



Doc. No. 78-0946-08

# Installing and Upgrading the CSC-C2FCIT FDDI Card and Appliques

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## **Product Numbers:**

**CSC-C2FCIT=**

**APP-LMM=**

**APP-LMS=**

**APP-LSM=**

**APP-LSS=**

**MC-C2FCIT-V10.3=**

This publication provides instructions for installing the Fiber Distributed Data Interface (FDDI) modules in the AGS+ router. These modules include the FDDI interface card with translational bridging (CSC-C2FCIT) and the four available fiber-optic transceiver appliques, which provide single-mode and/or multimode network interfaces. The C2FCIT card operates with the second-generation ciscoBus card (CSC-CCTL2).

This publication also includes instructions for upgrading the C2FCIT microcode when required.

The sections following are included in this publication:

- FDDI Module Overview, page 2
- Installation Prerequisites, page 7
- Installing Cards and Appliques, page 14
- Testing the Installation, page 23
- Upgrading Microcode, page 28

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**Note** The procedures in the section “Testing the Installation” assume that your system has been operating correctly up until the time you performed this installation or upgrade, and that any problems are a result of this procedure.

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If you encounter a new problem and determine that it is not the result of this installation or upgrade, refer to the *AGS+ Hardware Installation and Maintenance* publication for initial system startup troubleshooting procedures, or to the *Troubleshooting Internetworking Systems* publication for additional suggestions for resolving the problem.

## FDDI Module Overview

The FDDI interface modules described in this document include the single-port FDDI communications interface card with translational bridging (CSC-C2FCIT) and the four available fiber-optic transceiver appliques. While incorporating all of the functions of the C2FCI card, the C2FCIT card provides higher speeds than the C2FCI card as well as the following translational bridging capabilities: FDDI to FDDI (transparent), FDDI to Ethernet, and FDDI to Token Ring.

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**Note** Using the translational bridging feature with the C2FCIT card requires Software Release 9.1 (or later) bridging software on the processor card. Both the C2FCIT and CCTL2 cards must have Microcode Version 10.0 or later.

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The C2FCIT card must be installed in an AGS+ router that is running Software Release 9.1 or later and that contains a CSC/3 or CSC/4 processor card. The router must also contain a ciscoBus2 (CSC-CCTL2) card (which is indicated by C2 in the product number).

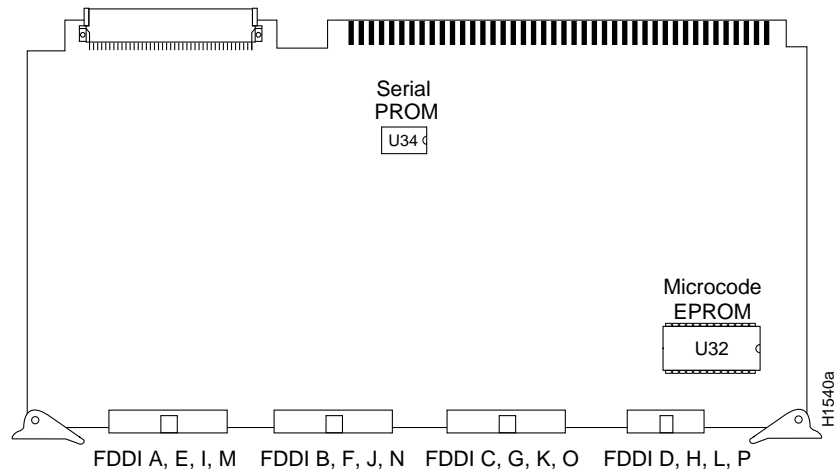
C2FCIT cards can be installed in any of the four available ciscoBus slots in the system card cage. A maximum of four C2FCIT cards is allowed in the AGS+, with one FDDI applique per C2FCIT card. The FDDI appliques are installed in the rear of the chassis in an applique card cage (Product Number MAS-CCG).

## C2FCIT Card

The C2FCIT card (see Figure 1) is one of the two AGS+ FDDI interfaces for both single-mode and multimode network interfaces. (The other FDDI interface card is the CSC-C2FCI.) The C2FCIT card is connected to the ciscoBus and Multibus backplanes in the AGS+ router.

The CCTL2 card is backward compatible with the FCI, HSCI/Ultra, and MEC cards, providing all have Microcode Version 10.0 or later, and the system is running Software Release 9.1 or later. An FCI, HSCI, or MEC card with Microcode Version 10.0 or later will include in its name C2 (C2FCI, C2HSCI/Ultra, and C2MEC), which indicates that the card has Microcode Version 10.0 or later and can be used with the CCTL2 ciscoBus card.

Figure 1 CSC-C2FCIT (FDDI) Card—Component-Side View



## FDDI Connections

The distance limitations for single-mode and multimode FDDI stations are listed in Table 1. Both FDDI modes provide 11 decibels (dB) of optical power.

**Table 1 FDDI Maximum Transmission Distances**

Transceiver Type	Maximum Distance Between Stations
Single-mode	Up to 6.2 mi (10 km)
Multimode	Up to 1.2 mi (2 km)

## FDDI Appliques

The fiber-optic transceivers reside on circuit cards called *appliques* that provide the interface between external network connections and the internal CSC-FCI card. The four applique configurations are shown in Figures 2 through 5; each provides a unique combination of single-mode and/or multimode FDDI interfaces.

Following are the four FDDI applique mode combinations:

- PHY-A multimode, PHY-B multimode (APP-LMM), Figure 2
- PHY-A multimode, PHY-B single mode (APP-LMS), Figure 3
- PHY-A single mode, PHY-B multimode (APP-LSM), Figure 4
- PHY-A single mode, PHY-B single mode (APP-LSS), Figure 5

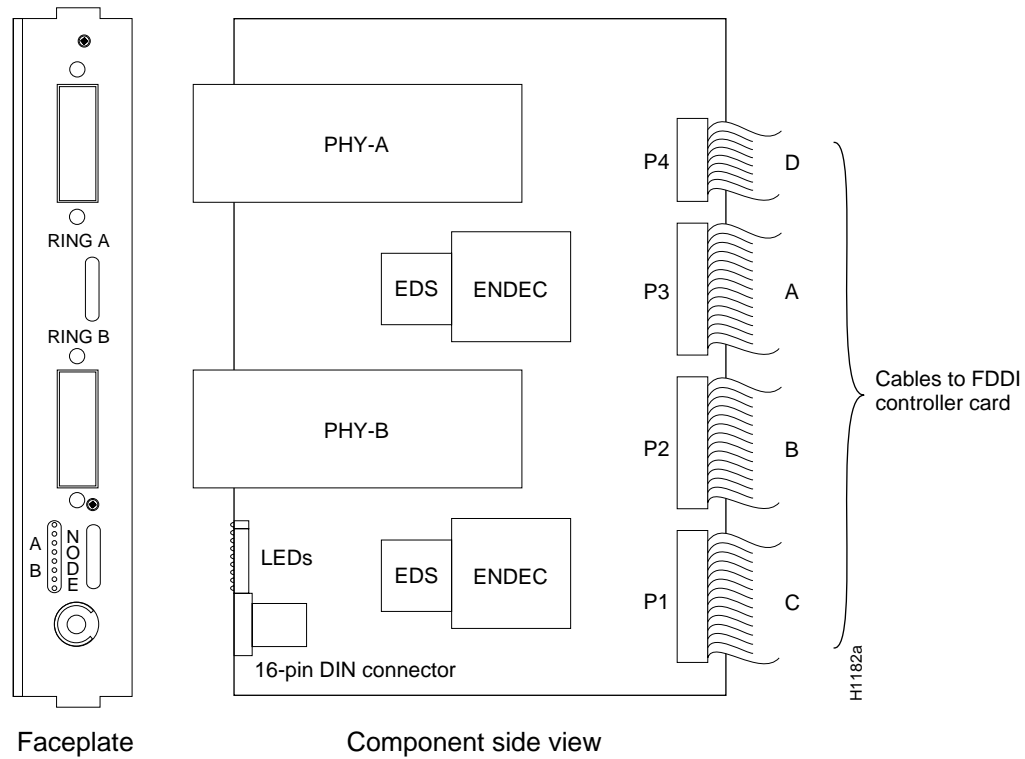
Both the single-mode and multimode transceivers provide a Class A dual attachment interface that can be connected to either a Class A or Class B station. Class A is a dual attachment station (DAS) with primary and secondary rings; Class B is a single attachment station (SAS) with only a primary ring.

The single-mode transceiver provides connectivity to single-mode FDDI fiber for distances up to 6.2 miles (10 kilometers). The connector is a simplex FC-type interface that accepts standard 8.2 to 10/125 micron (0.5) single-mode fiber-optic cable.

