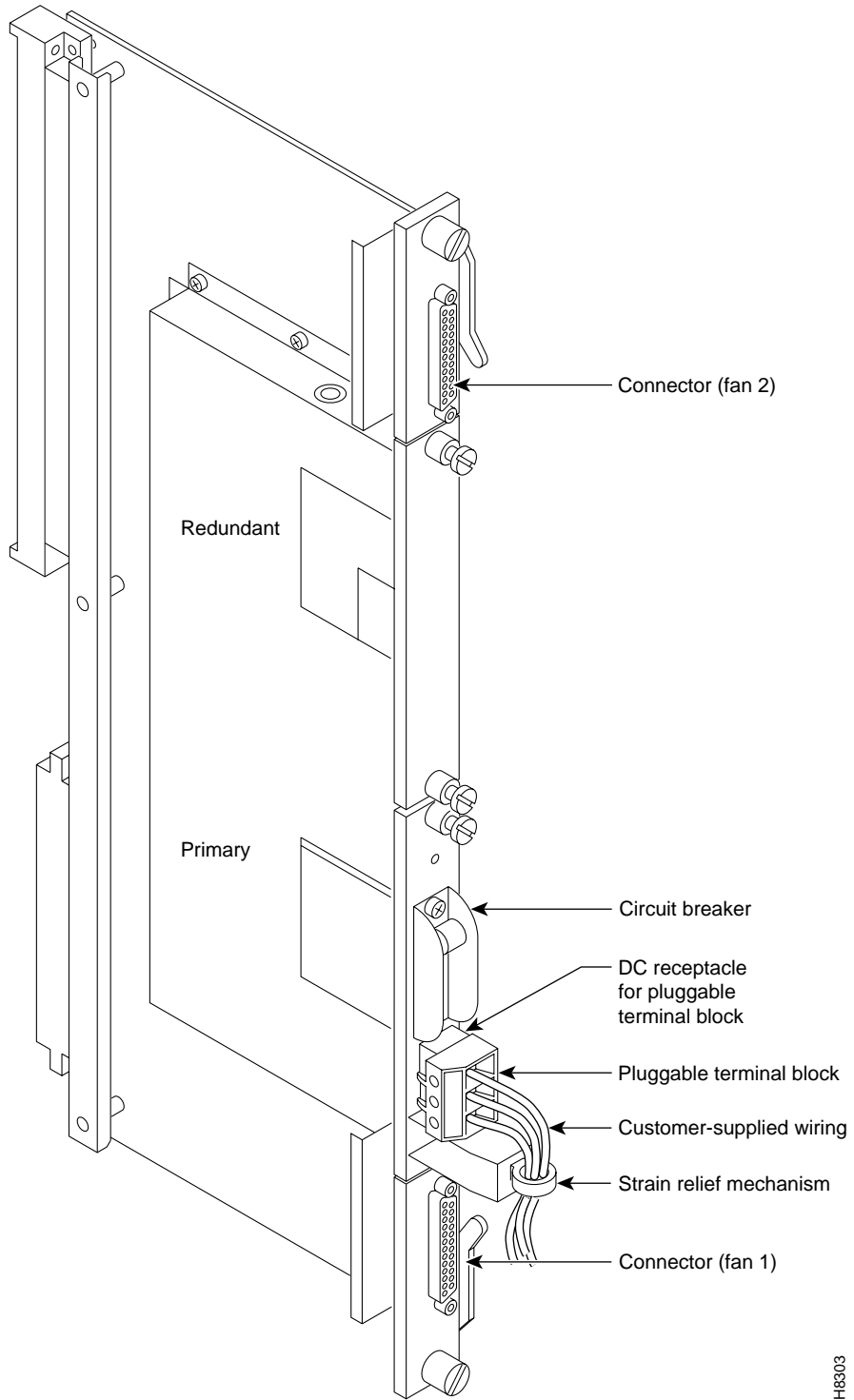
Installing Cards and Cables

Install the front and back cards. If you do not know how to install the cards, refer to the descriptions in the chapter titled "Card Installation and Node Startup." This section contains some reminders for card installation.

Warning Correct alignment between connector pins and receptacles is *extremely* important. Before inserting a card, make sure all backplane pins are straight. Make sure the connectors on the card and backplane are aligned. Insert card gently.

- Installing a front card requires the card to be inserted into the card track and pushed firmly but gently into the connector on the back card (or the backplane connector if the card is an NPM). If significant resistance occurs, the connectors may not be aligning with each other due to warpage in the card. In this case, removing other cards to provide room for manually aligning the card may be necessary.

- Hold the extractor handles in the open position until they contact the shelf supports and then rotate them into the closed position.

- Tighten the captive screws on the card's faceplate just enough to secure the card.

- To install a back card, insert the card into the card track and gently seat the card in the connector on the front card. If the back card is an SCM, it plugs into the backplane. If you detect significant resistance, the front and back connectors may not be aligning due to warpage in the card. In this case, you may need to remove other cards and manually align the cards.

- After you connect all the cables, loop them through the cable manager as needed.

Restarting the System

After you have installed the cables, start up the system. If necessary, refer to the IGX start-up instructions in the chapter titled "Card Installation and Node Startup." Executing the **dsppwr** command should show normal power operation.

After system operation appears to be normal, install the new cable guard.

System Specifications

This appendix contains system specifications for all models and communications types for the node.

General IGX 8410 Switch Specifications

This section provides general system information on the IGX 8410 node.

System capacity:	1 shelf with 8 card slots. Has 2 dedicated front slots for NPMs. Has 2 dedicated back slots for SCMs (1 slot with blank plate). Up to 48 physical lines for UNI or NNI. Up to 32 physical lines for trunks.
Enclosure size:	IGX 8410 Standalone/Rackmount: Height: 25 ins. (63.5 cm) standalone; 24.5 ins. (62.3 cm), rack Width: 19.9 ins. (50.5 cm), standalone; 19 ins. (48.3 cm.), rack Depth: 26.5 ins. (67.3 cm), standalone and rack-mount
Shipping weight:	270 pounds (122.7 kilograms)
Clearance requirement:	Min. clearance: 30 inches front; nominal 30 ins. rear; 12 ins. side.
Power input voltage:	AC system: Normal operating range is 100–240 VAC, 47 to 63 Hz. The (under and over-voltage limits are 90–264 VAC). DC system: –42 to –56 VDC. Each AC supply can provide up to 400 watts to the card shelves. Space is available for 4 power supplies.
Input AC power connector:	IEC 16 Amp input connector. 6 different power cords are available to comply with the standards of individual countries. Power cords are 6 feet (about 2 meters) long. See appendix titled Cabling Summary in the *Cisco IGX 8400 Series Installation* guide for details.
Current requirements:	Configuration-dependent: use Network Design Tool for exact requirements. For planning purposes, use the following:
• AC system	10 Amps maximum for 110 VAC, 5 A for 220 VAC.
• DC system	20 Amps maximum at –48 VDC; 25 Amps at –42 VDC (worst case).

DC input connections:	3-wire pluggable terminal block with screw terminal connectors.
Operating environment:	0°–40° C (32°–104° F) normal operation (50° C up to 72 hours). Maximum 85% relative humidity.
Shock:	Withstands 10 G, 10 ms. at 1/2 sine wave.
Vibration:	Withstands 1/4 G, 20–500 Hz.
Heat transfer to room:	IGX 8410: 2720 BTUs max.

General IGX 8420/8430 Switch Specifications

This section provides general system information on the IGX 8420 and IGX 8430 nodes.

System capacity:	1 or 2 shelves, each with 16 card slots. Requires 1 or 2 dedicated front slot(s) for NPMs. Requires 1 dedicated back slot for SCM. Up to 64 physical lines for UNI or NNI. Up to 32 physical lines trunks.
Enclosure size:	IGX 8420 Standalone/Rackmount: HT: 32.25 ins. (82 cm.), standalone; 31.75 ins. (80.7 cm.), rack WD: 19.9 inches (50.5 cm), standalone; 19 inches (48.3 cm.), rack DP: 26.75 inches (68 cm), standalone; 26 inches (66 cm.), rack IGX 8430 Standalone/Rackmount: HT: 55.5 inches (141 cm.), standalone, 55 inches (139.7 cm) rack WD: 19.9 inches (50.5 cm), standalone; 19 inches (48.3 cm.), rack DP: 26.75 inches (68 cm), standalone; 26 inches (66 cm.), rack
Shipping weight:	600 pounds (270 kilograms) for a fully loaded IGX 8430 enclosure. 400 pounds (180 kilograms) for a fully loaded IGX 8420 enclosure.
Clearance requirement:	Minimum 30 inches front and rear; nominal 12-inch side clearance.
Power input voltage:	AC system: Normal operating range is 200–240 VAC, 47 to 63 Hz. The under and over-voltage range is 180–264 VAC. DC system: –42 to –56 VDC. Each AC supply can provide up to 875 watts to a card shelf. Cabinet has space for 6 AC power supplies.
Current requirements:	Configuration-dependent: use Network Design Tool for exact requirements. For planning purposes, use the following:
• AC system	IGX 8420/8430 node: 12 Amps at a nominal voltage of 200 VAC. At the under-voltage limit of 180 VAC, the current draw is a maximum of 16 Amps.
• DC system	IGX 8420 node: 24 Amps max. per circuit at –42 VDC (worst case) IGX 8430 node: 44 Amps at nominal –48 VDC; 50 Amps at –42 VDC maximum per circuit at –42 VDC.

Input AC power connector:	AC Power Distribution unit is the same for all cabinets: IEC 16 Amp input connector. Six different power cords available, depending on country of destination. See appendix titled "Cabling Summary," In the *Cisco IGX 8400 Series Installation* manual
DC input connections:	DC power is the same for all IGX 8420/8430 cabinets shipped. DC: 3-screw pluggable terminal connectors.
Operating environment:	0°–40° C (32°–104° F) normal operation (50° C or 122° F up to 72 hours). Maximum 85% relative humidity.
Shock:	Withstands 10 G, 10 ms. at 1/2 sine wave.
Vibration:	Withstands 1/4 G, 20–500 Hz.
Heat transfer to room:	IGX 8420 node: 4300 BTUs max, AC-powered system. 3600 BTUs in a DC-powered unit. IGX 8430 node: 8600 BTUs max, AC-powered system. 6800 BTUs in a DC-powered unit.

E2 Trunk Interface on BTM

Required hardware:	AIT front card in an IPX node, BTM front card in an IGX node. The back card is the AIT-E2.
Line rate:	8.448 Mbps.
Line coding:	HDB3.
Cell delineation:	HEC.
Physical medium;	Coaxial.
Line length:	50 feet maximum; 6 feet nominal.
Connector:	BNC, 75 Ohms.
Synchronization:	Master/slave (NOTE: loop timing to IPX or IGX node is allowed.)
Interfaces per card:	One.
Applicable standards:	E2 specification and G.703.

HSSI Trunk Interface on BTM

Required hardware:	AIT front card on the IPX or BTM front card on the IGX node. The back card is the AIT-HSSI.
Line rate:	Pre-setable and programmable for the range 4–50.84 Mbps: increments depend on the attached DSU.
Line coding:	NRZ.
Cell delineation:	PLCP.
Physical medium:	Multi-conductor, 25 twisted pairs in a ribbon cable, 110 Ohms.
Line length:	50 feet maximum; 6 feet nominal.
Connector:	50-pin, 50 mil SCSI type.
Synchronization:	None—accepts DSU clocks.
Interfaces per card:	Single port.
Applicable standards:	High Speed Serial Interface specification, March, 1990:
	I.432, G.804.

T1 Interface on UFI-8T1 Back Card

This section applies to each T1 line on the UFI-8T1. The UFI-8T1 is the eight-port T1 back card for the UFM. The information applies whether the front card supports four or eight ports.

Line rate:	1.544 Mbps, ± 50 bps (± 200 bps VCO lock range).
Line framing:	ESF per AT&T TR 54016.
Frame Relay interface:	Meets ANSI T1.618, two-octet header.
Frame Relay rates:	Either 56 Kbps or n x 64 Kbps, where $1<=n<=24$. Sum of all $n<=24$.
Number of interfaces:	1–24 occupied channels where $1<= n <= 24$, and the sum of $n <= 24$.
Synchronization:	Transmitter can be either loop-timed to line or synchronized to node.
Line coding:	Bipolar AMI or B8ZS.
Framing formats:	Fractional T1, contiguous DS0s. Minimum of four DS0s required.
Signal level:	DSX-1 compatible.
Line impedance:	Terminated=100 Ohms nominal. Bridged=1 Kohm.
Pulse amplitude:	Individual pulse amplitude 2.4 V–3.6 V (making a total base-to-peak amplitude of 6 V ± 0.6V).
Minimum pulse density:	Zero-code suppression, either LSB, MSB or B8ZS.
VF signaling:	Robbed bit D4 with A and B bits.
Maximum line length:	Up to 533 feet with equalizers using ABAM cable.
Input jitter tolerance:	Meets AT&T PUB 62411 specifications.
Output jitter generation:	Meets AT&T PUB 62411 using normal mode synchronization.
Connector:	DB 15 female.

UFM Physical and Electrical Specifications

This section contains physical and electrical specifications for the UFM cards.

Dimensions:	Front card: 15.25 by 16.25 inches. Back card: 6.5 by 16.25 inches.
Weight:	Front card: 8 lbs (3.6 kg). Back card: 4 lbs (1.8 kg).
Input voltage:	–48 VDC
Power consumption:	UFM-C: 66 W. UFM-U: 60 W (V.35/X.21) or 87 W (HSSI).
Interface mode:	DTE or DCE
Standards:	FCC part 15. Bellcore GR1089-CORE. EN 55022, 60950. UL 1950. IEC 801-2, 801-3, 801-4, 801-5, 825-1 (Class 1).

