...the science of networking networks

Modular Products Hardware Installation and Reference

cisco Systems

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CISCO SYSTEMS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Modular Products Hardware Installation and Reference

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About This Manual

This guide contains the installation procedures for Cisco Systems communications and network server products. It will guide you through the initial site preparation, installation, and startup of your new equipment. Once your hardware is installed, you will use the appropriate companion manual to configure your system. These companion manuals are listed in the section titled, "Obtaining Additional Information."

Audience and Scope

Setting up and maintaining a network requires the knowledge and expertise of people with a variety of skills. In many environments, the people responsible for installing and maintaining hardware and wiring are not the ones who configure the software and administer the network. This guide provides information specifically for installing and upgrading the hardware. To use this guide, you should be familiar with electronic circuitry and wiring practices, and preferably have experience as an electronic or electromechanical technician. Descriptions of software-driven configuration commands, and the procedures for implementing them, are contained in the Cisco publications provided in the section titled, "Obtaining Additional Information."

Document Organization and Use

The organization of this guide follows the recommended installation sequence. The length of time it takes you to cover each chapter depends on the type of system you are installing.

This guide also includes some information that you may not need at initial installation but that is useful when upgrading or adding cards to the system. Additional reference information is included in the appendices.

The major sections of this guide are:

- "About This Manual," this introductory section, which describes the audience and scope of this document, the document conventions used within, and lists the organization of major topics.
- "Service and Support" provides warranty and support information, and instructions for getting help through customer service and the Technical Assistance Center (TAC).

- "Obtaining Additional Information" lists the software and configuration manuals which are the companions to this hardware guide, and additional reference material you may find useful.
- Chapter 1, "Hardware Overview," briefly describes and illustrates each Cisco Systems router and server product. The tables describe the hardware components and power and cooling specifications for each system.
- Chapter 2, "Preinstallation," is a preparation section. It describes the site considerations, tools required, and the procedures you should perform *prior* to actual installation.
- Chapter 3, "Installation Considerations," describes each step in the installation process. Once your hardware is installed, you will be directed to the appropriate configuration and reference publication to configure your system software.
- Chapter 4, "Installing Connectors and Appliques," provides information about cabling and installing backpanel connectors and appliques. Systems ordered from Cisco Systems are completely assembled; this section is useful for installing system additions and upgrades.
- Chapter 5, "Installing Interface and System Cards," provides detailed information about installing additional interface and system cards. It includes card illustrations, LED descriptions, jumper settings, and cabling instructions.
- Appendix A, "CPU Bootstrap Program," describes how to test for problems with system memory and the central processor unit (CPU) cards using the bootstrap program. It also provides a summary of the bootstrap diagnostic tests and command options.
- Appendix B, "Signal Summaries," lists the pin signals for connecting terminal and non-terminal devices, and the pinouts for each applique and connector type. It also provides a list of pinouts necessary for constructing an X.21 to RS-449 transition cable.
- Appendix C, "Industry-Standard Wiring Plans," lists the telephone industry color code scheme for 25-pair wires, including the pin numbers.
- Appendix D, "Optional Rack-Mount Installation," provides instructions for installing a rack-mount for the chassis and for the A-type chassis switch guard.
- The Glossary defines terminology and abbreviations used within this publication.

Document Conventions

This manual uses the following conventions to convey instructions and information:

`Screen type` shows information displayed on a terminal screen.

Boldface type highlights command names within the text.

Italicized type shows command variables, emphasizes new terms and concepts, and is used for titles of books and periodicals.

A string is defined as a nonquoted set of characters. The following is a set of instructions and an example showing correct usage. Note that while instructed to answer "yes," the correct input excludes use of quotes.

Example:

When you invoke the **setup** command from the EXEC, a prompt will ask if you want to "continue with the configuration dialog" before going into the interactive process. Answer "yes" to continue; answer "no" to quit out of the program.

```
Gateway#setup

                 --System Configuration Dialog--
At any point you may enter a question mark (?) for help. Refer to the
"Getting Started" Guide for additional help. Default settings are in
square brackets ([ ]).

Continue with configuration dialog? [yes]: yes
```

Note: is a special paragraph that means *reader take note.* It usually refers to helpful suggestions, the writer's assumptions, or references to materials not contained in this manual.

Caution: is a special paragraph that means *reader be careful.* It means that you are capable of doing something that might result in equipment damage, or worse, that you might have to take something apart and start over again.

Warning: is a special paragraph that means *danger.* It means that you are in a situation in which you may be injured or killed, usually by electrical shock. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry, and standard practices for preventing accidents. As a refresher, please read the "Safety" section in Chapter 2.