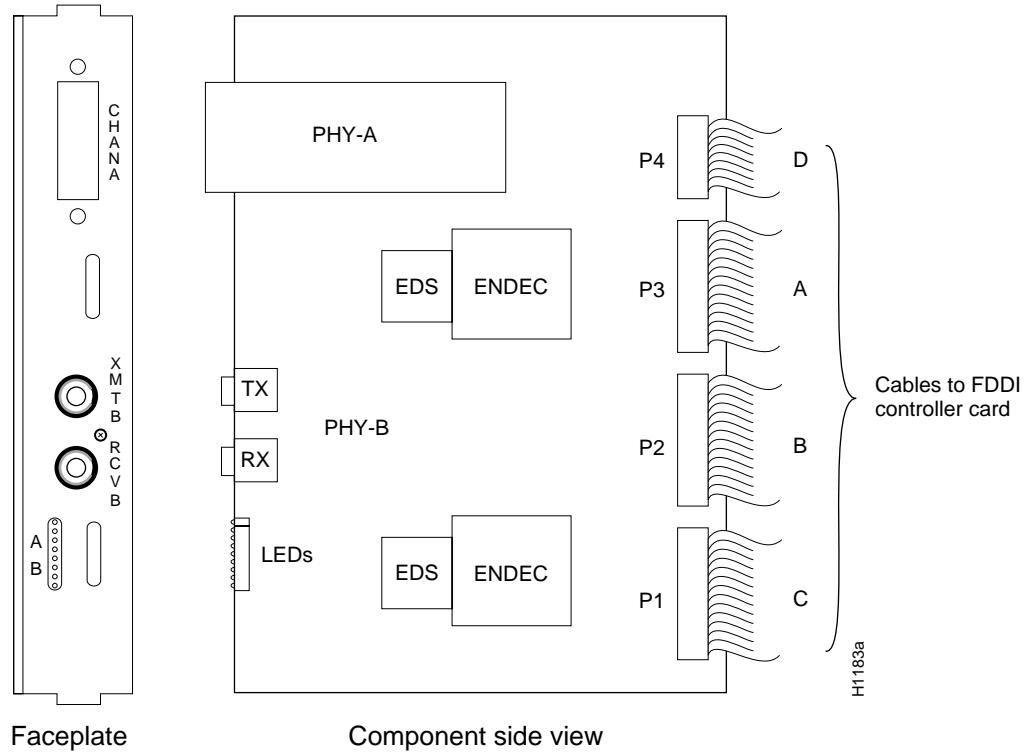
The multimode connectors are FDDI-standard physical (PMD) connectors. The connectors accept FDDI standard 62.5/125 micron multimode fiber-optic cable using the media interface connector (MIC). The MIC can also accept alternate cable sizes, such as 50, 85, or 100-micron multimode fiber. Use care when using alternate fiber sizes, to avoid violating optical power budget restrictions.

The multimode/multimode applique also provides a DIN port for connecting an optional optical bypass switch, which allows the light signal to pass directly from the receive port to the transmit port. When this optical bypass is used, the signal is not repeated, and significant signal loss may occur when transmitting to stations at maximum distances.

**Figure 2 Multimode/Multimode—APP-LMM**



**Figure 3 Multimode/Single Mode—APP-LMS**



**Figure 4 Single Mode/Multimode—APP-LSM**

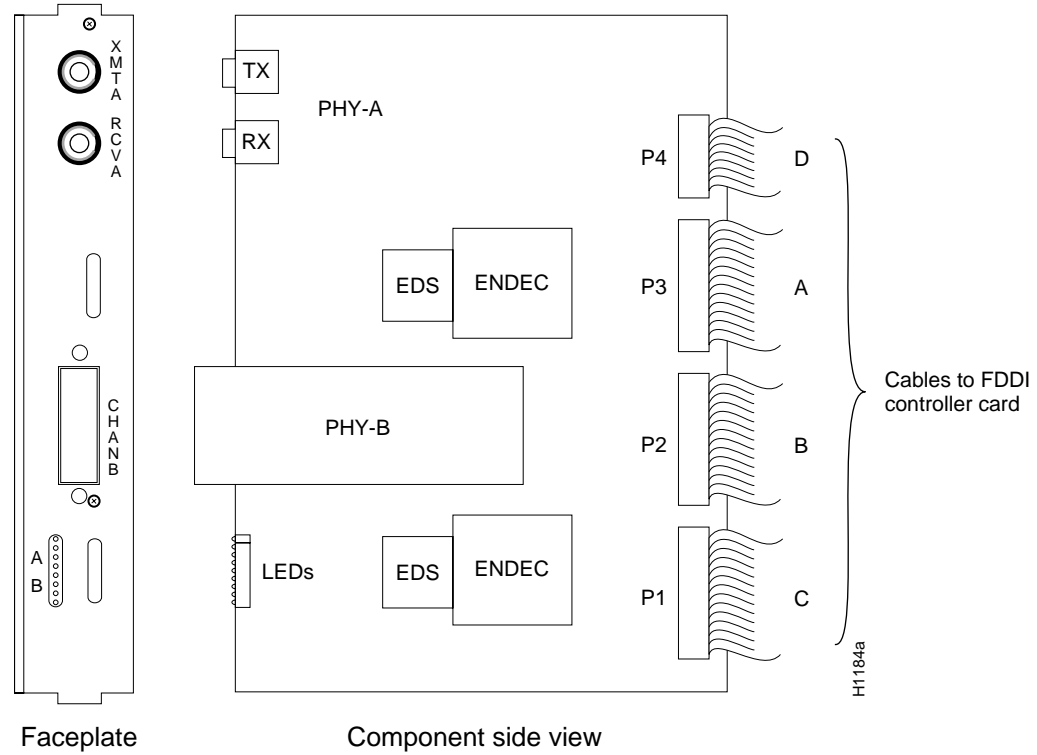
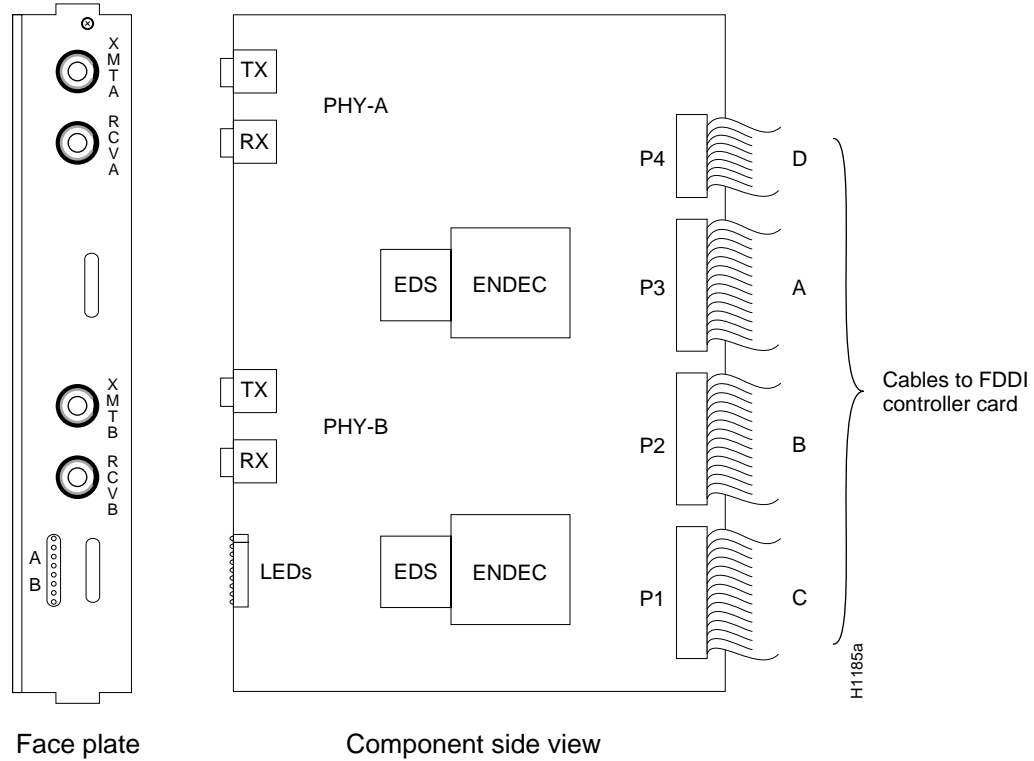


Figure 5 Single Mode/Single Mode—APP-LSS



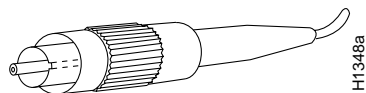
## FDDI Connectors

Following are the connectors typically used with single-mode and multimode FDDI applications.

### Single-mode

Figure 6 shows the fiber-optic network interface cable FC-type connector typically used for single-mode FDDI applications with the APP-LSS, APP-LSM, and APP-LMS FDDI appliques.

Figure 6 Single-Mode FDDI Network and Chassis Connector

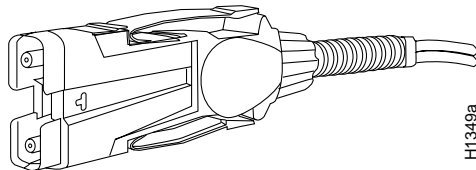


**Warning** Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.* This product meets the Class 1 Laser Emission Requirement from CDRH FDDI.

## Multimode

Figure 7 shows the fiber-optic MIC used for network and chassis connections with the APP-LMM, APP-LMS, and APP-LSM FDDI appliques.

**Figure 7 Multimode MIC for Network and Chassis Connections**



## Installation Prerequisites

Following are safety guidelines, system configuration and compatibility requirements, and lists of the parts and tools required for installation. Before installing any FDDI cards or appliques, review this section to ensure that you can perform the installation or upgrade without interruption.

## Safety

Follow these guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, turn OFF the system power and disconnect the power cord.
- Never assume that power has been disconnected from a circuit; always check.
- Do not work alone when a potentially hazardous condition exists.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded wiring or power cables, and missing safety grounds.

In addition, use the guidelines that follow when working with any equipment that is connected to telephone wiring or other network cabling.

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.



**Warning** Invisible laser radiation may be emitted from the aperture ports of the single-mode appliques when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.* This product meets the Class 1 Laser Emission Requirement from CDRH FDDI.

### System Compatibility

Following are the physical requirements and limitations that you must consider before installing new FDDI components in your system. For example, to obtain optimum performance, you must ensure that the new components are compatible with the existing system configuration and that you place interface cards in the proper card-cage slots.