E1 Interface for UFI-8E1 Back Card

This section applies to each E1 line on the UFI-8E1. The UFI-8E1 is the eight-port E1 interface card for the UFM. The information applies whether the UFM front card supports four or eight ports.

Line interface connector:	DB15 (120 Ohms), BNC (75 Ohms)
Line rate:	2.048 Mbps, ±50 bps (±200 bps VCO lock range).
Frame Relay interface:	Meets ANSI T1.618, two-octet header.
Number of Frame Relay interfaces:	1–31 occupied channels where $1 <= N <= 31$, and the sum of all $N <= 31$
Frame Relay interface rate:	Either 56 Kbps or N x 64 Kbps, where $1 <= N <= 31$. Sum of all $N <= 31$.
Line code:	Bipolar AMI or HDB3.
Line impedance:	120 ohms (balanced) or 75 ohms, balanced or unbalanced.
Minimum pulse density:	Zero-code suppression via HDB3 coding.
Frame format:	Unframed, 32-channel (G.703). Framed: 30 or 31-channel multiframe per ITU-T G.704.
VF signaling:	CAS or CCS.
Maximum line length:	E1 input complies with G.703, so line loss must not exceed -6dB/1000 feet at 1024 kHz (whether cable is coax or twisted pair).
Input jitter tolerance:	Meets G.823.
Output jitter generation:	Meets G.823.
Electrical interface:	Complies with G.703 Specification.
Connector:	Back card has either all DB15 female or all BNC connectors.

UFM Unchannelized Interface

This section contains specifications for the V.35/X.21 and HSSI interface cards for the UFM-U.

	V.35 or X.21	**HSSI**
Line rate:	56 Kbps–10.24 Mbps	1.-24–16.384 Mbps
Clock rate:	N x 64 KHz, where $1 <= N <= 32$ N x 1.024 MHz, where $2 <= N <= 10$	$1.024 + N$ x 0.512 MHz
Connector type:	DB 60	50-pin SCSI
Interface mode:	DTE or DCE	DTE or DCE

Frame Relay Interface for the FRM Front Card

This section contains technical specifications for Frame Relay service on the FRM

Type of service:	Permanent Virtual Circuit (PVC).
Data interface:	Per ITU-T I.122 and ANSI T1/S1 standards.
Data transfer protocol:	LAP-D frame level core functions.
Input data format:	High Level Data Link (HDLC) protocol.
Input data frame length:	Up to 4096 bytes.
Frame integrity check:	Frame Check Sequence and CRC check of data frame. If CRC fails, data frame is discarded at receiving node.
Input data rate:	56 Kbps–2.048 Mbps. The maximum rate is available with only one of four ports on the back card active).
Ports per card:	4 Model D.
	31 Model E.
PVCs per port:	252 per FRM card, distributed in any combination.
Port electrical interface:	ITU-T V.35. IGX node and X.21 can be DCE or DTE for direction of control leads and timing on Model D and E using E1 or T1.
Data clocking:	Normal or looped.
Virtual circuit identifier:	Data Link Connection Identifier (DLCI).
Control protocol:	Local Management Interface with XON/XOFF type flow control. The IGX node sets FECN and BECN bits in frame relay frame.
Bundled connections:	252 virtual circuits per card 1024 virtual circuits per node.
Billing time accuracy:	Upon request from a user-device, an IGX node provides GMT from any node accurate to within one second.

T1 Interface on FRI Back Card

The BC-FRI-T1 is the T1 interface for the FRM frame relay card.

Line rate:	1.544 Mbps, ± 50 bps (± 200 bps VCO lock range).
Line code:	Bipolar AMI or B8ZS.
Framing formats:	Fractional T1, adjacent or alternating channels. Minimum of four DS0 channels required.
Signal level:	DSX-1 compatible.
Line impedance:	Terminated=100 Ohms nominal. Bridged=1 KOhm.
Pulse amplitude	Individual pulse amplitude 2.4 V–3.6 V (making a total base-to-peak amplitude of 6 V ± 0.6V)
Minimum pulse density:	Zero code suppression, either LSB, MSB or B8ZS.
Frame format:	D4 and Extended Superframe (ESF).
VF signaling:	Robbed bit D4 with A and B bits.
Maximum line length:	Up to 533 feet with equalizers using ABAM cable.
Jitter transfer:	Meets AT&T PUB 62411 specifications.
Jitter tolerance:	Meets ANSI standards and AT&T PUB 62411 specifications.
Connector:	DB 15 female.

E1 Interface on BC-E1 Back Card

The BC-E1 is the E1 interface card for both the NTM trunk and the CVM voice card.

Line rate: 2.048 Mbps, $\pm$ 50 ppm ($\pm$ 200 bps VCO lock range)

Line code: Bipolar AMI or HDB3

Line Impedance: 120 Ohms (balanced) or 75 Ohms (balanced or unbalanced)

Minimum pulse density: Zero-code suppression via HDB3 coding

Frame format: Unframed, 32-channel (G.703). Framed: 30 or 31-channel multiframe per ITU-T G.704.

VF signaling: CAS or CCS

Maximum line length: The E1 input complies with G.703, so cabling must not exceed –6dB/1000 feet at 1024 kHz (applies to 75 Ohm coax or 120 Ohm twisted pair up to 350 meters or 1000 feet). Cisco supplies cable with a maximum attenuation of 7 dB /1000 ft.

Jitter: Transmit output jitter, receive jitter tolerance, and jitter gain meet G.823.

Electrical interface: Complies with G.703 Specification.

Connector: DB 15 female or BNC.

Voice Circuit Support

This section lists voice circuit specifications. Where appropriate, the text names the card to which the specification applies.

Voice channel interface:	24-channel T1 (D4 format). 24-channel T1-ESF. 30-channel framed E1.
Voice compression:	32/24/16 Kbps ADPCM on the CVM 32/24/16 Kbps ADPCM 16 Kbps or 8 Kbps LDCELP (UVM only) Voice Activity Detection (VAD) compression
Compression algorithm:	ITU-T G.721, G.723, G.726. Cisco 32 Kbps ADPCM Cisco LDCELP Cisco CSACELP
PCM encoding types:	Accommodates µ-Law or A-Law encoding, End-to-end conversion available.
Channel gain control:	–8 dB to +6 dB.
Signaling modes:	T1: Robbed bit or CCS (ISDN). E1 and J1: Channel Associative Signaling (CAS) or Common Channel Signaling (CCS).
Signaling conditioning:	Various make-busy and forced-idle routines during circuit alarm, configurable on a per-channel basis.
Quantizing distortion added:	2.5 Quantizing Distortion Units (QDU)s with 32 Kbps ADPCM over 1 hop plus 0.7 QDUs with Digital Loss PAD (µ-law or A-Law).
Nominal transmission loss:	0 dB at 1 Khz.

UVM Physical and Electrical Standards

This section lists physical and electrical characteristics for the UVM card sets.

Dimensions:	Front card: 15.25 by 16.25 inches. Back card: 6.5 by 16.25 inches.
Weight:	Front card: 8 lbs (3.6 kg). Back card: 4 lbs (1.8 kg).
Input voltage:	–48 VDC.
Power consumption:	55 watts.
Electrical and safety standards:	FCC Part 15 Bellcore GR1089-CORE IEC 801-2, 801-3, 801-5, 825-1 (Class 1) EN 55022, 60950 UL 1950

T1 Interface on the BC-UVI-2T1EC

The BC-UVI-2T1EC is the two-port T1 interface for the UVM voice card.

Line rate:	1.544 Mbps, ± 32 ppm.
Line code:	B8ZS, AMI.
Line impedance:	100 ohms.
Frame format:	D4, ESF.
VF signaling:	CAS (robbed bit), CCS (ISDN).
Signaling conditioning:	Configurable.
Idle code:	Hex 7F.
Cable length:	0–655 feet.
Jitter:	± 32 ppm.
Standards:	ANSI T1.102, T1.231, T1403 ITU-T G.824.
Connector:	Two DB 15, female.

J1 Interface on the BC-UVI-2E1EC

The BC-UVI-2E1EC is the two-port E1 interface for the UVM voice card.

Line rate:	2.048 Mbps, ± 50 ppm.
Line code:	HDB3, AMI.
Line impedance:	120 ohms on BNC (balanced), 75 ohms on DB 15.
Frame format:	Framed: 30 or 31-channel multiframe per ITU-T G.704.
VF signaling:	CAS or CCS
Signaling conditioning:	Configurable.
Idle code:	Hex 54.
Maximum line length:	The E1 input complies with G.703, so cabling must not exceed –6dB/1000 feet at 1024 kHz (applies to 75 Ohm coax or 120 Ohm twisted pair up to 350 meters or 1000 feet). Cisco supplies cable with a maximum attenuation of 7 dB /1000 feet.
Jitter:	± 50 ppm.
Standards:	ITU-T G.703, G.704, G.706, G.732, G.735-9, G.775, G.823, G.826, I.431.
Connector:	Two DB 15, female, and two pairs of BNCs.

J1 Interface on the BC-UVI-2J1EC

The BC-UVI-2J1EC is the two-port J1 interface for the UVM voice card.

Line rate:	2.048 Mbps, ± 50 ppm (± 200 bps VCO lock range)
Line code:	Bipolar CMI
Line impedance:	110 Ohms
Frame format:	TTC-2M / JJ-20.11
VF signaling:	CAS or CCS
Signaling conditioning:	Configurable.
Idle code:	Hex 7F.
Maximum line length:	100 meters. Cisco supplies cable with a maximum attenuation of 7 dB per 1000 ft., but the maximum cable length recommended for this J1 interface is 100 meters.
Jitter:	± 50 ppm: transmit output jitter, receive jitter tolerance, and jitter gain meet G.823.
Standards:	Applicable JATE standards.
Connector:	Two DB 15, female.

J1 Interface on the BC-J1

The BC-J1 is a J1 interface card for both the NTM trunk card and the CVM voice card.

Line rate:	2.048 Mbps, ± 50 ppm (± 200 bps VCO lock range)
Line code:	Bipolar CMI
Line impedance:	120 Ohms (balanced) or 75 Ohms (balanced or unbalanced)
Frame format:	Per JJ-20.11
VF signaling:	CAS or CCS
Maximum line length:	100 meters. Cisco supplies cable with a maximum attenuation of 7 dB /1000 ft., but the maximum cable length recommended for this J1 interface is 100 meters.
Jitter:	Transmit output jitter, receive jitter tolerance, and jitter gain meet G.823.
Electrical interface:	Complies with G.703.
Connector:	DB 15 female or BNC.

Data Channel Support for HDM and LDM

This section contains interface card specifications for the HDM and LDM data cards.

Synchronous data interfaces:	EIA/TIA-232C/D, EIA/TIA-449/422, V.24, X.21, and V.35 with IGX switch as DCE or DTE.
High-speed rates (HDM):	2.4 Kbps–1.344 Mbps.
Low-speed data rates:	2.4 to 19.2 Kbps per LDM port.
Ports per card:	LDI: 4 or 8. SDI: 4.
Control leads supported:	SDI: Per interface standards. SDI: Up to 7 in each direction for fast EIA. LDI: 3 in each direction for DCE and DTE for each port.
Control lead sync w/data:	Control leads are sampled every 50 ms. A change normally follows data within 100 to 1000 msec. Fast EIA lead is within 1 byte.
Data clocking:	Synchronous and isochronous clocking. Normal, looped, and split clock configurations.
Pleisochronous clock range:	± 2 percent of nominal data rate.

ATM Interface

This section contains general ATM interface specifications. For specifications that apply to the UXM only, see the section in this appendix titled "E2 Trunk Interface on BTM."

Type of service:	Permanent Virtual Circuit (PVC).
Interface types:	User-to-Network (UNI) and Network-to-Network (NNI) per ITU-T I.361 and I.363.
Data rates:	T1, E1, T3, E3, OC3 (STM-1).
ATM layer:	Physical Layer Convergence Protocol per AT&T publication TA-TSY-00772 and 000773 for T3; ITU I-361 with HEC for E3.
Cell rate:	T3: 96,000 cps in PLCP mode, 104268 cps in HEC mode.
	E3: 80,000 cps.
Adaptation layer:	AAL5.
Number of PVCs per card:	255.
VPI addressing range:	0–255.
VCI addressing range:	0–65535.
Traffic queues:	CBR, VBR, and ABR (except ALM/A).
Management protocol:	LMI (Layer Management Interface) and ILMI (Interim Layer Management Interface).

Network Synchronization

External clock sources:	The IGX switch synchronizes to the nearest, highest-stratm clock available. Any T1, E1, T3, E3, OC3 (STM-1) line, trunk, or optional external clock input can serve a clock source.
Internal to node source:	T1: 1.544 MHz, ± 10 ppm. (stratm 4). E1: 2.048 MHz, ± 10 ppm (stratm 4).
Clocking hierarchy:	Dynamic primary, secondary, and tertiary clocking.

Network Management Control

Network control terminal:	StrataView Plus workstation and Cisco software required for graphical display of network status, statistics gathering and display, and automatic downloading of software.
Control terminal:	DEC VT100, WYSE 85, Televideo 970 or equivalent terminal for basic system configuring and alarm monitoring.
Remote alarm reporting:	Auto-dial modem connects to one of two control ports on each IGX node for automatic reporting of network alarms.
Remote diagnostics:	Auto-answer modem connects to one of two control ports on each IGX node for remote diagnostic access by Cisco TAC or other authorized personnel.
Network control ports:	Two ports per node—one EIA/TIA 232C interface and one Ethernet LAN port.
Alarm notification:	Status of all trunks and nodes in network distributed to and stored by each individual node. Reported to StrataView Plus workstation at connecting node.
External Alarms:	Meets Bellcore Compatibility Bulletin #143 and AT&T Technical Reference PUB 43801 DS1 (T1) facility alarm requirements when equipped with DTI group.
Indicators and controls:	Active and Fail lights on all cards and power supplies.

Peripherals Specifications

Introduction

This appendix provides details on the IGX peripherals specifications.

Note EIA/TIA-232 and EIA/TIA-449 existed as recommended standards RS-232 and RS-449 before the Electronics Industries Association (EIA) and Telecommunications Industry Association (TIA) accepted them as standards.

Network Management Terminal

StrataView Terminal

A StrataView Plus workstation is required for managing an IGX network. Refer to the *Cisco StrataView Plus Installation Manual* for setup instructions and specifications for the Cisco Network Management Terminal. The *Cisco StrataView Plus Installation Manual* has necessary information for obtaining network alarm, control, and statistics from IGX switch software for Cisco StrataView Plus.

Control Terminal

Table B-1 lists the control terminals requirements.

Table B-1   Control Terminal Interface Requirements

Parameter	Requirement
IGX Port Used:	Control terminal port on the SCM card is used to interface with a local control terminal.
Code:	Standard 7 or 8-bit ASCII; 1 or 2 stop-bits; even, odd or no parity.
Interface:	EIA/TIA-232 DCE.
Data Rate:	All standard asynchronous data rates from 300 to 19200 bps, independently software-selectable.
Supported Terminals:	VT-100, or equivalent, recommended.
Cable Required:	Straight-through EIA/TIA-232 cable.

Printer

The maintenance printer that is currently being shipped with the IGX node is the Okidata Model 184.Refer to Table B-2 for interface requirements.

Table B-2   Printer Interface Requirements

Parameter	Requirements
IGX port used:	The AUX port on the SCM is the interface with the maintenance printer.
Code:	Standard 8-bit ASCII; 8 data bits, 1 stop-bit, odd parity
Interface:	EIA/TIA-232 DCE
Data Rate:	9600 baud
Supported Printers:	Okidata 184
Cable Required:	Straight-through EIA/TIA-232 cable

DIP Switch Settings for Okidata 184

DIP Switch A is an eight-section DIP switch located on the main circuit board of the printer. For access to the configuration switches, slide back the switch cover at the top-rear of the printer case. Set Switch A according to the information in Table B-3.

Table B-3   Switch A Settings—Okidata 184 Printer

Switch A	Setting	Description
1	Off	ASCII with
2	Off	non-slashed
3	Off	zero.
4	Off	11-inch
5	On	paper.
6	Off	No Auto Line Feed.
7	On	8- bit data.
8	Off	Enables front panel.

The High Speed Serial Interface DIP Switch consists of two DIP switches, SW1 and SW2, located on a serial-board that is attached to the printer's main board. Set switches 1 and 2 as indicated in Table B-4 and Table B-5.

Table B-4   Switch 1 Settings—Okidata 184 Printer

Switch 1	Setting	Description
1	On	Odd parity.
2	On	No parity.
3	On	8 data bits.
4	On	Ready/busy protocol.
5	On	Test select circuit.
6	On	Print mode.
7	On	Busy line selection.
8	On	DTR pin 2 enabled.

Table B-5   Switch 2 Settings—Okidata 184 Printer

Switch 2	Setting	Description
1	Off	Transmission
2	On	speed =
3	On	9600 baud.
4	On	DSR active.
5	On	Buffer = 32 bytes.
6	On	Timing = 200 ms.
7	On	Space after power on.
8	Don't care	Not used.

Modems

In general, a dial-out connection to a modem uses the AUX port on the SCM. A dial-in connection from a modem uses the Control port on the SCM. Refer to Table B-6 for interface requirements.

Table B-6   Modem Interface Requirements

Parameter	Requirement
IGX port used:	Control port on SCM is used for auto-answer modem. AUX port on SCM is used for auto-dial modem.
Code:	Standard 8-bit ASCII, 1 stop-bit, no parity.
Interface:	EIA/TIA-232 DCE.
Cable:	Null modem cable.
Phone lines:	Dedicated, dial-up business telephone line for TAC-to-IGX modem and auto-dial-to-TAC modem.
Data rate:	Standard, asynchronous rates 3.0–19.2 Kbps, independently software-selectable.
Supported modems:	Motorola Model V.34R 9600 baud modem.

Motorola V.34R IGX Dial-In/Out Configuration

IGX Auto-Answer

Auto-answer is a setup in which the TAC can dial into the your switch. Using the **cnfterm** command, set the IGX Control port speed to 9600 bps. Using the **cnftermfunc** command, set the terminal type to VT100/StrataView. To program the modem, temporarily attach a terminal to the modem using a null modem cable. The modem EIA port automatically match the 9600 bps setting of the terminal. Enter the commands listed in Table B-7 to set up the modem for proper operation.

Table B-7   Setting Up the Motorola V.34R Modem for Auto-Answer mode

Step	Command	Function
1.	AT&F&W	Reset to factory default and save.
2.	ATSØ=1	Enables Auto-Answer Mode (answer on first ring).
3.	ATL1	Modem speaker at low volume.
4.	AT*SM3	Enables automatic MNP error correction.
5	AT*DC0	Disables data compression.
6.	AT*FL0	Disables XON/XOFF flow control.
7.	AT&S1	Sets DSR to "normal".
8.	ATEØ	Disables local character echo.
9.	ATQ1	Disables result codes. (Modem will appear "dead.)
10.	AT&W	Saves current configuration settings in non-volatile memory.

IGX Auto-Dial

Using the **cnfterm** command, set the IGX Auxiliary port (AUX port) speed to 9600 bps and enable XON/XOFF flow control. Using the **cnftermfunc** command, select option 7, Autodial Modem, then enter the Cisco-designated Network ID and the Cisco modem phone number. Attach a 9600 bps terminal to the modem using a cross-over cable and enter the following commands (Table B-8).

Table B-8   Setting Up the Motorola V.34R Modem for Auto-Dial mode

Step	Command	Function
1.	AT&F	Initializes factory defaults.
2.	ATL1	Modem speaker at minimum volume.
3.	AT*SM3	Enables automatic MNP error correction.
4	AT*DC0	Disables data compression.
5.	AT*SC1	Enables DTE speed conversion
6.	AT*FL1	Enables XON/XOFF flow control.
7.	AT*SI1	Enables 5-minute inactivity disconnect.
8.	AT&C1	DCD controlled by modem.
9.	AT&D2	Modem disconnects when node toggles DTR.
10.	AT&V	Verifies entries.
11.	AT&W	Saves current settings to non-volatile memory.

Connect the modem to the IGX AUX port using the cable shown in Figure B-1. Ask the Cisco TAC
to assist in the modem testing.

Modem Cables

The IGX Auto-Dial to Cisco application (also called "call home") and IGX Auto-Answer (call from
Cisco) application use different modem cables. Figure B-1 shows the modem cable pinout for IGX
Auto-Dial to Cisco's TAC. Figure B-2 shows the modem cable pinout for IGX Auto-Answer (call
from Cisco TAC).

Figure B-1   Pinout for Customer to Auto-Dial Cisco (Call Home)
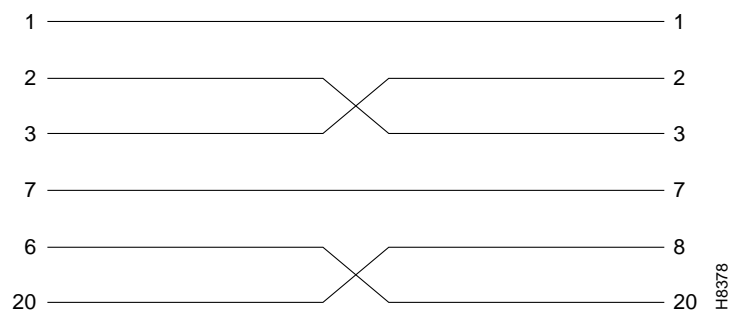
Figure B-2   Cable Pinout for Auto-Answer by Customer's Modem
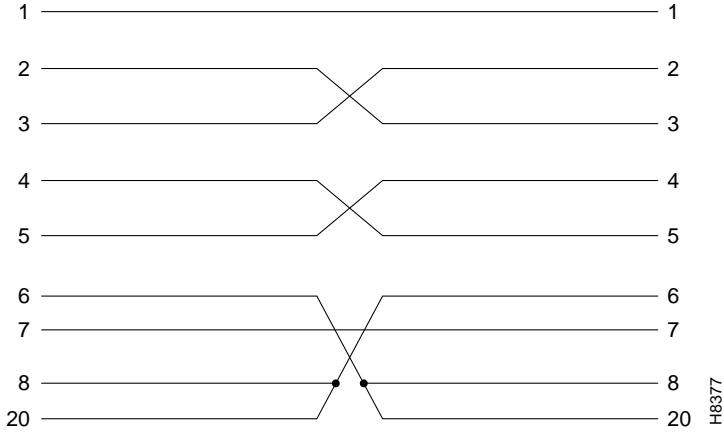
Cabling Summary

Introduction

This appendix provides details on the cabling required to connect customer devices to an IGX node. In all cable references, the transmit direction is *from* the node, and receive is *to* the node.

Note   EIA/TIA-232 and EIA/TIA-449 existed as recommended standards RS-232 and RS-449 before the Electronics Industries Association (EIA) and Telecommunications Industry Association (TIA) accepted them as standards.

T1 Cabling

Trunk cables connect the customer DSX-1 crossconnect point or T1-E1 Channel Service Unit (CSU) to the IGX node at the BC-T1 or BC-E1 back card. Refer to Table C-1 for details.

Table C-1   T1 Trunk/Circuit Line Cabling Specification

Cable Parameter	Description
Cable Type:	Western Electric 22 AWG, ABAM individually shielded twisted pair. Two pair per T1 line (1 transmit and 1 receive).
Cable Connector:	Male DB-15 subminiature. See Table C-2 for pinouts. The connector pinouts are the same for both the BA-T1 and the MT3 Distribution Panel.
Maximum Cable Length:	533 ft (162 m.) maximum between the node and the first repeater or CSU.

Table C-2   T1 Connector Pin Assignments

Pin Number	Description
1	Transmit, Tip
2	Transmit Pair Shield
3	Receive, Tip
4	Receive Pair Shield
9	Transmit, Ring
11	Receive, Ring

E1 Cabling

E1 trunk cables connect the customer DSX-1 crossconnect point or E1 Channel Service Unit (CSU) to the node at the back card. Note that variations exist in the pin assignments for some interfaces: Table C-5 and Table C-6 show the D-connector pinouts for the CVM, NTM, UFM, UVM, and FRM

Table C-3   E1 Trunk/Circuit Line Cabling Specification

Cable Parameter	Description
Cable Type:	75-ohm coaxial cable for balanced line or 100–120-ohm twisted pair for unbalanced line. Balanced lines use two cables per E1 port.
Cable Connector:	Two female BNC for balanced connection; male DB15 for unbalanced connection. See Table C-4, Table C-5, and Table C-6 for pinouts.
Max. Cable Length:	E1 output complies with G.703, so attenuation must not exceed –6dB at 1024 kHz (applies to 75 Ohm coax or 120 Ohm twisted pair). Maximum length is 100 meters between the IGX node and the first repeater or CSU.

Table C-4   E1 Connector Pin Assignments (Balanced)

Connector	Description
Rx BNC	Receive E1 from trunk
Tx BNC	Transmit E1 to trunk

Table C-5   E1 D-Connector Pinout, CVM and NTM Back Cards

Pin #	Description
1	Receive, Tip
2	Receive Pair Shield
3	Transmit, Tip
9	Receive, Ring
10	Transmit Pair Shield
11	Transmit, Ring

Table C-6   E1 D-Connector Pinout, FRM, UFM, and UVM Back Cards

Pin #	Description
1	Transmit, Tip
2	Transmit Pair Shield
3	Receive, Tip
4	Receive Pair Shield
9	Transmit, Ring
11	Receive, Ring

Subrate (SR) Cabling

This section lists general data for the subrate cabling and the pinouts for different types of interfaces that support subrate operation. Table C-7 contains general specifications for the subrate cabling. Table C-8, Table C-9, and Table C-10 list the pinouts for V.11, V.35, and EIA/TIA-449 interfaces, respectively.

Table C-7   Subrate Trunk Cabling Specification

Cable Parameter	Description
Cable Type:	100–120-ohm twisted pair telephone cable.
Cable Connector:	V.11, DB15 subminiature, male. V.35, 34 pin M block (Winchester), male. MIL188/RS-449, DB-37 subminiature, male. See Table C-8 through Table C-10 for pinouts.
Max. Cable Length:	Depends on operating speed. Ranges are 400 meters for 256 Kbps though 50 meters for 1.92 Mbps.