Your AGS+ must meet the following general compatibility requirements before you install a C2FCIT card and associated appliques:

- Your AGS+ has a CSC/3 (or later) processor card running Software Release 9.1 or later.
- An applique card cage (Product Number MAS-CCG) is installed in the chassis with at least one empty slot available, or you received a new card cage in which the FDDI applique is already installed.
- The currently installed ciscoBus cards meet the rules provided in the section “Slot Priority” on page 9.
- You have a second-generation ciscoBus card (CSC- CCTL2) installed; the first-generation ciscoBus (CCTL) card is *not* compatible with the C2FCIT card.
- Your C2FCIT and CCTL2 cards must have Microcode Version 10.0 or later.
- Use the **show version** command to verify the type of processor card and software release and the **show controller cbus** command to verify the microcode versions.
- Your site must have the appropriate network interface wiring with which you will connect the router to your FDDI ring(s).
- To operate with the CCTL2 card, all other ciscoBus cards in the AGS+ must have Microcode Version 10.0 or later (C2FCI, C2HSCI, and C2MEC, and so forth).
- The power budget of your chassis will not be exceeded by adding more C2FCIT cards. Current draw for the C2FCIT and applique is 6.9A (7.7A with any traffic), and the power dissipation is 36W.
- Microcode upgrades—If you are upgrading to C2FCIT Microcode Version 10.3, your system software must be Software Release 9.1(1) or later. For additional information, refer to the section “Upgrading Microcode” on page 28.

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**Note** If your current system configuration does not meet all of the above requirements, contact a customer service representative for information on hardware and software upgrades.

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### Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) is a discharge of stored static electricity that can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Following are guidelines for preventing ESD damage:

- Before you open a chassis, ensure that power to the unit is turned off, but that the power cord is connected to the wall receptacle. Having the power cord connected will ensure a ground path for any ESD voltages.
- Always use an ESD-preventive wrist strap or ankle strap and ensure that it makes good skin contact.



- Connect the equipment end of the strap to an unpainted surface of the chassis frame or another proper grounding point or surface. We recommend that you attach it to the inside bottom of the chassis, or to the rear panel (inside or outside), without making contact with any connectors or appliques.
- Avoid contact between equipment and clothing. The wrist strap only protects the equipment from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Handle printed circuit cards and appliques by the edges only; avoid touching the components, traces, or any connector pins.
- Place a removed card component-side-up on an antistatic surface or in a static shielding bag. If the component will be returned to the factory, immediately place it in a static shielding bag.
- Do not remove the wrist strap until the installation is complete.

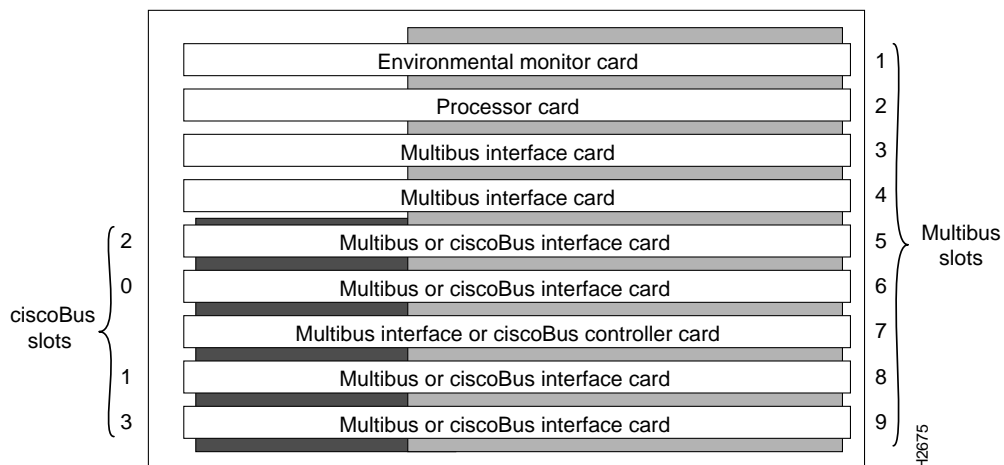


**Caution** For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 mega ohms.

## Slot Priority

The AGS+ card cage, shown in Figure 8, has nine slots, five of which are designated ciscoBus slots. The center ciscoBus slot is reserved for the ciscoBus card, leaving four ciscoBus slots available for ciscoBus interface cards.

**Figure 8 AGS+ Card Cage and Backplanes—Front View**



**Note** The ciscoBus currently supports a maximum of four C2FCIT cards.

The AGS+ uses a slot priority scheme that assigns a priority to each ciscoBus card according to the ciscoBus slot in which the card resides. The card in ciscoBus slot 0 receives the highest ciscoBus priority, while the card in ciscoBus slot 3 receives the lowest ciscoBus priority.

Slot priorities are set to accommodate the amount of traffic generated by each interface card and the amount of card buffering required. Each ciscoBus interface card is placed in a specific slot with regard to other ciscoBus interface cards, if any. The order of priority is the same for both first- and second-generation ciscoBus cards, except that the cards with the designation C2 can only be used with the CSC-CCTL2.

Following is a list of ciscoBus interface cards in order of priority, from highest to lowest:

- 1 CSC-MEC and C2MEC (10 megabits per second [Mbps])
- 2 CSC-C2CTR (16 Mbps)
- 3 CSC-HSCI and C2HSCI with an APP-LHS applique (High-Speed Serial Interface) (45 through 52 Mbps)
- 4 CSC-FCI and C2FCI (100 Mbps)
- 5 CSC-C2FCIT (100 Mbps)
- 6 CSC-HSCI and C2HSCI with an APP-ULA applique (UltraNet interface) (125 Mbps)

Install CSC-MEC or C2MEC cards in the lowest-numbered slots, beginning with slot 0 (which has the highest priority), followed by CSC-C2CTR cards. After all CSC-MEC and CSC-C2CTR cards are installed, install CSC-HSCI and C2HSCI cards with the APP-LHS applique in the lowest-numbered slots available. Follow with the CSC-FCI and C2FCI cards. Next, install CSC-C2FCIT cards. Last, install the CSC-HSCI and C2HSCI cards with the APP-ULA (UltraNet) applique. Always install cards in the lowest-numbered available slot. For example, if you are using only CSC-C2HSCI cards (with APP-ULA), place the first in slot 0, the second in slot 1, and so forth.

Table 2 lists the maximum port and card configurations for all of the ciscoBus cards currently available. Use this table as a guide when installing new ciscoBus cards and reconfiguring your AGS+.

**Table 2 Maximum Port and Card Configurations for ciscoBus Interface Cards**

C2FCIT/(C2)FCI <sup>1</sup>		(C2)MEC		(C2)HSSI		C2CTR	
Ports	(Cards)	Ports	(Cards)	Ports	(Cards)	Ports	(Cards)
0	(0)	24	(4)	0	(0)	0	(0)
1	(1)	18	(3)	0	(0)	0	(0)
0	(0)	18	(3)	1	(1)	0	(0)
0	(0)	18	(3)	0	(0)	4	(1)
2	(2)	12	(2)	0	(0)	0	(0)
1	(1)	12	(2)	1	(1)	0	(0)
1	(1)	12	(2)	0	(0)	4	(1)
0	(0)	12	(2)	2	(2)	0	(0)
0	(0)	12	(2)	1	(1)	4	(1)
0	(0)	12	(2)	0	(0)	8	(2)
1	(1)	6	(1)	0	(0)	6	(2)
0	(0)	6	(1)	1	(1)	6	(2)
3	(3)	6	(1)	0	(0)	0	(0)
0	(0)	6	(1)	3	(3)	0	(0)
2	(2)	6	(1)	1	(1)	0	(0)
2	(2)	6	(1)	0	(0)	4	(1)
0	(0)	6	(1)	2	(2)	4	(1)
1	(1)	6	(1)	1	(1)	4	(1)
1	(1)	6	(1)	2	(2)	0	(0)
3	(3)	0	(0)	0	(0)	2	(1)
2	(2)	0	(0)	1	(1)	2	(1)
1	(1)	0	(0)	2	(2)	2	(1)
0	(0)	0	(0)	3	(3)	2	(1)
4	(4)	0	(0)	0	(0)	0	(0)
3	(3)	0	(0)	1	(1)	0	(0)
2	(2)	0	(0)	2	(2)	0	(0)
1	(1)	0	(0)	3	(3)	0	(0)
0	(0)	0	(0)	4	(4)	0	(0)

1. The designator C2 in parentheses indicates that the card has Microcode Version 10.0 or later installed. The designator C2 not in parentheses indicates that the card ships with Microcode Version 10.0 or later by default.

## Calculating the Chassis Power Budget

In an AGS+ chassis shipped on or after October 1, 1991, the total power drawn by all installed cards must not exceed 300 watts (W) per chassis. In chassis shipped before this date, the total power cannot exceed 260W. (The earlier chassis contained a 5-amp [A] circuit breaker, rather than the 7.5A circuit used in the later chassis configuration.) Table 3 lists the power requirements for each card available for the AGS+.

**Table 3 Interface Card Power Requirements**

<b>Card</b>	<b>Power (Watts)</b>
CSC/3	31
CSC/4	35
CSC-ENVM	10
CSC-MC+	3
CSC-MCI	28 <sup>1</sup>
CSC-SCI	20
CSC-R16M	34
CSC-1R or CSC-2R	30
CSC-CCTL	29
CSC-CCTL2	34
CSC-(C2)FCI	50
CSC-FCIT	36
CSC-(C2)MEC(2, 4, or 6)	22 <sup>1</sup>
CSC-(C2)HSCI	48
CSC-C2CTR with 1 applique (2 ports)	30
CSC-C2CTR with 2 appliques (4 ports)	42

1. Add 4W for each external Ethernet transceiver.

Before installing new cards, check the power requirements of the existing system and the new card(s) to avoid exceeding the power budget. Calculate the power requirements of an existing system by adding the values for each card in the chassis; the sum is the power requirement. Determine the available power budget, subtract that sum from 300W (260W for chassis shipped before 10/1/91); the result is the power budget available for new cards.

The following example shows how to determine if you can add two new CSC-C2FCIT cards to an AGS+ (with all values in watts):

One CSC-ENVM card	$1 \times 10 = 10$
One CSC/4 processor card	$1 \times 35 = 35$
One CSC-CCTL2 card	$1 \times 34 = 34$
Two CSC-C2MEC6 cards	$2 \times 22 = 44$
One CSC-MCI 2E card	$1 \times 28 = 28$
14 Ethernet transceivers	$14 \times 4 = 56$
Power requirement of present system	207
Available power budget	$300 - 207 = 93$
Two CSC-FCIT cards	$2 \times 36 = 72$
New cards within power budget	$72 < 93$

## List of Required Parts and Tools

The following parts are necessary to install each new FDDI interface:

- One CSC-C2FCIT interface card.
- One FDDI applique (APP-LMM, APP-LMS, APP-LSM, or APP-LSS) for each CSC-C2FCIT card.
- Applique card cage (MAS-CCG)—One card cage is required for every two appliques and might already be installed in the AGS+ chassis.
- One ground strap (a short ground strap if the applique will be mounted next to a blank connector plate, or a long ground strap if the applique will be mounted next to another applique that requires a ground strap).
- Media-dependent external FDDI network interface cables (not included)—Two simplex cables for each single-mode interface, one duplex cable for each multimode interface. Refer to the section “FDDI Connectors” on page 6.
- One port address label for each applique (FDDI 0, FDDI 1, and so forth)—This label should be attached to the applique when you receive it.

If you are upgrading the C2FCIT microcode, you also need one or more replacement components. For instructions, proceed to the section “Upgrading Microcode” on page 28.

Verify that you received all the parts for the interfaces you will install. In general, each interface card requires one applique, and every two appliques require one applique card cage. If any parts are missing, contact a customer service representative.

Following are the tools required for installing interface cards and appliques:

- Flat-blade screwdriver (medium if you are removing the AGS+ front access panel for the first time)
- Number 1 Phillips screwdriver
- Chip extractor or IC removal tool (for microcode upgrades only)
- Needlenose pliers (for microcode upgrades only)
- ESD-preventive wrist strap (your own or the one provided with your FDDI component)

### Setup Command Facility

Whenever you install new hardware components, the system automatically invokes the **setup** command facility the first time the system is started. You can use **setup** to configure the new interfaces, or exit from the **setup** command facility and configuring the new interfaces with the **configure EXEC** command.

Before installing new interfaces, be prepared with the information you will need such as the protocols you plan to route on each interface, IP addresses if you will configure the interfaces for IP, and which interfaces, if any, will use bridging.

For detailed descriptions of **setup** and initial configuration procedures, refer to the *Router Products Getting Started Guide* and *Router Products Command Reference* publications. The *Router Products Getting Started Guide* and the *Router Products Configuration and Reference* publications provide detailed descriptions and sample sessions of both the **setup** command and the **configure** command.

### Installing Cards and Appliques

Following are the procedures described in this section:

- “Chassis Access Procedure” on page 14
- “Installing the C2FCIT Card” on page 15
- “Installing the FDDI Applique” on page 16
- “Connecting Internal and External Cables” on page 20

Before proceeding, ensure that your system and equipment meet the requirements listed in the section “Installation Prerequisites” on page 7.

### Chassis Access Procedure

Following is the procedure for accessing the chassis interior.



**Warning** Before accessing the chassis interior, turn off power to the chassis and unplug the power cord because hazardous voltages may exist in or near the power supply. Use extreme caution when working near the power supply.

**Step 1** If you will need to handle any electronic components (cards, and so forth), attach appropriate ESD protection and attach the AC power cord but, to prevent a shock hazard, make certain the chassis power is OFF.

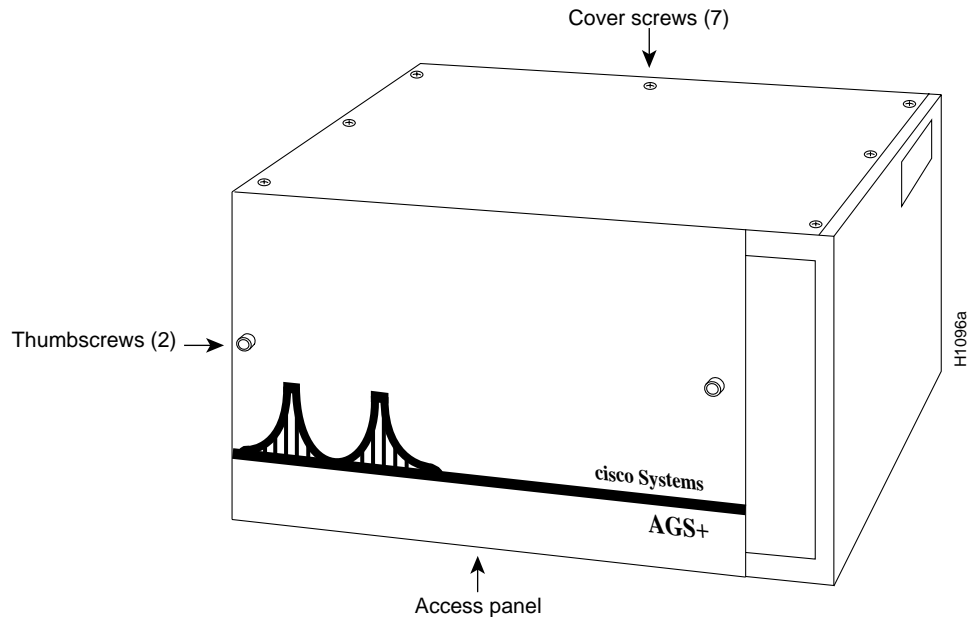
**Step 2** To access cards in the card cage, loosen the two thumbscrews and remove the front panel from the chassis. (See Figure 9.)

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**Note** The front panel is secured with two thumbscrews, which are tightened with 12 in/lb of torque for shipping. If you are removing the front panel for the first time, use the medium flat-blade screwdriver to turn the thumbscrews counterclockwise to loosen them. When you replace the panel, turn the thumbscrews clockwise until they are finger-tight.

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Figure 9 Chassis Front and Top Panels




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**Note** To reassemble the chassis, reverse all steps.

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## Installing the C2FCIT Card

Following is the procedure for installing the C2FCIT card:

**Step 1** Slip on an ESD-preventive wrist strap and connect it to the chassis as described in “Preventing Electrostatic Discharge Damage” on page 8.



**Caution** To avoid possible equipment failure, follow the ESD-prevention procedures described previously.

**Step 2** Grasp the C2FCIT card ejector levers and position the card with the component side up and the bus edge away from you. Handle the card as little as possible, and when you do handle it try to make contact with only the ejector levers and card edges.

**Step 3** Place the bus edge of the C2FCIT card into the predetermined ciscoBus slot in the system card cage. For slot priority guidelines, refer to the section “Slot Priority” on page 9.

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**Note** You will have to use a moderate amount of force to push the card into the slot properly. Before pushing the card into the slot, ensure that the card is aligned with the ciscoBus and Multibus slots and that the chassis is firmly mounted on a stable surface.

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- Step 4** Place your thumbs on the ejector levers and push the card in firmly until it snaps into place and is firmly seated in the slot. The ejector levers close automatically when the card is properly seated.
- Step 5** If you are going to install FDDI appliques immediately, leave the front access panel off and proceed to the following section, “Installing the FDDI Applique.”
- If FDDI appliques are already in place, leave the front access panel off and proceed to the section “Connecting Internal and External Cables” on page 20.

### Installing the FDDI Applique

The FDDI applique is installed in an applique card cage in the rear of the chassis; access to the rear of the chassis requires removing the front panel and top cover of the chassis. (See Figure 9.) The following procedure is required *only* if an FDDI applique is not already installed.



**Warning** Invisible laser radiation may be emitted from the aperture ports of the single-mode applique when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.* This product meets Class 1 Laser Emission Requirement from CDRH FDDI.

### Installing the FDDI Applique in the Applique Card Cage

Following is the procedure for installing the FDDI applique in the applique card cage.

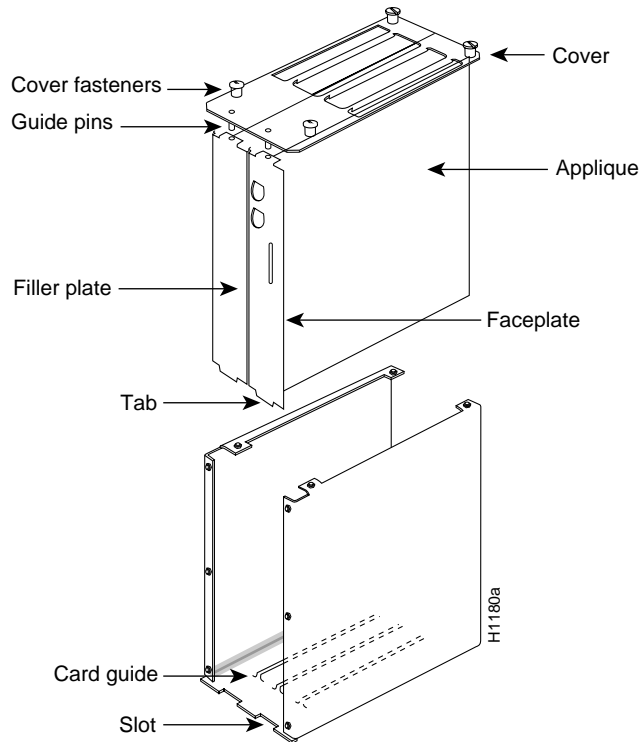
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**Note** Before the FDDI applique is installed in the applique card cage, remove the applique card cage from the chassis to make the installation easier. If you have a card cage assembly that is not installed in the chassis, skip to step 4.