Table C-8   SR Connector Pin Assignments (V.11)

Pin #	Description
1	Shield ground
2	TX-A
9	TX-B
3	CA
10	CB
4	RX-A
11	RX-B
5	IA
12	IB
6	SA
13	SB
7	not used
8	Signal ground
14	not used
15	not used

Table C-9   SR Connector Pin Assignments (V.35)

Pin #	Name	Source	Description
A	Gnd.	both	Protective (Shield) ground
B	Sig. Gnd.	both	Signal ground
C	RTS	DTE	Request to Send
D	CTS	DCE	Clear to Send
E	DSR	DCE	Data Set Ready
F	DCD	DCE	Data Carrier Detect (RLSD)
H	DTR	DTE	Data Terminal Ready
J	RI	DCE	Ring Indicator
K	TM	DCE	Test Mode
L-N			not used
P/S	TxD	DTE	Transmit Data from DTE
R/T	RxD	DCE	Received Data to DTE
U/W	XTC	DTE	External Transmitter Clock
V/X	RxC	DCE	Receiver Clock
Y/AA	TxC	DCE	Transmitter Clock
BB-EE			not used

Table C-10   SR Connector Pin Assignments (EIA/TIA-449)

Pin #	IGX Name	EIA Name	Source	Description
1	Frm. Gnd.		Both	Shield Ground
2	SI	SI	DCE	Signaling Rate Indicator (to DTE)
4/22	TxD	SD	DTE	Transmit Data from DTE
5/23	TxC	ST	DCE	Transmitter Clock
6/24	RxD	RD	DCE	Received Data to DTE
7/25	RTS	RS	DTE	Request to Send
8/26	RxC	RT	DCE	Receiver Clock
9/27	CTS	CS	DCE	Clear to Send
10	LL	LL	DTE	Local Loopback
11/29	DSR	DM	DCE	Data Set Ready
12/30	DTR	TR	DTE	Data Terminal Ready
13/31	DCD	RR	DCE	Data Carrier Detect (RLSD)
14	RL	RL	DTE	Remote Loopback
15	RI	IC	DCE	Ring Indicator
16	SF	SF	DTE	Signal Rate Select (to DCE)
17/35	XTC	TT	DTE	External Transmitter Clock
18	TM	TM	DCE	Test Mode
19	Sig. Gnd.	SG	Both	Signal Ground
20		RC	DCE	Receive Common
28	BSY	IS	DTE	Busy (in service)
32	SS	SS	DTE	Select Standby
33	SQ	SQ	DCE	Signal Quality Detect
34	NS	NS	DTE	New Synchronization
36	SB	SB	DCE	Standby Indicator
37		SC	DTE	Send Common
3, 21				Spare

T3/E3 Cabling

Cables that support T3/E3 rates connect to back cards AIT-T3, AIT-E3 trunk, UAI-1T3-BC, or UAI-1E3-BC. These cables can connect a back card to a either a DSX-3 cross-connect point, another back card in a co-located node, or a BPX node at the LM-3T3 back card.

Table C-11   T3 /E3 Trunk Cables

Cable Parameter	Description
Type:	75-ohm coax cable (RG-59 B/U for short runs, AT&T 734A for longer runs). Two per T3/E3 line (XMT and RCV).The chosen cable has frequency/attenuation characteristics that follow a $\sqrt{f}$ law with a maximum attenuation of 6 dB at 1024 KHz.
Max. Length:	450 feet max. between the BTM back card and the DSX-3 point, or BTM trunk card.
Connector	Female BNC; Rx is receive T3/E3 to BTM back card, Tx is transmit T3/E3 to DSX-3 cross-connect.

Table C-12   T3 Connector Pin Assignments

Connector	Description
Rx BNC	Receive T3 from trunk
Tx BNC	Transmit T3 to trunk

Data Cabling

This section contains Table C-13 through Table C-22. These tables describe the applicable cables for the LDM and HDM card sets for synchronous and asynchronous data circuits.

Table C-13   Synchronous Data Cables

Cable Parameter	Description
Cable Type:	Standard EIA/TIA-232C/D (V.24), V.35, or EIA/TIA-449/422 (with adaptor cable for X.21).
Cable Connectors:	EIA/TIA-232C/D (V.24): DB-25 Subminiature, male. V.35: 34 pin M block-type (Winchester), male. EIA/TIA-449/422: DB-37 Subminiature, male.
Max. Cable Length:	Not to exceed interface standards.

SDI EIA/TIA-232D Port Pin Assignments

Table C-14 contains a listing of IGX EIA/TIA-232D port pin assignments for the SDI data card. A standard EIA/TIA-232 cable works in this application.

Table C-14   **SDI EIA/TIA-232D Port Pin Assignment**s

Pin #	IGX Name	EIA Name	Source	Description
1	Frame Gnd.	AA	Both	Frame Ground
2	TxD	BA	DTE	Transmit Data from DTE
3	RxD	BB	DCE	Received Data to DTE
4	RTS	CA	DTE	Request to Send
5	CTS	CB	DCE	Clear to Send
6	DSR	CC	DCE	Data Set Ready
7				Signal Ground
8	DCD	CF	DCE	Data Carrier Detect (RLSD)
9	+VS		Both	+12 volt test
10	-VS		Both	−12 volt test
11	QM		DCE	Equalizer Mode (to DTE only)
12	SDCD	SCF	DCE	Secondary Data Carrier Detect
13	SCTS	SCB	DCE	Secondary Clear to Send
14	STxD	SBA	DTE	Secondary Transmit Data
15	TxC	DB	DCE	Transmitter Clock
16	SRxD	SBB	DCE	Secondary Received Data
17	RxC	DD	DCE	Receiver Clock
18	RL		DTE	Remote Loop Back
19	SRTS	SCA	DTE	Secondary Request to Send
20	DTR	CD	DTE	Data Terminal Ready
21	SQ	CG	DCE	Signal Quality Detect
22	RI	CE	DCE	Ring Indicator
23	SF	CH	DTE	Signal Rate Select (to DCE)
23	SI	CI	DCE	Signaling Rate Indicator (to DTE)
24	XTC	DA	DTE	External Transmitter Clock
25	TST		DCE	Test Indicator

SDI EIA/TIA-232C (V.24) Port Pin Assignments

Table C-15 contains a listing of IGX EIA/TIA-232C port pin assignments for the SDI data card. A standard EIA/TIA-232 (V.24) cable is used for this application.

Table C-15   SDI EIA/TIA-232C Port Pin Assignments

Pin #	IGX Name	EIA Name	Source	Description
1	Frame Gnd.	AA	Both	Frame Ground
2	TxD	BA	DTE	Transmit Data from DTE
3	RxD	BB	DCE	Received Data to DTE
4	RTS	CA	DTE	Request to Send
5	CTS	CB	DCE	Clear to Send
6	DSR	CC	DCE	Data Set Ready
7				Signal Ground
8	DCD	CF	DCE	Data Carrier Detect (RLSD)
9	+VS		Both	+12 volt test
10	-VS		Both	−12 volt test
11	QM Pin 11		DCE DTE	Equalizer Mode (to DTE). Pin 11 to (DCE)
12	SDCD	SCF	DCE	Secondary Data Carrier Detect
13	SCTS	SCB	DCE	Secondary Clear to Send
14	STxD	SBA	DTE	Secondary Transmit Data
15	TxC	DB	DCE	Transmitter Clock
16	SRxD	SBB	DCE	Secondary Received Data
17	RxC	DD	DCE	Receiver Clock
18	DCR		DCE	Divided Receiver Clock
19	SRTS	SCA	DTE	Secondary Request to Send
20	DTR	CD	DTE	Data Terminal Ready
21	SQ	CG	DCE	Signal Quality Detect
22	RI	CE	DCE	Ring Indicator
23	SFCI	CH CI	DTE DCE	Signal Rate Select (to DCE). Signaling Rate Indicator (to DTE)
24	XTC	DA	DTE	External Transmitter Clock
25	BSY		DTE	Busy (in service)

SDI EIA/TIA-449/422 Port Pin Assignments

Table C-16 contains a listing of IGX EIA/TIA-449/422 port pin assignments. A standard EIA/TIA-449 cable is used for this application unless the interface is X.21.

Table C-16   SDI EIA/TIA-449/422 Port Pin Assignments

Pin #	IGX Name	EIA Name	Source	Description
1			Both	Shield Ground
2	SI	SI	DCE	Signaling Rate Indicator (to DTE)
3				Spare
4/22	TxD	SD	DTE	Transmit Data from DTE
5/23	TxC	ST	DCE	Transmitter Clock
6/24	RxD	RD	DCE	Received Data to DTE
7/25	RTS	RS	DTE	Request to Send
8/26	RxC	RT	DCE	Receiver Clock
9/27	CTS	CS	DCE	Clear to Send
10	LL	LL	DTE	Local Loopback
11/29	DSR	DM	DCE	Data Set Ready
12/30	DTR	TR	DTE	Data Terminal Ready
13/31	DCD	RR	DCE	Data Carrier Detect (RLSD)
14	RL	RL	DTE	Remote Loopback
15	RI	IC	DCE	Ring Indicator
16	SF	SF	DTE	Signal Rate Select (to DCE)
17/35	XTC	TT	DTE	External Transmitter Clock
18	TM	TM	DTE	Test Mode
19		SG	Both	Signal Ground
20		RC	DCE	Receive Common
21				Spare
28	BSY	IS	DTE	Busy (in service)
32	SS	SS	DTE	Select Standby
33	SQ	SQ	DCE	Signal Quality Detect
34	NS	NS	DTE	New Synchronization
36	SB	SB	DCE	Standby Indicator
37		SC	DTE	Send Common

See Table C-17 and Table C-18 for Wire Lists for adapter cables for X.21 application. This adapter cable is available in two models: one is used when the SDI operates as a DCE and the other when the SDI operates as a DTE. It has a male DB-37 on the IGX end and a female DB-15 (DCE) or male DB-15 (DTE) on the user-end.

Table C-17   Wiring List, SDI EIA/TIA-449-to-X.21 Adapter Cable (for EIA/TIA-449 DCE)

DB-37 Pin # (SDI)	IGX Name	DB-15 Pin # (User)	Description
1	Drain	1	Frame Ground
4	TxD-A	2	Transmit Data from DTE
22	TxD-B	9	Transmit Data from DTE
6	RxD-A	4	Receive Data to DTE
24	RxD-B	11	Receive Data to DTE
7	RTS-A	3	Request to Send
25	RTS-B	10	Request to Send
9	CTS-A	5	Clear to Send
27	CTS-A	12	Clear to Send
8	RxC-A	6	Receive Clock
26	RxC-B	13	Receive Clock
19	SG	8	Signal Ground

Table C-18   Wiring List, SDI EIA/TIA-449 to X.21 Adapter Cable (for EIA/TIA-449 DTE)
)

DB-37 Pin # (SDI)	IGX Name	DB-15 Pin # (User)	Description
1	Drain	1	Frame Ground
4	TxD-A	2	Transmit Data from DTE
22	TxD-B	9	Transmit Data from DTE
6	RxD-A	4	Receive Data to DTE
24	RxD-B	11	Receive Data to DTE
7	RTS-A	3	Request to Send
25	RTS-B	10	Request to Send
9	CTS-A	5	Clear to Send
27	CTS-A	12	Clear to Send
5	TxC-A	6	Transmit Clock
23	TxC-B	13	Transmit Clock
19	SG	8	Signal Ground
5 to 8	TxC-A		Receive Clock[1]
23 to 26	TxC-B		Receive Clock *

1. Loops Receive Clock to Transmit Clock when necessary.

SDI V.35 Port Pin Assignments

Table C-19 contains a listing of IGX V.35 Port pin assignments for the SDI card. A standard V.35 cable works this application.

Table C-19   **SDI V.35 Port Pin Assignments**

Pin #	Name	Source	Description
A	Gnd.	both	Protective (Shield) ground
B	Sig. Gnd.	both	Signal ground
C	RTS	DTE	Request to Send
D	CTS	DCE	Clear to Send
E	DSR	DCE	Data Set Ready
F	DCD	DCE	Data Carrier Detect (RLSD)
H	DTR	DTE	Data Terminal Ready
J	RI	DCE	Ring Indicator
K	TM	DCE	Test Mode
P/S	TxD	DTE	Transmit Data from DTE
R/T	RxD	DCE	Receive Data to DTE
U/W	XTC	DTE	External Transmitter Clock
V/X	RxC	DCE	Receiver Clock
Y/a	TxC	DCE	Transmitter Clock

LDI EIA/TIA-232 Port Pin Assignments

Table C-20 lists the LDI EIA/TIA-232 Port Pin Assignments at the DB-15 connector on the card. The LDM card supports only a limited subset of EIA control leads. The LDI is always used with a DCE or DTE DB-15 to DB-25 Adapter Cable. Refer to Table C-18 and Table C-21 for wiring lists and the pin-outs for the standard male DB-25 connector to the user data device.

Table C-20   LDI EIA/TIA-232 Port Pin Assignments

Pin #	IGX Name	EIA Name	Source	Description
1	Shield	AA	Both	Frame Ground
2	TxD	BA	DTE	Transmit Data from DTE
3	CTS	CB	DCE	Clear to Send
4	RxD	BB	DCE	Received Data to DTE
5	RTS	CA	DTE	Request to Send
6	XTC	DB	DCE	Transmitter Clock
7	RxC	DD	DCE	Receiver Clock
8	SG	AB	Both	Signal Ground
9	DSR	CC	DCE	Data Set Ready
10	DTR	CD	DTE	Data Terminal Ready
11	+VS		Both	+12V test voltage
12	–VS		Both	–12V test voltage
13	DCD	CF	DCE	Data Carrier Detect (RLSD)
14	RL		DTE	Remote Loop (for modem loopback)
15	MOD			Mode Select for cable (DTE or DCE)

Table C-21   Wiring List, DB15 to DB25 Adapter Cable (LDI as DTE) [1]

DB-15 Pin # (LDI)	IGX Name	DB-25 Pin # (User)	Description
1	Frm. Gnd.	1	Frame Ground
2	RxD	3	Received Data to DTE
3	RTS	4	Request to Send
4	TxD	2	Transmit Data from DTE
5	CTS	5	Clear to Send
6	XTC	24	External Transmit Clock
7	RxC	17	Receive Clock
8	SG	7	Signal Ground
9	DTR	20	Data Terminal Ready
10	DSR	6	Data Set Ready
11	+VS	9	+12V test voltage [2]
12	–VS	10	–12V test voltage [2]
13	DCD	8	Data Carrier Detect (RLSD)
14	RL	21	Remote Loop output
15	MOD	n.c.	Connects internally to DB15-8
(3)	LL	18	Local Loop output [3]

1. You can order this cable in lengths of 10 ft., 25 ft., 50 ft., 75 ft., and 100 ft. The Cisco model number is CAB-5626E-xx, where xx is the length, as follows: 10=10 ft.; 25=25 ft.; 50=50 ft.; 75=75 ft., and 00=100 ft.
2. You can use one of these pins to force a control pin to stay high or low.
3. No LDI local loop output is available. Try using DTR output: DB15-9.