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- Step 1** If the applique card cage is installed in the chassis, disconnect any external connections to the applique it contains.
- Step 2** Remove the card cage from the chassis by removing the six screws that secure it to the rear panel. Carefully lift the card cage up and out of the chassis, using care not to strain any internal ribbon cables that still may be attached to interface cards in the system card cage.
- Step 3** Remove the top cover of the applique card cage by loosening the four cover fasteners that secure it. (See Figure 10.)



**Figure 10 FDDI Appique and Appique Card Cage—Exploded View**

- Step 4** If the card cage is empty, remove both filler plates from the rear. (See Figure 10.) If an appique is currently installed, remove only the filler plate.
- Step 5** If you are installing only one appique in an empty card cage, install the FDDI appique, with its attached faceplate, into the right side of the card cage. (Orient the card cage as in Figure 10 for the following steps.)
- Step 6** Position the appique so the status LEDs are on the bottom. Ensure that the tab on the bottom of the appique faceplate is inserted into the slot in the bottom of the appique card cage and that the appique is seated in the card guide. (See Figure 10.)
- Step 7** For one appique only—If you are installing only one FDDI appique, insert the blank faceplate in the left side of the card cage, sliding it down so that the front edge aligns with the faceplate on the right side of the card cage.
- For two appliques only—If you are installing a second FDDI appique in the card cage, install the appique in the left side of the card cage by sliding it down so that the faceplate aligns with the faceplate of the appique on the right side of the card cage. Insert the appique into the card cage with the status LEDs on the bottom. Ensure that the tab on the bottom of the appique faceplate is inserted into the slot in the bottom of the appique card cage and that the appique is seated in the card guide. (See Figure 10.)
- Step 8** Replace the top cover of the appique card cage. Ensure correct alignment of the cover with the two guide pins on the bottom of the cover. The guide pins should pass through the alignment holes in the tabs on the top of each appique and faceplate assembly. Secure the top cover to the card cage with the four cover fasteners. (See Figure 10.)

### Installing the Applique Card Cage in the Chassis

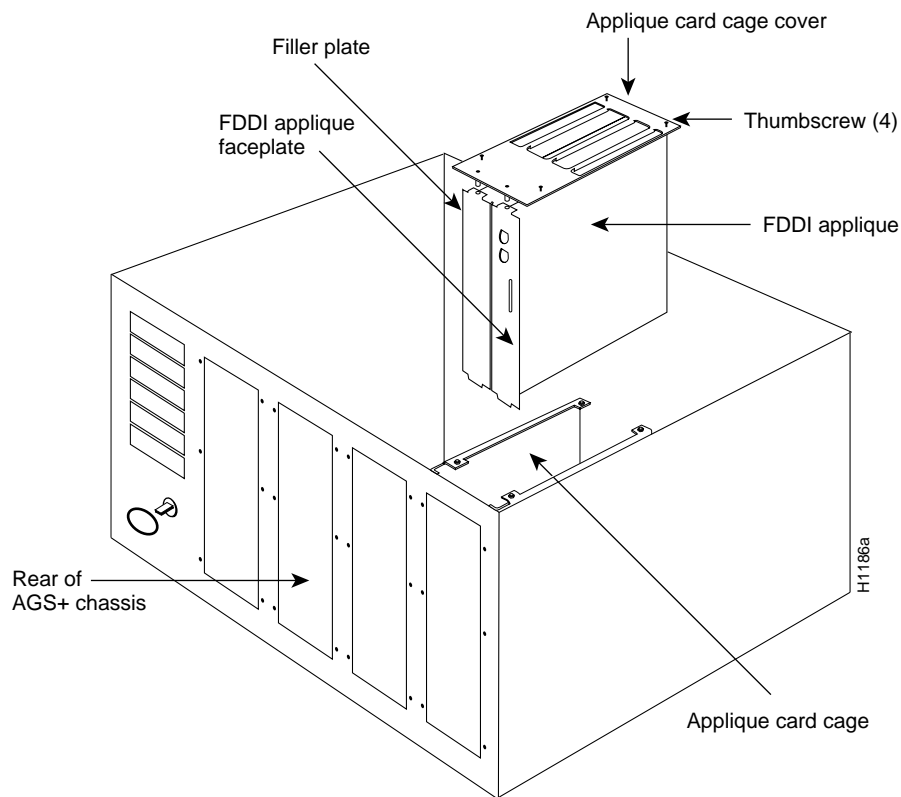
The applique card cage can only be installed in one of the two large plate areas on the right side of the rear panel of the chassis. (For the remainder of this procedure, orient the card cage and chassis as shown in Figure 11.)

---

**Note** If you removed the card cage to install the applique, proceed to step 2. (The connector plate area has already been removed.)

---

**Figure 11** Installing the FDDI Applique and Card Cage in the AGS+ Chassis



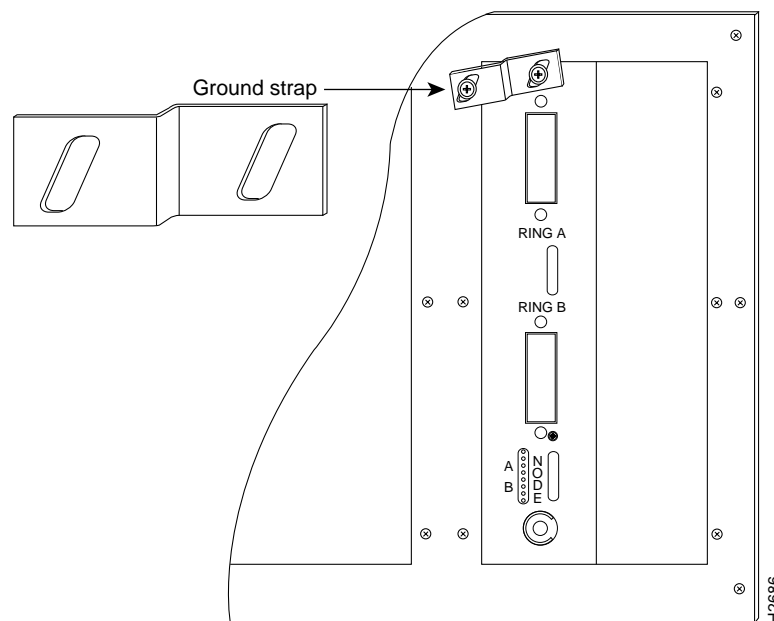
- Step 1** Remove a blank connector plate from one of the two right-side connector areas by removing the six screws that secure it. (See Figure 11.)
- Step 2** Place the applique card cage inside the rear of the chassis, in the empty large plate area. (See Figure 11.) Align the screw holes in the rear panel of the chassis with those in the applique card cage.
- Step 3** Secure the card cage with the connector plate screws you removed earlier, leaving appropriate holes empty for the ground straps. See Figure 12 and Figure 13 for ground strap configurations.

- Step 4** Attach the appropriate label (FDDI 0, FDDI 1, and so forth) to the lower part of the applique faceplate; the label will be clearly visible in this position.
- Step 5** Decide if your installation requires a short or long ground strap. Use a short ground strap when you install the applique next to a blank connector plate (see Figure 12) or next to an applique that does not contain a hole for the long ground strap screw. Use a long ground strap when you install the applique next to an applique that contains a hole for the long ground strap, for example, another FDDI applique (see Figure 13).

### Installing a Short Ground Strap

The ground strap, which is included with all appliques, grounds the applique to the chassis to prevent EMI noise on your network interface. The applique card cage containing the FDDI appliques should already be installed in the chassis and secured with five screws. Refer to Figure 12 while you install the short ground strap.

**Figure 12 Short Ground Strap Installation**

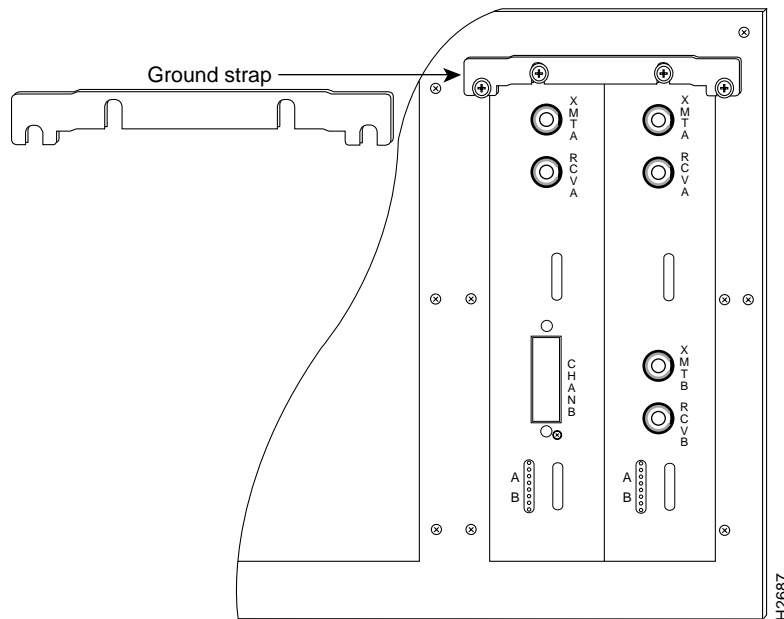


- Step 1** Remove the Phillips screw from the top center of each applique.
- Step 2** Position the ground strap so that it straddles the applique and rear panel of the chassis. Align the holes in the ground strap with those on the rear panel and the applique.
- Step 3** Secure the ground strap with the two Phillips screws.
- Step 4** Connect ground straps to other appliques as necessary, and proceed to the section, “Connecting Internal and External Cables” on page 20.

### Installing a Long Ground Strap

Ground straps, which are included with all appliques, ground the applique to the chassis to prevent EMI noise on your network interface. The applique card cage containing the FDDI appliques should already be installed in the chassis and secured with four screws. Refer to Figure 13 while you install the long ground strap.

**Figure 13 Long Ground Strap Installation,**



- Step 1** Remove the Phillips screw from the top center of each applique.
- Step 2** Position the ground strap so that it straddles both appliques and the rear panel of the chassis. Align the holes in the ground strap with those on the back panel and the appliques.
- Step 3** Secure the ground strap with the four Phillips screws.
- Step 4** Connect ground straps to other appliques as necessary, and proceed to the next section, “Connecting Internal and External Cables.”

### Connecting Internal and External Cables

The four internal ribbon cables (permanently attached to the FDDI applique) attach to the four connectors on the front edge of the C2FCIT card. The FDDI network interface cables attach to the FDDI applique and provide the external connections to your network. Before beginning these procedures, position the chassis with the open card cage facing you.

#### Connecting the Internal FDDI Ribbon Cables

The four internal ribbon cables are fixed to the applique and must be routed and attached to ports on the C2FCIT card. The ribbon cables are labeled alphabetically depending on the number of appliques you will install. The C2FCIT card connectors are shown in Figure 14, and the ribbon cable connectors are listed in Table 4. The ribbon cable orientation and labeling for the FDDI applique is shown in Figure 15.

The ribbon cables from your FDDI applique are labeled as follows:

- FDDI A through D for the first applique
- FDDI E through H for the second applique
- FDDI I through L for the third applique
- FDDI M through P for the fourth applique

Connect the four applique ribbon cables to the C2FCIT card as follows.



**Caution** To prevent twisting the ribbon cables and causing a possible short circuit, individually route each cable (from the FDDI applique) under the main card cage through the space provided and then up to the corresponding C2FCIT card connector.

**Step 1** Connect the applique ribbon cable *P3 A, E, I* or *M* (the second cable from the left in Figure 15) to the 26-pin connector labeled *FDDI A, E, I*, or *M* on the left front edge of the C2FCIT card shown in Figure 14.

**Step 2** Connect the applique ribbon cable *P2 B, F, J*, or *N* (the second cable from the right in Figure 15) to the 26-pin connector labeled *FDDI B, F, J*, or *N* in Figure 14.

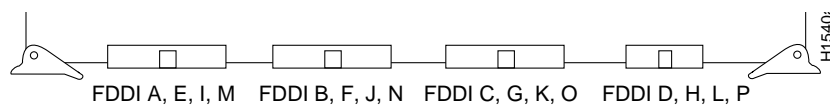
**Step 3** Connect the applique ribbon cable *P1 C, G, K*, or *O* (the far-right cable in Figure 15) to the 26-pin connector labeled *FDDI C, G, K*, or *O* in Figure 14.

**Step 4** Connect the applique ribbon cable *P4 D, H, L*, or *P* (the far-left cable in Figure 15) to the far-right (16-pin) connector labeled *FDDI D, H, L*, or *P* in Figure 14.

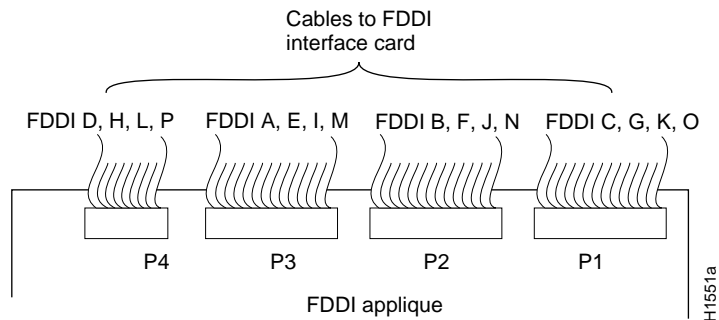
**Table 4 FDDI Applique Ribbon Cable and CSC-C2FCIT Connector Designations**

FDDI Ribbon Cable	From Connector	To CSC-C2FCIT Connector
FDDI A, E, I, or M	P3	FDDI A, E, I, or M
FDDI B, F, J, or N	P2	FDDI B, F, J, or N
FDDI C, G, K, or O	P1	FDDI C, G, K, or O
FDDI D, H, L, or P	P4	FDDI D, H, L, or P

**Figure 14 Orientation of the FDDI Connectors on the CSC-C2FCIT Card**



**Figure 15 Orientation of the Ribbon Cables on the FDDI Applique**



**Connecting the External Fiber-Optic Cables**

Following is the procedure for connecting the external FDDI cables. Refer to Figure 6 for an illustration of the single-mode FDDI connector and to Figure 7 for illustrations of the single-mode and multimode FDDI connectors.



**Warning** Invisible laser radiation may be emitted from the aperture ports of the single-mode appliques when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.* This product meets the Class 1 Laser Emission Requirement from CDRH FDDI.

**Step 1** If you are not installing an optical bypass switch, skip to step 3.

Plug the male DIN connector (from the optical bypass switch) into the female DIN connector on the APP-LMM applique, then plug the fiber-optic MIC cables from the bypass switch into the PHY-A and PHY-B connectors on the FDDI applique.

**Step 2** Connect the FDDI cables from the network into the PHY-A and PHY-B connectors on the optical bypass switch. Up to 100 milliamperes of current can be supplied to the optical bypass switch. A pinout of the DIN connector on the optical bypass switch is listed in Table 5.

**Table 5 Optical Bypass Switch Pinout**

Pin No.	Description
1	+5V to secondary switch
2	+5V to primary switch
3	Ground to enable primary switch
4	Ground to enable secondary switch
5	Sense circuit—1 kohm to +5V
6	Ground—sense circuit return

**Step 3** Multimode connections—Attach the fiber-optic MIC cables from the FDDI network to the PHY-A and PHY-B connectors on the applique. (See Figures 2 through 5.)

Single-mode connections—Attach the single-mode cables from the network to the appropriate transmit (XMT) A or B and receive (RCV) A or B connections on the FDDI applique.



**Caution** Maintain the correct A-to-B and B-to-A relationship with the FDDI connectors. Failure to maintain this relationship will prevent the FDDI interface from initializing. For the optical bypass switch, PHY-A from the network goes to PHY-B on the switch, and PHY-B from the network goes to PHY-A on the switch. Some signal degradation will occur with the optical bypass switch installed in the FDDI ring.

**Step 4** Attach all other external cables to the appropriate applique connectors on the rear panel and *loosely place* the top cover on the chassis. Leave the front panel off until you finish testing the installation.

## Testing the Installation

After you have installed your new FDDI module, verify the installation (before replacing the front panel) by taking the following steps.



**Caution** With the front panel removed and power on, the chassis is susceptible to overheating. Apply power to the chassis only long enough to go through the configuration dialog routine, check LEDs, and verify proper system operation. Replace the front panel if it is necessary to leave on the power to the chassis for some time.

**Step 1** Turn ON the system power and allow the system to boot.

---

**Note** In order to test the microcode EPROM installation, step 2 is unnecessary.

---

**Step 2** Go through the configuration dialog (or **setup**) routine to assign an address and subnet mask to each new FDDI interface you have installed.

**Step 3** Observe the LED status indicators on the CCTL2 card and the FDDI applique, and then use the EXEC **show** commands to verify that your interfaces are recognized and have been assigned port (unit) addresses by the system.

---

**Note** In order to test the microcode EPROM installation, the following sections discuss the LED functions and **show** commands in depth.

---

## Reading the LED Indicators

Two separate sets of LEDs provide status about the installation: those on the CCTL2 card and those on the FDDI applique. The LEDs on the CCTL2 card will verify the presence (and correct installation) of the C2FCIT cards in the ciscoBus backplane, while the LEDs on the applique report the state of the FDDI interfaces.

### CSC-CCTL2 Card LED Indicators

The C2FCIT card contains no LEDs or indicators. The LEDs on the CCTL2 card indicate when a ciscoBus interface is present in a ciscoBus slot. The front edge of the CCTL2 card contains a bank of five LEDs as shown in Figure 16, one red LED for each interface slot in the ciscoBus, and a green (boot) LED to indicate a successful boot procedure.

One red LED will be on for each correctly connected ciscoBus card using the correct version of microcode. It will not be on if the card is incorrectly connected or if the microcode version is wrong.

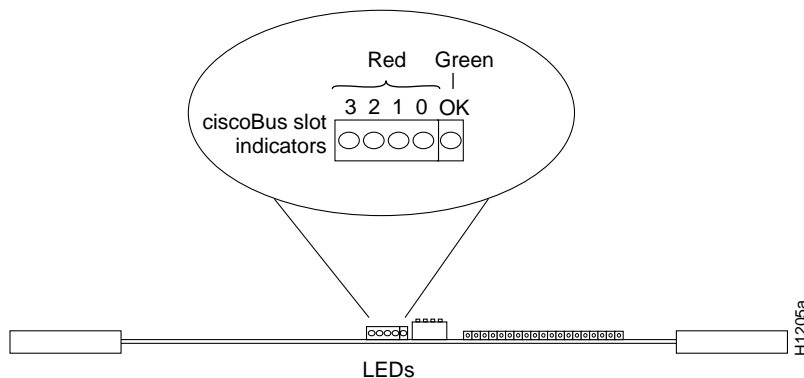
On power up, all five LEDs are on, indicating that the CCTL2 card is active. Once the system is booted, and the ciscoBus controller card microcode has completed its discovery phase, the only red LEDs will be those on that indicate the presence of a card in a ciscoBus slot. The green LED is also on to indicate a successful boot operation. Figure 16 illustrates which LED will be on to indicate the presence of a card in the ciscoBus slot. The numbers above each LED (3, 2, 1, and 0 from left to right) indicate the ciscoBus slot number assigned to that LED.