Note Two adapter cables are available for the LDI card. The choice of cable determines whether the LDI card functions as a DCE or as a DTE. These may be ordered from Cisco Systems or made by the customer. Make sure the correct cable is used for the type of user device connected.

Table C-22   Wiring List, DB15 to DB25 Adapter Cable (LDI as DCE)
[1]

DB-15 Pin # (LDI)	IGX Name	DB-25 Pin # (User)	Description
1	Shield	1	Frame Ground
2	TxD	2	Transmit Data from DTE
3	CTS	5	Clear to Send
4	RxD	3	Receive Data to DTE
5	RTS	4	Request to Send
6	RxC	17	Receive Clock, connects to DB25-15[2]
7	XTC	24	External Transmit Clock
8	SG	7	Signal Ground
9	DSR	6	Data Set Ready
10	DTR	20	Data Terminal Ready
11	+VS	9	+12V test voltage [3]
12	–VS	10	–12V test voltage [3]
13	not connected	not connected	not used
14	DCD	8	Data Carrier Detect (RLSD)
15	MOD	n.c.	Mode Select, no connection for DCE cable
not connected [2]	TxC	15	Transmit Clock, connects to DB25-17 [2]

1. You can order this cable in lengths of 10 ft., 25 ft., 50 ft., 75 ft., and 100 ft. The Cisco model number is CAB-5625-xx, where xx is the length, as follows: 10=10 ft.; 25=25 ft.; 50=50 ft.; 75=75 ft., and 00=100 ft.
2. Pins 15 and 17 connect through a jumper.
3. You can use one of these pins to force a control pin to stay high or low.

FRI V.35 Port Pin Assignments

Table C-23 contains a listing of IGX V.35 pin assignments for the Frame Relay FRI card. A standard V.35 cable is used for this application.

Table C-23   FRI V.35 Port Pin Assignments

Pin #	Name	Source	Description
A	Gnd.	both	Protective (Shield) ground
B	Sig. Gnd.	both	Signal ground
C	RTS	DTE	Request to Send
D	CTS	DCE	Clear to Send
E	DSR	DCE	Data Set Ready
F	DCD	DCE	Data Carrier Detect
H	DTR	DTE	Data Terminal Ready
L	LLB	DTE	Local Loopback command to user device
N	RLB	DTE	Remote Loopback command to user device
n	TM	DTE	Test Mode indicates user device. ready for test
P/S	TxD	DTE	Transmit Data from DTE
R/T	RxD	DCE	Receive Data to DTE
U/W	XTC	DTE	External Transmitter Clock
V/X	RxC	DCE	Receiver Clock
Y/a	TxC	DCE	Transmitter Clock

UFM Cabling

Table C-24 lists the cables that can connect to the UFM back cards for synchronous and asynchronous circuits.

Table C-24   UFM Data Cables

Cable Parameter	Description
Cable Type:	Standard V.35 or X.21.
Cable Connectors:	X.21 DTE: DB-60, male. (provides two X.21 ports) X.21 DCE: DB-60, male. (provides two X.21 ports) V.35 DTE: DB-60, male. (provides two V.35 ports) V.35 DCE: DB-60, male. (provides two V.35 ports HSSI: DB-50, Male
Maximum Cable Length:	Not to exceed interface standards.

UFI X.21 and V.35 DTE Port Pin Assignments

Table C-25 lists the UFI X.21 and V.35 DTE pin assignments at the DB-60 connector on the card.

Table C-25   UFI X.21 and V.35 DTE Port Pin Assignments

Pin #	Name	Source	Direction	Description
7/14	SG	Both	—	Signal Ground
9/22	RxC	DCE	Input	Receive Clock
5/18	TxC	DCE	Input	Transmit Clock
3/16	RxD	DCE	Input	Receive Data
2/15	TxD	DTE	Output	Transmit Data
6/19	XTC	DTE	Output	External Transmit Clock
4/17	DTR	DTE	Output	Data Terminal Ready
10/23	DSR	DCE	Input	Data Set Ready
11	RTS	DTE	Output	Request To Send
24	CTS	DCE	Input	Clear To Send
12	LLB	DTE	Output	Local Loopback Command
13	RLB	DTE	Output	Remote Loopback
26	TM	DTE	Output	Test Mode
20	SG	Both	—	Signal Ground
25	DCD	DCE	Input	Data Carrier Detect
1	—	DCE	Input	Port in DCE Mode

UFI X.21 and V.35 DCE Port Pin Assignments

Table C-26 lists the UFI X.21 and V.35 DCE pin assignments at the DB-60 connector on the card.

Table C-26   UFI X.21 and V.35 DCE port Pin Assignments

Pin #	Name	Source	Direction	Description
7/14	SG	Both	—	Signal Ground
8/21	RxC	DCE	Output	Receive Clock
6/19	TxC	DCE	Output	Transmit Clock
3/16	TxD	DTE	Input	Transmit Data
2/15	RxD	DCE	Output	Receive Data
9/22	XTC	DTE	Input	External Transmit Clock
4/17	DSR	DCE	Output	Data Set Ready
10/23	DTR	DTE	Input	Data Terminal Ready
11	CTS	DCE	Output	Clear To Send
24	RTS	DTE	Input	Request To Send
25	LLB	DTE	Input	Local Loopback Command
26	RLB	DTE	Input	Remote Loopback
13	TM	DTE	Output	Test Mode
20	SG	Both	—	Signal Ground
12	DCD	DCE	Output	Data Carrier Detect
1	—	DTE	Input	Port in DTE Mode

UFI HSSI Port Pin Assignments

Table C-27 lists the UFI HSSI pin assignments at the DB-50 connector on the card.

Table C-27   UFI HSSI Pin Assignments

Pin #	Name	Source	Direction	Description
1/26	SG	Both	—	Signal Ground
2/27	RT	DCE	Output	Receive Timing
3/28	CA	DCE	Output	DCE Available
4/29	RD	DCE	Output	Receive Data
5/30	LC	DTE	Output	DCE loop Request
6/31	ST	DCE	Output	Send Timing
7/32	SG	Both	—	Signal Ground
8/33	TA	DTE	Input	DTE Available
9/34	TT	DCE	Input	Terminal Timing
10/35	LA	DTE	Input	Loopback Circuit A
11/36	SD	DTE	Input	Send Data
12/37	LB	DTE	Input	Loopback Circuit B

Table C-27   UFI HSSI Pin Assignments (Continued)

Pin #	Name	Source	Direction	Description
13/38	SG	Both	—	Signal Ground
14/39	DT	DTE	Input	Send Timing in DTE
15 to 18	—	DCE	Output	Undefined: to DCE
19/44	SG	Both	—	Signal Ground
20 to 23	—	DTE	Input	Undefined: from DCE
24/49	TM	DTE	Output	Test Mode
25/50	SG	Both	—	Signal Ground

V.35 DCE Female Cable Pin Assignments

Table C-28 lists the V.35 DCE female cable pin assignments.

Table C-28   UFM V.35 DCE Female Cable Pin Assignments

Signal	Pin No. (from J3)	Wire	Pin No. (to J1)	Signal
Signal ground	55/56	Shorting group		Signal ground
Signal ground	50/51	Shorting group		Signal ground
Shield ground	46	Shield	A	Shield ground
v11-TXD	17/18	Twisted Pair #1	T/R	RD
v11-TXCOUT	19/20	Twisted Pair #2	AA/Y	SCT
v11-RXCOUT	21/22	Twisted Pair #3	X/V	SCR
v11-RXCIN	25/26	Twisted Pair #4	W/U	SCTE
v11-RXD	27/28	Twisted Pair #5	S/P	SD
v28-DSR/v28-CTS	34/35	Twisted Pair #6	H/C	DTR/RTS
v28-RTS/v28-DTR	42/43	Twisted Pair #7	D/E	CTS/DSR
v28-LL-DCD/Not used	44/16	Twisted Pair #8	F/B	RLSD/—
v28-DCD-LL/Not used	33/16	Twisted Pair #9	K/B	LT/Not used
Shield ground	45	Shield	A	Shield ground
v11-TXD	3/4	Twisted Pair #1	T/R	RD
v11-TXCOUT	5/6	Twisted Pair #2	AA/Y	SCT
v11-RXCOUT	7/8	Twisted Pair #3	X/V	SCR
v11-RXCIN	29/30	Twisted Pair #4	W/U	SCTE
v11-RXD	31/32	Twisted Pair #5	S/P	SD
v28-DSR/v28-CTS	38/36	Twisted Pair #6	H/C	DTR/RTS
v28-RTS/v28-DTR	40/41	Twisted Pair #7	D/E	CTS/DSR
v28-LL-DCD/Not used	39/15	Twisted Pair #8	F/B	RLSD/—
v28-DCD-LL/Not used	37/15	Twisted Pair #9	K/B	LT/Not used

Note   The CAB-2-V.35 DCE '1' Winchester connector corresponds to an odd UFM-U port and the CAB-2-V.35 DCE '2' Winchester connector corresponds to an even UFM-Uport.

V.35 DTE Male Cable Pin Assignments

Table C-29 lists the V.35 DTE male cable pin assignments.

Table C-29   UFM V.35 DTE Male Cable Pin Assignments

Signal	Pin No. (from J3)	Wire	Pin No. (to J1)	Signal
p2_mode_0/Ground/p2_mode_DCE	55/56/54	Shorting group		
p1_mode_0/Ground/p1_mode_DCE	50/51/52	Shorting group		
Shield ground	46	Shield	A	Shield ground
v11-TXD	17/18	Twisted Pair #1	S/P	SD
v11-TXCOUT	19/20	Twisted Pair #2	W/U	SCTE
v11-TXCIN	23/24	Twisted Pair #3	AA/Y	SCT
v11-RXCIN	25/26	Twisted Pair #4	X/V	SCR
v11-RXD	27/28	Twisted Pair #5	T/R	RD
v28-DSR/v28-CTS	34/35	Twisted Pair #6	E/D	DSR/CTS
v28-RTS/v28-DTR	42/43	Twisted Pair #7	C/H	RTS/DTR
v28-LL-DCD/Not used	44/16	Twisted Pair #8	K/B	LT/—
v28-DCD-LL/Not used	33/16	Twisted Pair #9	F/B	RLSD/Not used
Shield ground	45	Shield	A	Shield ground
v11-TXD	3/4	Twisted Pair #1	S/P	SD
v11-TXCOUT	5/6	Twisted Pair #2	W/U	SCTE
v11-TXCIN	13/14	Twisted Pair #3	AA/Y	SCT
v11-TXCIN/v11-RXCIN	29/30	Twisted Pair #4	X/V	SCR
v11-RXD	31/32	Twisted Pair #5	T/R	RD
v28-DSR/v28-CTS	38/36	Twisted Pair #6	E/D	DSR/CTS
v28-RTS/v28-DTR	42/43	Twisted Pair #7	C/H	RTS/DTR
v28-LL-DCD/Not used	39/15	Twisted Pair #8	K/B	LT/—
v28-DCD-LL/Not used	37/15	Twisted Pair #9	F/B	RLSD/Not used

Note   The CAB-2-V.35 DTE '1' Winchester connector corresponds to an odd UFM-U port and the CAB-2-V.35 DTE '2' Winchester connector corresponds to an even UFM-U port.

Redundancy Cabling

The redundancy cables are a special "Y" cable available from Cisco Systems. They are required for redundant data and trunk interfaces. Table C-30 lists the Y-cables used for redundancy for various IGX back cards.

Table C-30   Redundancy Y-Cables

Cable	Used On	Cisco Part Number
EIA/TIA-232C	SDI	5624
EIA/TIA-232D	SDI	5624
EIA/TIA-232	LDI	5629
V.35	SDI	5635
V.35	SDI	special DTE/DCE jumper
EIA/TIA-422/449	SDI	5644
T1	BC-T1	5607
E1	BC-E1	5685

Power Cabling

This section describes AC and DC power cabling between the IGX and the power source. Source-end connector information is not available for all countries, so local codes must be known or obtained by either the customer or installer.

AC Power Cabling

Piece	Standard
Cable:	Cisco provides a 6-foot (1.8m), 3-conductor cord with an IEC 320 C-19 appliance coupler for mating with the IGX on the system end. The other end of the power cord should be a grounding-type attachment plug as described in the paragraphs that follow.
Connector:	For North America and Japan:For IGX 16/32: NEMA L6-20 Twist Lock
	For IGX 8: NEMA L6-20 Twist Lock or NEMA 5-15
	For Continental Europe:CEE 7/7 (Schuko)
	For Italy:CEI 23-16/VII (16 Amp plug)
	For United Kingdom and Ireland:BS 1363
	For Australia and New Zealand: AS 3112
	For those countries not appearing in the preceding list, use a power cord with an IEC 320 C-19 appliance coupler for the system-end and an appropriate grounding-type attachment plug at the other end in accordance with local standards.

DC Power Cabling

Piece	Standard
Cable:	You provide a 3-conductor cord. The other end of the power cord should be a grounding-type attachment. The wire gauge is 10 to 12 AWG or 4 sq. mm.
Connector:	At the system end, Cisco provides a pluggable wire block with screw-type clamping for the three conductors. The customer or installer attaches the customer supplied wiring to this block.