---

**Note** Verify that the red LED for the ciscoBus slot in which your C2FCIT card is installed comes on and remains on. If it does not, check the C2FCIT card to ensure that it is firmly seated in the ciscoBus and Multibus backplanes. When the card is installed correctly, the ejector levers are firmly in place.

---

**Figure 16 CCTL2 Card LED Indicators—Front-Edge View**





## FDDI Applique LED Indicators

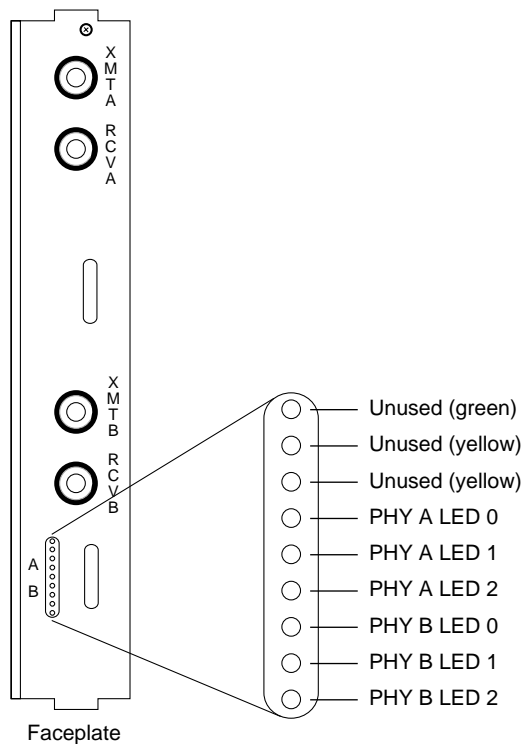
Each FDDI applique contains a bank of nine LEDs, which indicate the current line state of each of the two physical connections on the card. The applique LEDs are shown in Figure 17, and their line states are listed in Table 6.

**Table 6 Line State Indications for PHY-A or PHY-B LEDs**

0	1	2	State
On	On	On	Line State Unknown (LSU)
On	On	Off	Halt Line State (HLS)
On	Off	On	Master Line State (MLS)
On	Off	Off	Active Line State (ALS)
Off	On	On	Noise Line State (NLS)
Off	On	Off	Quiet Line State (QLS)
Off	Off	On	Idle Line State (ILS)
Off	Off	Off	Elasticity Buffer Overflow/Underflow (OVUF)

When the ring is operational (when the line protocol is up), the LEDs for each physical connection (A and B) will oscillate between ILS, ALS, and MLS. ILS will predominate, so LED 2 will glow most brightly; LED 0 will be slightly dimmer; and LED 1 will be almost completely dark. The X3T9.5 FDDI specification explains the meaning of these line states in detail.

**Figure 17 FDDI Applique Faceplate Showing the LEDs (APP-LSS shown)**



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### Using the EXEC Show Commands

When the LEDs show that the applique is installed correctly, use EXEC **show** commands to verify that the new FDDI interface is properly recognized by the system. When the system is started, the interface cards query the appliques for interface information.

---

**Note** If an applique is not connected to its interface card when the system initializes, neither will be recognized until they are properly connected and the system is restarted.

---

The EXEC command **show controller fddi** displays the current internal status of the C2FCIT card(s). The first line of the display shows the FDDI interface hardware version (type) and microcode version. It also indicates that the system has identified your new interface; however, it does *not* indicate the state of the line or protocol.

Following is sample output of the **show controller fddi** command:

```
Router# show controller fddi

Fddi0 - hardware version 7.0, microcode version 10.3
  Phy-A registers:
    cr0 4, cr1 4, cr2 0, status 3, cr3 0
  Phy-B registers:
    cr0 2, cr1 0, cr2 0, status 5, cr3 0
  FORMAC registers:
    irdtlb 73DF, irdtneg F85E, irdthtt 8473, irdmir FFFF0BDC
    irdtrth F85F, irdtmax FBC5, irdtvxt 8585, irdstmc 0810
    irdmode 6A20, irdimsk 0000, irdstat 8060, irdtpri 0000
  FDDI-T registers
    ccb: 002C cmd: 0006 fr: 000F mdptr: 0000 mema: 0000
    icb: 00C0 arg: 0003 app: 0004 mdpq: 0000 af: 0700
    clm: E002 bcn: E016 clbn: 0168 rxoff: 0020 en: 0001
    clmbc: 8011 bcnbc: 8011 robn: 0005 park: 0000 fop: 94F0

    txchn: 0000 pend: 0000 act: 0000 tail: 0000 cnt: 0000
    state: 0003 check: 0000 eof: 0000 tail: 0000 cnt: 0000
    rxchn: 0000 buf0: 03C0 nxt0: 03A8 eof: 0000 tail: 0000
    eofch: 0000 buf1: 03B4 nxt1: 039C pool: 0052 err: 005C

    head: 096C cur: 0000 t0: 0030 t1: 0001 t2: 007D
    tail: 096C cnt: 0001 t3: 0000 rxlft: 002E used: 0000
    txq_s: 0016 txq_f: 0016 Aarm: 0000 Barm: 1388 fint: 94F0
Router#
```

The EXEC command **show controller cbus** displays the current internal status of the ciscoBus card, as well as the status of *all* other ciscoBus cards being used (including the C2FCIT).

Following is sample output of the **show controller cbus** command:

```
Router# show controller cbus

ciscoBus 0, controller type 6.0, microcode version 11.0
 512 Kbytes of main memory, 128 Kbytes cache memory
 88 1520 byte buffers, 32 4480 byte buffers, 50 4484 byte buffers
 1044 byte system buffer
 Restarts: 0 line down, 0 hung output, 0 controller error
FDDI-T 0, controller type 7.0, microcode version 10.3
Interface 0 is Fddi0, station address 0000.0c01.72c0 (bia 0000.0c01.72c0)
50 buffer RX queue threshold, 51 buffer TX queue limit,
buffer size 4484 ift 0006, rql 46, tq 0000 0000, tql 50
```

To obtain more information about the interfaces, such as the state of the lines and protocol types, use the EXEC command **show interface fddi unit** (where *unit* is the unit address of the desired interface) to display statistics about a particular FDDI interface in the router.

The first line of the **show interface fddi unit** command display names the interface (FDDI) and its unit number (0) and indicates whether the hardware and line protocol are up or down.

Following is sample output of the **show interface fddi unit** command:

```
Router# show interface fddi 0

Fddi 0 is up, line protocol is up
Hardware type is cBus Fddi, hardware address is aa00.0400.0134
Internet address is 111.111.1.1, subnet mask is 255.255.255.0
MTU 4532 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
Encapsulation is SNAP, loopback is not set, keepalive is not set
ARP type: SNAP
Phy-A state is active, neighbor is B, cmt signal bits 08/20C, status ILS
Brk 1, Con 1, Tra 0, Nxt 11, Sig 10, Join 1, Vfy 1, Act 1
Phy-B state is active, neighbor is A, cmt signal bits 20C/08, status ALS
Brk 1, Con 1, Tra 0, Nxt 11, Sig 10, Join 1, Vfy 1, Act 1
CFM is through A, token rotation 5000 usec, ring operational 0:01:42
Upstream neighbor aa00.0400.6608, downstream neighbor 0000.0000.0000
Last input 0:00:00, output 0:00:00, output hang never
Last clearing of "show interface" counters never
Output queue 0/40, 0 drops; input queue 0/75, 31 drops
Five minute input rate 9000 bits/sec, 9 packets/sec
Five minute output rate 3000 bits/sec, 6 packets/sec
6813620 packets input, 1756956503 bytes, 31 no buffer
Received 1794204 broadcasts, 0 runts, 0 giants
691 input errors, 0 CRC, 691 frame, 0 overrun, 0 ignored, 0 abort
6047443 packets output, 551753389 bytes, 190 underruns
0 output errors, 0 collisions, 5 interface resets, 0 restarts
8 transitions
Router#
```

Some aspect of the hardware is not functioning properly if the line protocol is down (in the first line of the above sample output). Ensure that the network interface is properly connected and terminated.

### Additional C2FCIT Commands

In addition to the **show** commands already described, two new commands are available with the Software Release 9.1 or later C2FCIT card: **[no] fddi encapsulate** and **[no] fddi if-cmt**. The command **fddi encapsulate** is used to put the C2FCIT interface into encapsulation mode when bridging. In this mode, the C2FCIT card will interoperate with earlier C2FCI or C2FCIT encapsulating interfaces on the same ring when bridging.

The command **no fddi encapsulate** will turn off the encapsulation mode and return the C2FCIT interface back to its native “pure” transparent (nonencapsulating) mode.

The **fddi encapsulate** command can *only* be used with C2FCIT interfaces because the C2FCI card is always in encapsulating bridge mode.

The command **fddi if-cmt** is used to enable the new configuration management (CMT) feature that is now in the microcode on the C2FCIT card. This feature is on by default, but may be turned off with the **no fddi if-cmt** command. This command would typically be used when you are working with a new piece of FDDI equipment and bringing the ring up presents a problem. The “cmt-plus” microcode will be disabled using the **no fddi if-cmt** command, and the **debug fddi-cmt-events** feature will be turned on. This enables the main system code rather than the CMT microcode to perform the CMT function while debugging output is generated.

---

**Note** More information is displayed in the **show** commands than is required for testing the C2FCIT or microcode EPROM installation. For further information about the **show** commands, refer to the *Router Products Configuration Guide* and *Router Products Command Reference* publications.

---

### Restarting the System

After the FDDI module installation (or microcode upgrade) tests successfully, take the following steps:

- Step 1** Turn OFF the system power and unplug the power cable.
- Step 2** Replace and secure top cover and front panel of the router.
- Step 3** Install the system in the network.

This completes the installation of the FDDI card and FDDI applique.

### Upgrading Microcode

This procedure is required *only* if you need to change or upgrade the microcode EPROM device on your CSC-C2FCIT card from Microcode Versions 10.0 (the initial release), 10.1, or 10.2 to Version 10.3. Microcode Version 10.3 requires Software Release 9.1(1) or later.

Before proceeding, use the **show version** command to ensure that the current system software is Software Release 9.1(1) or later. As shown in the following partial display, the first line of the **show version** output indicates the current software version, which is 9.1(8) in this example:

```
router# show version

GS Software (GS3-BFX), Version 9.1(8)
Copyright (c) 1986-1993 by cisco Systems, Inc.
Compiled Wed 03-Feb-93 02:24
```

## Tools and Parts Required

Following are the tools and parts you need to upgrade the C2FCIT card:

- EPROM extractor tool or a small (3/16-inch) flat-blade screwdriver
- Medium flat-blade screwdriver (1/4-inch or larger if you are removing the AGS+ front access panel for the first time)
- Small needlenose pliers
- Antistatic mat or antistatic foam for the removed C2FCIT card
- One microcode EPROM for Microcode Version 10.3 (Part Number 17-0876-05)
- One serial programmable read-only memory (PROM) device (Part Number 17-0878-04)

---

**Note** C2FCIT Microcode Version 10.3 requires Software Release 9.1(1) or later. If your system is running an earlier software release, you must upgrade the system software before you install this microcode upgrade. Contact a customer service representative for upgrade information.

---



**Caution** To prevent ESD damage to the EPROM, be sure to follow the procedures described in the section “Preventing Electrostatic Discharge Damage” on page 8.

## Removing the C2FCIT Card

Following is the procedure for removing the C2FCIT card from the chassis.



**Warning** To avoid possible shock hazard or damage to the system cards, turn OFF power to the chassis before accessing and removing any cards.

- Step 1** Remove the front panel according to the procedure in the section “Chassis Access Procedure” on page 14.
- Step 2** Slip on an ESD-preventive wrist strap and connect it to the chassis as described in the section “Preventing Electrostatic Damage” on page 8. To channel ESD voltages to ground, make certain the power cord is connected, but that power is OFF.
- Step 3** Position the chassis so that the open card cage is facing you for the remainder of this procedure.
- Step 4** Note the positions of each of the four ribbon cables attached to the connectors on the front edge of the C2FCIT card (see Figure 18); they should be labeled as shown in Table 4. If not, label them so that you reconnect them to the correct ports when you replace the card.
- Step 5** Disconnect the four ribbon cables from the front of the C2FCIT card. It may be necessary to disconnect cables from other cards in order to pull the C2FCIT out of the card cage. If so, label the cables and their corresponding ports before disconnecting them.
- Step 6** Use your thumbs to pull the ejector levers out and away from the card edge to loosen it and pull the card out of its slot.
- Step 7** Remove the C2FCIT card from the card cage slot and place it on an antistatic mat or antistatic foam in the orientation shown in Figure 18.

## Replacing Components

Following is the procedure for replacing components on the C2FCIT card:

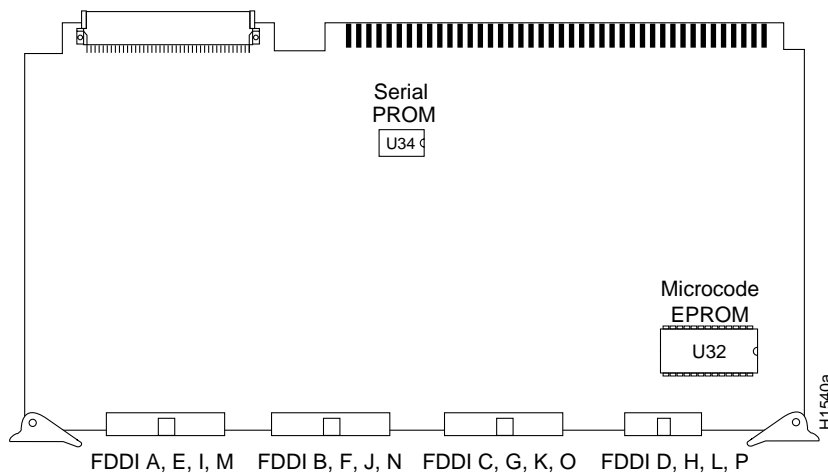
- Step 1** Referring to Figure 18, locate the microcode EPROM (socket position U32) in the lower right corner of the C2FCIT card. (With the card in this position, the EPROM label might appear upside down.) Note the position of the notch (see Figure 18) in the end of the EPROM and socket so that you can place the new EPROM correctly.
- Step 2** Use a chip extractor to remove the EPROM component from socket U32. If you do not have a chip extractor available, carefully use the tip of the screwdriver blade to gently pry the component out of its socket.
- Step 3** Align the notch on the new EPROM (Part Number 17-0876-05) with the notch in the U32 socket. Ensure that the pins are aligned with the socket, then insert the new component. Do not rely on the orientation of the label to correctly position the new EPROM.



**Caution** When inserting a new component, be very careful not to break or bend any of the pins. To straighten a bent pin, use needlenose pliers. If a pin breaks or if the device is installed backwards when power is turned ON, contact a customer service representative to obtain a replacement because, in both cases, the device is rendered unusable.

- Step 4** Referring to Figure 18, locate the serial PROM component (socket position U34) toward the rear of the card near the bus connector. Note the position of the notch.

**Figure 18 Microcode Components on the C2FCIT Card**



- Step 5** Use a chip extractor or small flat-blade screwdriver to remove the serial PROM component from the U34 socket.
- Step 6** Align the notch on the new serial PROM (Part Number 17-0878-04) with the notch in the U34 socket. Ensure that the pins are aligned with the socket, then insert the new component.



**Caution** To prevent damaging the new EPROM and PROM components, ensure that you replace each component with the notched end in the correct orientation. Align the notch on the new component with the notch on the socket. Do *not* use the label on the component as an indicator for correct orientation.

- Step 7** Replace the card in the card cage. Place your thumbs on the ejector levers, and push the card in firmly until it snaps into place and is firmly seated in the slot.
- Step 8** Looking at the four connectors on the front edge of the C2FCIT card, attach the ribbon cables from left to right. Refer to the section “Connecting Internal and External Cables” on page 20.
- Step 9** Attach any cables that you removed from other cards.
- Step 10** Turn ON power to the system for an installation check, which is described in the section “Testing the Installation” on page 23.

---

**Note** If the microcode component is not installed correctly, or if any of the pins are bent during installation, the ciscoBus card will not recognize that a card exists in that ciscoBus slot. The corresponding LED on the ciscoBus card will not light. If this happens, remove the component, straighten any bent pins, then reinsert it and try again.

---

To verify the microcode version for the C2FCIT card after the system boots successfully, use the **show controller fddi** command as follows:

```
router# show controller fddi

Fddi0 - hardware version 7.3, microcode version 10.3
Phy-A registers:
  cr0 4, cr1 0, cr2 0, status 6, cr3 0
Phy-B registers:
  cr0 4, cr1 4, cr2 0, status 6, cr3 0
FORMAC registers:
  irdtlb 73A4, irdtneg F85E, irdthtt 5D49, irdmir FFFF0BDC
  irdtrth F85F, irdtmax FBC5, irdtvxt 8585, irdstmc 0810
  irdmode 6A20, irdimsk 0000, irdstat 8060, irdtpri 0000
FDDI-T registers
  ccb: 0026 cmd: 0006 fr: 000F mdptr: 0000 mema: 0000
  icb: 0090 arg: 0003 app: 0004 mdpg: 0000 af: 0700
  clm: E002 bcn: E016 clbn: 0150 rxoff: 002A en: 0001
  clmbc: 8011 bcncb: 8011 robn: 0000 park: 0000 fop: 9078

  txchn: 0000 pend: 0000 act: 0000 tail: 0000 cnt: 0000
  state: 0003 check: 0000 eof: 0000 tail: 0000 cnt: 0000
  rxchn: 0000 buf0: 048C nxt0: 0468 eof: 0000 tail: 0000
  eofch: 0000 buf1: 0450 nxt1: 0498 pool: 0050 err: 005C

  head: 0A44 cur: 0498 t0: 0030 t1: 0025 t2: 0028
  tail: 0A44 cnt: 0001 t3: 0000 rxlft: 0041 used: 0000
  txq_s: 001C txq_f: 001C Aarm: 0000 Barm: 1388 fint: 9078
```

For descriptions of additional commands and examples, refer to the *Router Products Configuration Guide* publication. If you have any problems, contact a customer service representative.

## Cisco Information Online

Cisco Information Online (CIO) is Cisco Systems' primary, real-time support channel. You can use your product serial number to activate CIO for a single user during your warranty period. Maintenance customers and partners can self-register on CIO to obtain additional content and services.

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You can access CIO in the following ways:

- WWW: <http://www.cisco.com>.
- Telnet: [cio.cisco.com](telnet://cio.cisco.com) (198.92.32.130).
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; data bits: 8; parity: none; stop bits: 1; and baud rates up to 14.4 kbps.

For a copy of CIO's Frequently Asked Questions (FAQ), contact [ciohelp@cisco.com](mailto:ciohelp@cisco.com). For additional information, contact [cioeam@cisco.com](mailto:cioeam@cisco.com).

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**Note** If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or [tac@cisco.com](mailto:tac@cisco.com). To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or [csrep@cisco.com](mailto:csrep@cisco.com).

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