SCM Cabling

SCM cabling connects the Network Management ports on the SCM to StrataView Plus Network Management computers, control terminals, and modems. This cabling also provides the connection for an external clock source.

Auxiliary and Control Port Cabling

Interface:	The IGX SCM auxiliary and control ports are configured as an EIA/TIA-232 DCE port.
Suggested Cable:	24 AWG, 25-pair. A straight-through EIA/TIA-232 cable is used for a terminal or printer connection. A null modem cable (Figure C-1) is needed when interfacing with modems on either port.
Cable Length:	50 feet (15 m.) max.
Cable Connector:	DB-25, subminiature, male. Table C-31 contains a list of the port pin assignments.

Table C-31   SCM AUX. and CONT. Port Pin Assignments

Pin#	Name	Source	Description
1	FG	both	Frame Ground
2	TxD	DTE	Transmit Data
3	RxD	DCE	Receive Data
4	RTS	DTE	Request to Send
5	CTS	DCE	Clear to Send
6	DSR	DCE	Data Set Ready
7	SG	both	Signal Ground
8	CD	DCE	Carrier Detect
20	DTR	DTE	Data Term Ready

Null Modem Cable

Figure C-1 shows a null modem cable that connects some of the 1200 and 2400 baud modems to the IGX Control and Auxiliary ports.

Figure C-1   Null Modem Cable
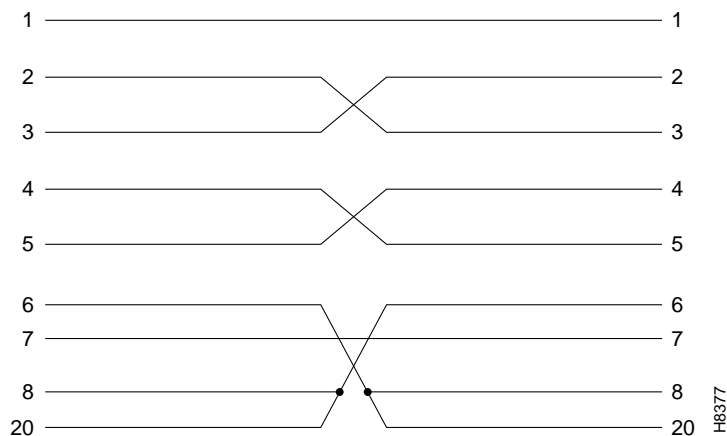
External Clock Input Cabling

This cable is for connecting external clock inputs to the SCM EXT. CLK. connector. There are two separate inputs, A and B, for primary and standby clock sources, either one or both of which may be 1.544 Mbps or 2.048 Mbps rate. SCM automatically selects clock input A or B.

Table C-32   Ext. Clock Cabling Specification

Cable Parameter	Description
Interface:	Balanced RS 422, unterminated
Suggested Cable:	24 AWG, individually shielded, 1 or 2-pair
Cable Connector:	DB-15, subminiature, male. See Table C-33 for pinouts
Max. Cable Length:	50 feet (15 m.)

Table C-33   EXT. CLK. Connector Pin Assignments

Pin #	Description
1	Ext. Clk 1-A
9	Ext. Clk 1-A
2	Shield gnd. pair 1
3	Ext. Clk 2-A
11	Ext. Clk 2-B
4	Shield gnd. pair 1
5	8.192 MHz. test output[1]

1. For factory use only.

External Alarm Cabling

This cable connects network alarm outputs to either the DTI Faceplate or the ARI card Alarm connector only. Table C-34 particulars for the physical interface. Table C-35 lists the pinouts for the network alarm outputs. In Table C-35, note that pins whose names end in "A" are normally open, and pins whose names end in "C" are common.

Table C-34   **External Alarm Interface**

Parameter	Description
Interface:	Dry-contact relay closure.
Wire:	24 AWG, shielded, 10 pairs.
Connector:	DB-37, Subminiature, male

Table C-35   Network Alarm Pin Assignments

Pin#	Name	Description
1	CHASSIS	Chassis Ground
2		Reserved
3	NWMAJA	Network Major Alarm
4	NWMAJC	Network Major Alarm
5		Reserved
6		Reserved
7		Reserved
8		Reserved
9		Reserved
10	MNVISA	Minor Visual Alarm
11		Reserved
12	MNVISC	Minor Visual Alarm
13		Reserved
14		Unused
15		Unused
16	MJAUDC	Major Audible Alarm
17	MJAUDA	Major Audible Alarm
18		Unused
19		Unused
20		Reserved
21		Reserved
22		Reserved
23	NWMINA	Network Minor Alarm
24		Reserved
25	NWMINC	Network Minor Alarm
26		Reserved
27		Reserved
28		Reserved
29	MNAUDA	Minor Audible Alarm
30		Reserved
31	MNAUDC	Minor Audible Alarm
32		Unused
33		Unused
34		Unused
35	MJVISC	Major Visual Alarm
36	MJVISA	Major Visual Alarm
37		Unused

Standard IGX Cables

Table C-36 lists the cables that you can order directly from Cisco Systems. Cable lengths are specified as a suffix to the IGX model number. For example 5610-50 indicates a 50 foot cable. Cables are generally available in standard lengths of 10 ft (3 m.), 25 ft (7.6 m.), 50 ft (15 m.), 75 ft (22.8 m.) and 100 ft (30 m.) Lengths of 101 ft. (30 m.) to 600 ft. (183 m.) are available on a special order.

Where applicable, Table C-36 indicates the connector gender (male-female) as well as the number of pins. For example T1/M15-M15 indicates a cable terminated with a male DB15 at both ends.

Table C-36   Standard IGX Cables Available from Cisco

Model Number	Description	Usage
5605	T1, 12 pair, pigtail-pigtail	T1 trunk, general
5608	T1, pigtail to RJ48	CSU to telco demarc
5618	T1, F15 to RJ48	CSU to telco demarc
5619	T1, RJ48 to RJ48	CSU to telco demarc
5609	T1, 2 pair, pigtail-pigtail, Teflon	CSU to DSX; for fire resistance code
5610	T1, 2 pair, pigtail-pigtail	CSU to DSX, echo canceller to chan. bank
5611	T1/M15-pigtail	T1 trunk to CSU, DSX; external echo canceller to PBX, chan. bank.
5612	T1, F15 sliplock-pigtail	same as 5611
5613	T1/F15-pigtail	same as 5611
5614	T1/M15-M15 turnover	E1 trunk to CSU
5615	T1/M15-M15 sliplock	same as 5611
5616	T1/M15-M15	same as 5611
5617	T1/F15 sliplock-RJ48	same as 5610
5618	T1/F15-RJ48	
5619	T1/RJ48-RJ48	CSU to connectorized patch panel
5680	BNC-DB15	E1 trunk
5685	T1/M15-M15 turnover, Y-cable	E1 trunk redundancy
5630	V.35/M34-F34	Subrate trunk or data circuit
5633	V.35/M34-M34	Subrate trunk or data circuit
5636	V.35 Y-cable	Subrate trunk or data circuit redundancy
5640	EIA/TIA-422/M37-F-37	Subrate trunk or data circuit
5643	EIA/TIA-422/M37-M-37	Subrate trunk or data circuit
5645	EIA/TIA-422/X.21 adapter-DTE	IGX is DTE
5646	EIA/TIA-422/X.21 adapter-DCE	IGX is DCE
5644	EIA/TIA-422 Y-cable	Subrate trunk or data circuit redundancy
5690	X.21/V.11 DTE-M to DCE-M	Subrate trunk or data circuit
5691	X.21/V.11 DTE-M to DCE-F	Subrate trunk or data circuit
5695	X.21/DB15 Y-cable	Subrate trunk or data circuit redundancy

Table C-36   Standard IGX Cables Available from Cisco (Continued)

Model Number	Description	Usage
5620	EIA/TIA-232/M25-F25	Control port to control terminal, StrataView Plus, or external window device
5621	EIA/TIA-232/M25-M25 special	Control or Aux. port to modem
5622	EIA/TIA-232/M25-M25 special	Aux. port to Okidata 184 printer
5623	EIA/TIA-232/M25-M25	Aux. port to ext. window device
5625	V.35/M15-F25	LDI8 (DCE) to data device
5626E	V.35/M15-M25	LDI8 (DTE) to data device
5628	V.35/M15-F25 adapter	LDI8 (DCE) to data device
5627	V.35/M15-F25 adapter	LDI8 (DTE) to data device
5629	EIA/TIA 232/M15-M15, Y-cable	LDI redundancy
5651	F50 Amphenol-M50 Amphenol	VF, chan. bank to P66 block
5660	Punch-down block w/F50 Amphenol	VF termination
5601	Ground cable	DC
5670	Molex-pigtail	DC
5671	Spade lug-pigtail	DC

Note Most cables listed as T1 can also be used for E1 service.

TTC JJ-20 (J1) Cabling

Table C-37   Japanese J1 Cabling

Cable Parameter	Description
Cable Type:	110 ohm twisted pair for balanced operation. Two cable pairs (1 transmit, 1 receive) per TTC line.
Cable Connection:	Male DB15 for balanced connection. See Table C-36 for pinouts.
Max. Cable Length:	The loss in the cable determines maximum cable length. The maximum permissible loss is 13 dB.

Table C-38   TTC Connector Pin Assignments (Balanced)

Pin #	Description
2	Send Tip S(T)
9	Send Ring S(R)
4	Receive Tip R(T)
11	Receive Ring R(R)

(Continued)

Pin #	Description
1	Ground

"Y" (Y1) Trunk Cabling

Table C-39   Japanese Y1 Cabling

Pin #	Description
Cable Type:	110 ohm twisted pair, balanced operation. Two cable pairs (1 transmit, 1 receive) per Y1 line.
Cable Connection:	Male DB15. See Table C-38 for pinouts.
Max. Cable Length:	Maximum cable length is determined by Vp-p (Voltage peak-to-peak). The maximum permissible value is 1 Vp-p.

Table C-40   "Y" Trunk Connector Pin Assignments (Balanced)

Pin #	Description
2	Transmit Tip T(A)
9	Transmit Ring T(B)
4	Receive Tip R(A)
11	Receive Ring R(B)
1	Shield

Note   Transmit direction is towards the "Y" trunk.

Cisco Cabinet Dimensions

This appendix illustrates the space requirements for various system configurations in the Cisco cabinet and a typical cable management setup. It also contains a table with the height of Cisco WAN switching components in inches, centimeters, and rack-mount units (RMUs). This can help in the calculation of height requirements for individual system configurations. The last illustration shows the bracket installation in the Cisco cabinet (for a BPX 8620 node, in this case). The illustrated components are the:

- BPX 8620

- IGX 8410, 8420, and 8430 switches

- Cisco MGX 8220 edge concentrator

The sequence of illustrations in this chapter is as follows:

- Cisco Cabinet

- Cable Management

- Examples of System Configurations

- Table of Component Heights

Figure D-1   Back View of Cisco Cabinet

Frame
bonding
connection

Frame
bonding
connection

H8215
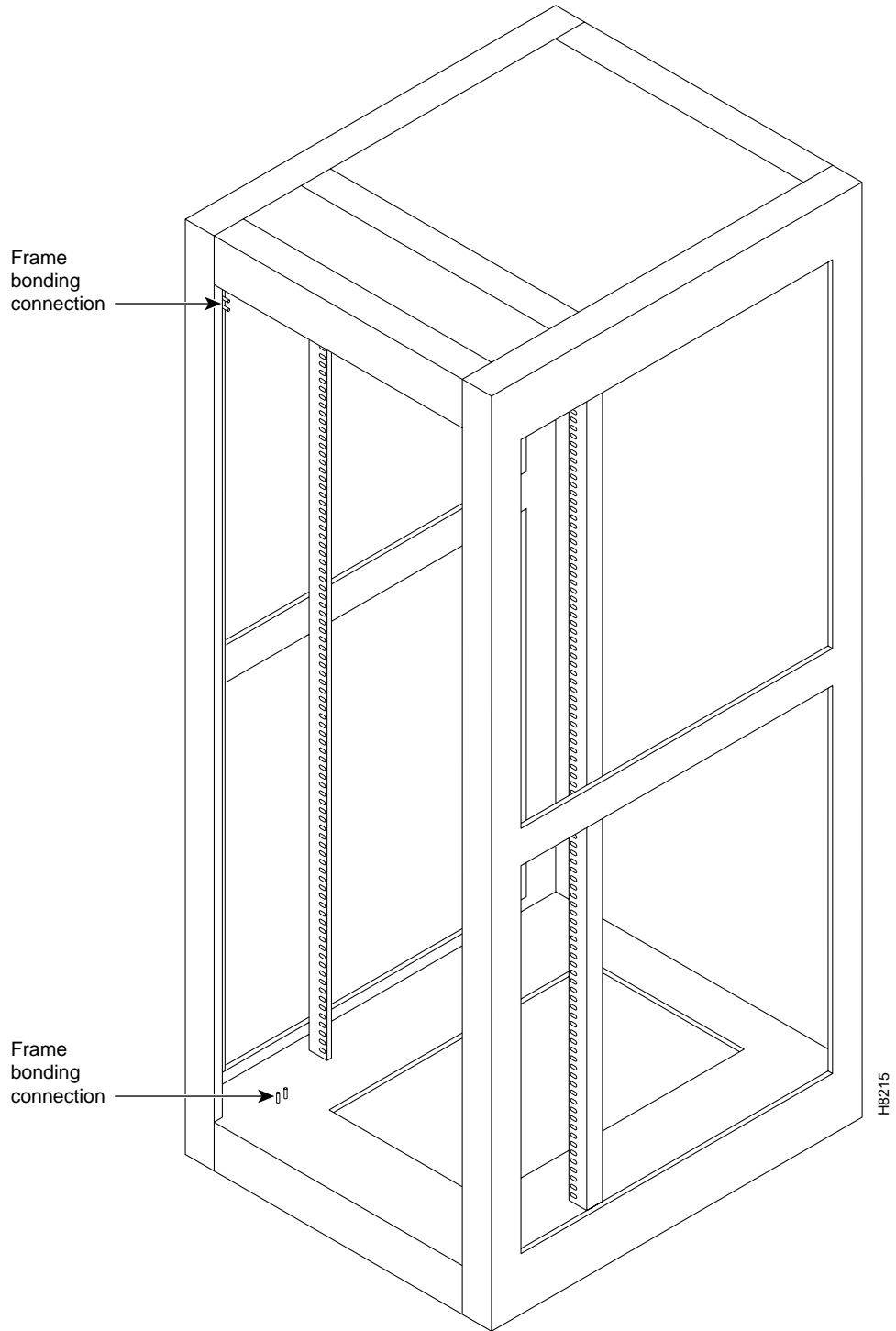
Figure D-2   Cable Management

Cable manager

Cable manager

Frame bonding connection
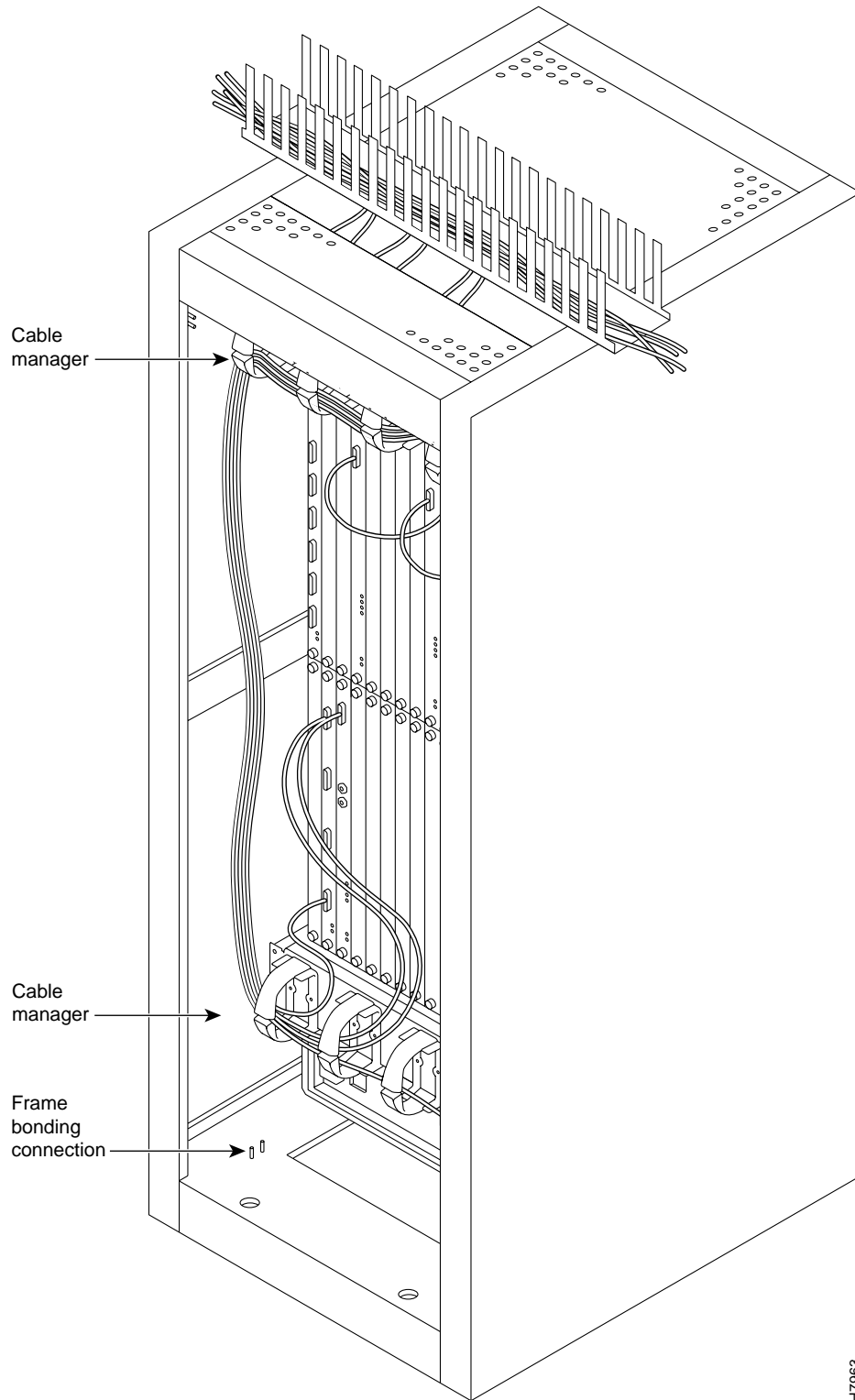
H7963

Figure D-3   IGX 8430 Switch, AC and DC-Powered

DC-powered
IGX 8430 switch

AC-powered
IGX 8430 switch
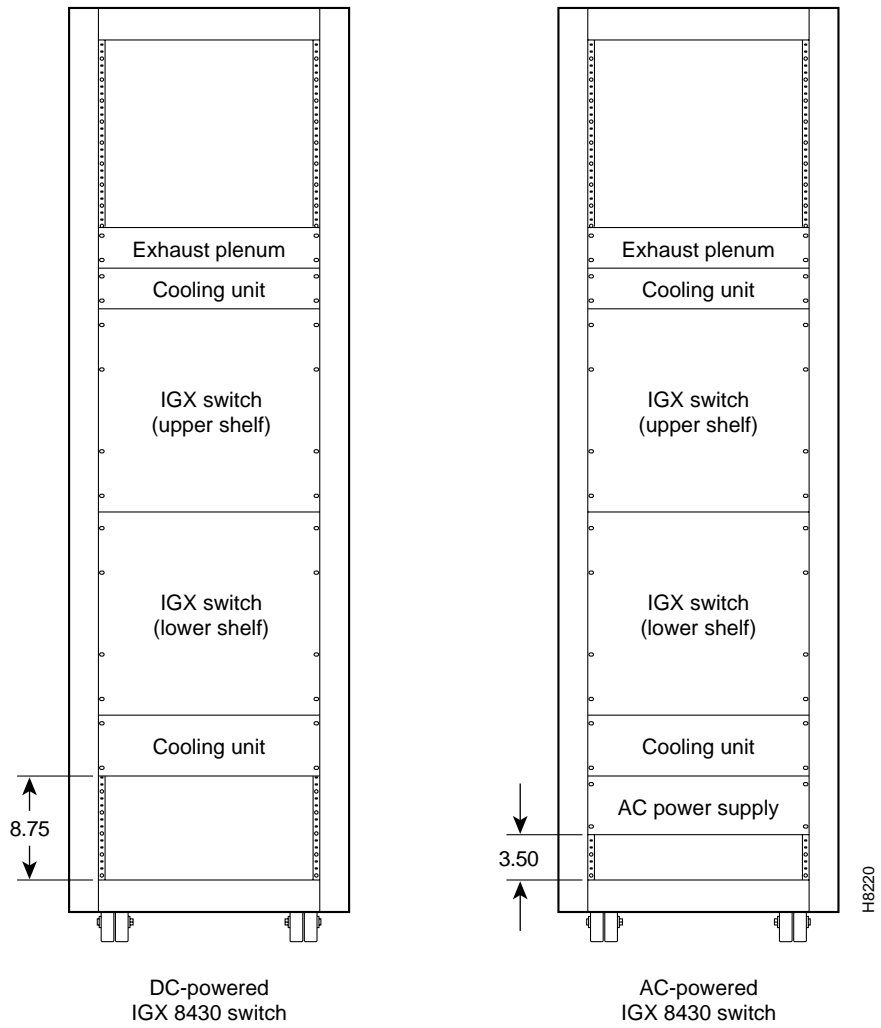
Figure D-4   IGX 8420 Swtch, DC-Powered and AC-Powered

Exhaust plenum

IGX switch

Cooling unit

8.75

DC-powered
IGX 8420 switch

Exhaust plenum

IGX switch

Cooling unit

AC power supply

8.75

H8364

AC-powered
IGX 8420 switch
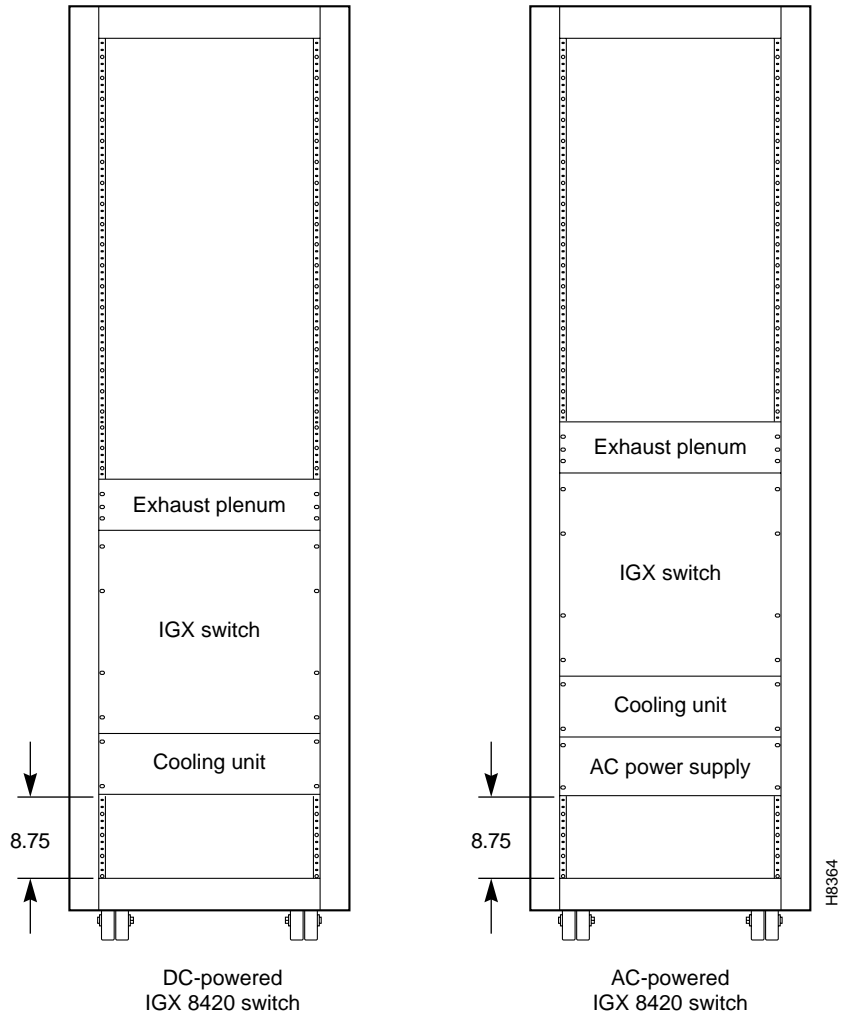
Figure D-5   IGX 8410 Switch, AC or DC-Powered

IGX 8410 switch

8.75

H8365
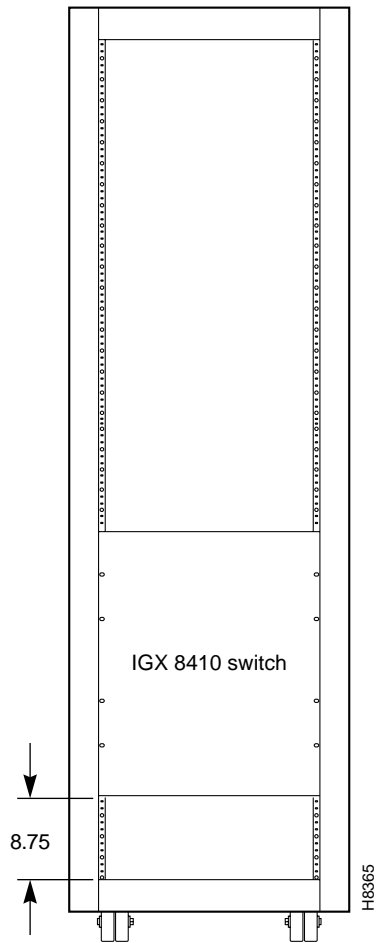
AC or DC-powered
IGX 8410 switch

Figure D-6   Single BPX Switch, AC and DC-Powered

BPX 8620 switch

8.75

DC-powered BPX 8620 node

BPX 8620 switch

AC power supply

3.50

AC-powered BPX 8620 node

H8217
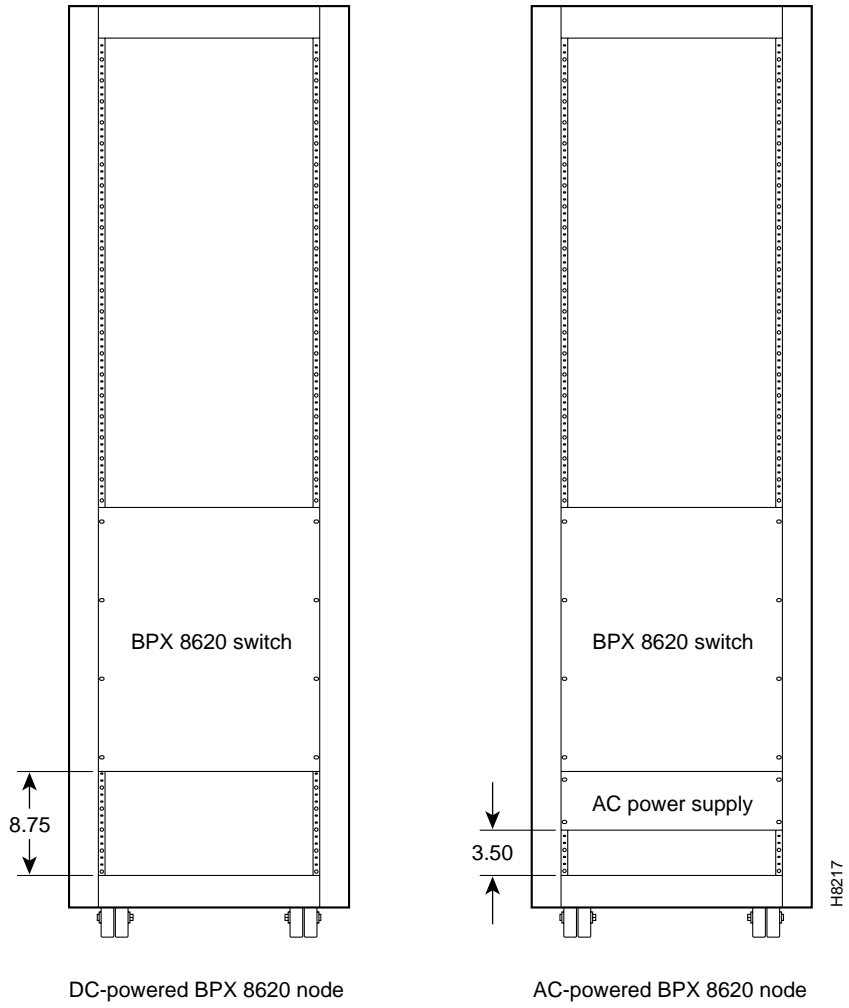
Figure D-7   Single BPX Node and MGX 8220 Edge Concentrator, AC and DC-Powered

Exhaust plenum

MGX 8220

Cooling unit

BPX 8620 switch

8.75

DC-powered BPX 8620
and MGX 8220 units

Exhaust plenum

MGX 8220

Cooling unit

AC power supply

BPX 8620 switch

AC power supply

3.50

H8218

AC-powered BPX 8620
and MGX 8220 units
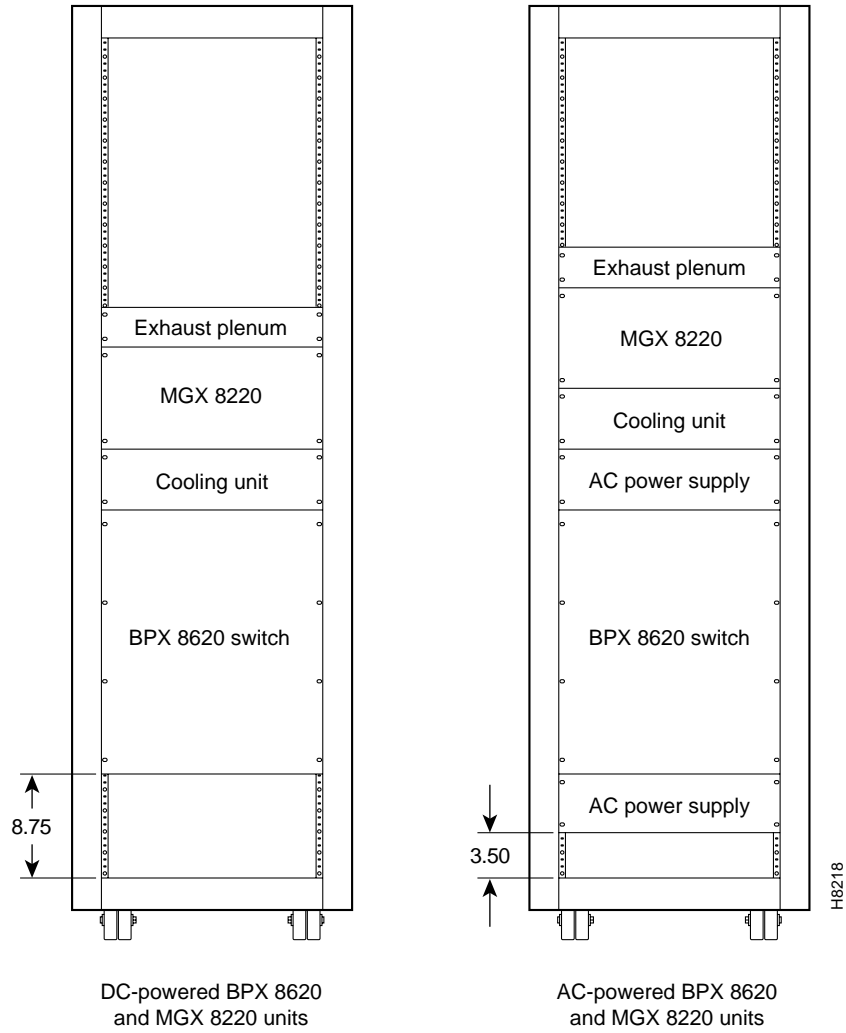
Figure D-8   BPX Node, MGX 8220 Edge Concentrator, and ESP, AC and DC-Powered

WAN service node
BPX 8620/MGX 8220/ESP
DC power

WAN service node
BPX 8620/MGX 8220/ESP
AC power
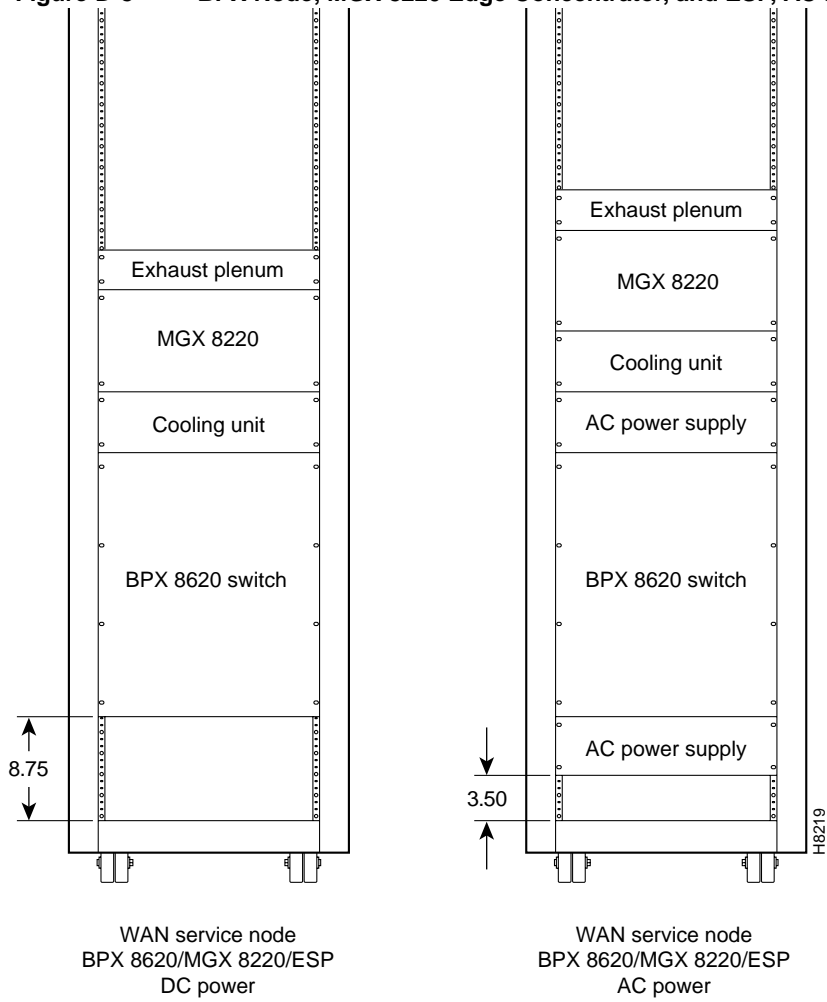
Figure D-9   BPX Node With 2 ESP Systems and 3 MGX 8220 Shelves, DC-Powered

Exhaust plenum

MGX 8220

MGX 8220 booster

MGX 8220

MGX 8220

Cooling unit

ESP

ESP

BPX 8620

H8221
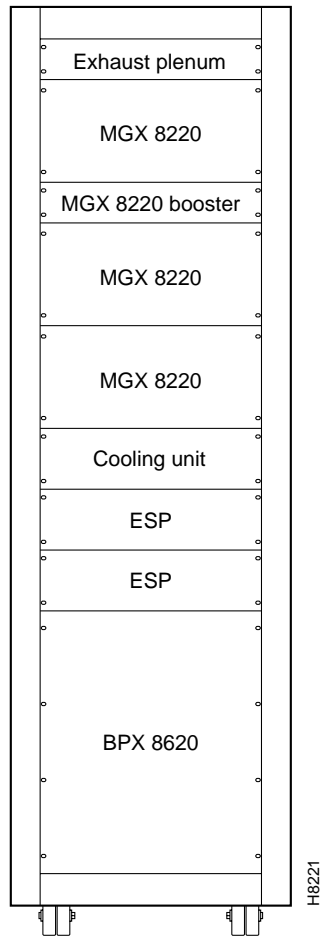
WAN Service Node
BPX 8620/MGX 8220/ESP
DC power

Figure D-10   Six MGX 8220 Edge Concentrators, DC-Powered
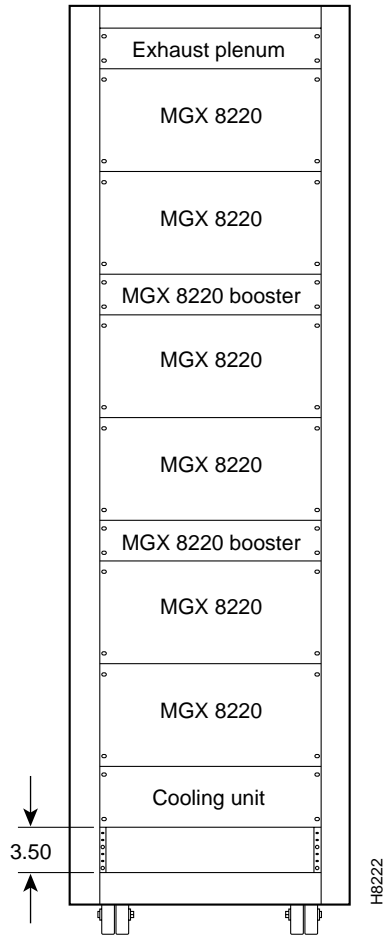
Six MGX 8220 edge concentrators

Figure D-11   BPX Node With Three MGX 8220 Edge Concentrators, DC-Powered

Exhaust plenum

MGX 8220
Concentrator

MGX 8220 booster

MGX 8220
Concentrator

MGX 8220
Concentrator

Cooling unit

BPX 8620 switch

3.50

H8223

One BPX 8620 and
three MGX 8220 units
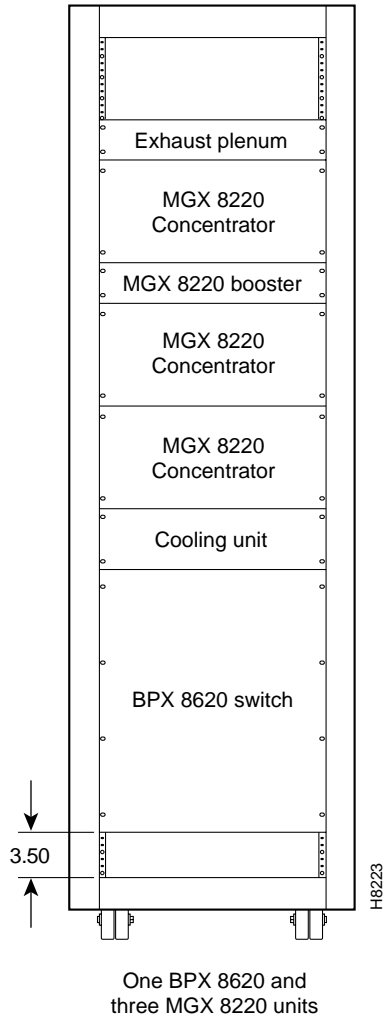
Table D-1   Table of Cisco Cabinet and Component Heights

Components	Unit Height		
	Inches	**CM**	**RMUs**
MGX 8220 Card Cage	8.75	22.225	5
MGX 8220 AC Power Supply shelf	5.25	13.335	3
MGX 8220 Booster Fan Assembly	3.5	8.89	2
MGX 8220 Cooling Assembly	5.25	13.335	3
MGX 8220 Exhaust Plenum	3.5	8.89	2
BPX AC Power Supply shelf	5.25	13.335	3
BPX Card Cage	22.75	57.785	13
IGX AC Power Supply shelf	5.25	13.335	3
IGX Booster Fan Assembly	3.5	8.89	2
IGX Card Cage	17.5	44.45	10
IGX Cooling Assembly	5.25	13.335	3
IGX Exhaust Plenum	3.5	8.89	2
IGX Node	24.5	62.23	14
VNS	5.25	13.335	3
Cabinet	Unit Height		
	Inches	**CM**	**RMUs**
Cisco Cabinet	71.75	1822.45	41
Other Cabinets	75.25	1911.35	43

Note   The depth of the Cisco-supplied cabinet is 36 inches, the width is 23 inches, and the weight (empty of equipment with side panels installed) is 233 pounds.

Figure D-12   Mounting Brackets (BPX Example)

BPX shelf

Rear rail

Bottom of
support bracket
is mounted even
with bottom of
BPX shelf

Additional
bracket for
AC power
supply

Front
rail

19.86 Ref

H8205

Y

Z