Service and Support

Warranty Information

All Cisco Systems products are covered under a limited factory warranty. This warranty covers defects in the hardware, software, or firmware. Refer to the Cisco Systems *Customer Services Product Guide* for more information on Cisco's warranty policy, or contact Cisco Systems at 1-800-553-NETS or 1-415-326-1941.

Note: Warranty and other service agreements may differ for international customers. Contact your closest Cisco regional representative for more information.

Maintenance Agreements

Cisco Systems offers Comprehensive Maintenance Agreements throughout North America, which include on-site remedial services, software support, a 24-hour emergency hot line, overnight parts replacement, and an escalation procedure. Cisco also offers Software and Advanced Replacement Service under a SMARTnet agreement for customers who desire those services. Noncontract maintenance services are provided at current time-and-materials rates. For more information contact Customer Services at 1-800-553-NETS or 1-415-326-1941.

Our maintenance strategy is founded upon customer-initiated service requests to the Cisco Systems Technical Assistance Center (TAC). The TAC coordinates all customer services, including hardware and software telephone technical support, on-site service requirements, and module exchange and repair.

The TAC is available during normal business hours from 6:00 A.M. to 6:00 P.M. Pacific coast time, Monday through Friday excluding company holidays, at the TAC telephone number listed below. If you must return your Cisco equipment for repair or replacement, please contact the TAC or a Cisco regional representative for more information.

Customer Support

Hardware and software support specialists are available to help diagnose and solve customer problems. They will be able to isolate and solve your problem much faster if you are prepared with the information they need.

When you call have the following information ready:

- Chassis serial number
- Maintenance contract number
- Software version

You can display your software version level and your hardware configuration by using the **show hardware** command.

How to Contact Customer Support

For technical assistance:

TAC Telephone Number: 1-800-553-2447
1-415-688-8209

FAX: 1-415-688-7878
Email: `tac@cisco.com`

For sales and order information:

Phone: 1-800-553-NETS (6387)
1-415-903-7208

FAX: 1-415-903-8080
Email: `csrep@cisco.com`

Obtaining Additional Information

This section provides the titles of network-related subjects you may find helpful. Other Cisco publications, and the procedures for ordering them, are also included.

Information About Networks in General

The following list includes references used in this publication and suggested reading. Please also see the *Terminal Server Installation and Reference*, the *Protocol Translator Installation and Reference*, and the *Router Products Configuration and Reference* publications for additional reading suggestions.

Chapman, John T., and Halabi, Mitri. HSSI: High Speed Serial Interface Design Specification, Menlo Park, CA and Santa Clara, CA: Cisco Systems and T3plus Networking, Inc., 1990

Stallings, William. *The Handbook of Computer Communications Standards, Volumes 1, 2, and 3.* New York, NY: Macmillan Publishing Company, 1987.

Tannenbaum, Andrew S. *Computer Networks.* Englewood Cliffs, NJ: Prentice-Hall, 1988. item Comer, Douglas. *Internetworking with TCP/IP, Principles, Protocols, and Architecture.* Englewood Cliffs, NJ: Prentice Hall, 1988.

Schwartz, Mischa. *Telecommunications Networks: Protocols, Modeling, and Analysis.* Reading, MA: Addison-Wesley, 1987.

DDN Protocol Handbook, 4 volumes, 1989.

The DDN Network Information Center (NIC) maintains bibliographies of computer networks and protocols, including Requests for Comments (RFCs), and produces documents of interest to network managers. For information, contact:

Government Systems, Inc.
Attn: Network Information Center
14200 Park Meadow Drive, Suite 200
Chantilly, VA 22021
1-800-365-4642 (1-800-365-DNIC)
1-703-802-4535

Electronic Mail address: `nic@nic.ddn.mil`

Advanced Micro Devices, *The Supernet Family for FDDI* — Technical Manual Number 09779A, Sunnyvale, CA, 1989.

The Supernet Family for FDDI — 1989 Data Book Number 09734C, Sunnyvale, CA, 1989.

Ordering Additional Cisco Publications

The most important companions to this publication are those that accompany the products, the *Terminal Server Installation and Reference*, the *Protocol Translator Installation and Reference*, the *Router Products Configuration and Reference*, and the *Router Products Getting Started* publications. Refer to them for system software configuration information after completing the hardware installation. software. These and the following publications are also available:

Terminal Server Configuration and Reference—Provides information for using the Cisco Terminal Server, including the system interface, system configuration, and network and system administration.

Router Products Configuration and Reference—Provides information for using Cisco Routers, including system interface use, system configuration, and network and system administration.

Protocol Translator Configuration and Reference—Provides information for using the Cisco Protocol Translator, including system interface use, system configuration, and network and system administration.

Field Service Manual—Contains hardware troubleshooting and replacement procedures for all Cisco hardware products.

Current price information for all Cisco publications are included in the Cisco Systems North American Price List. Consult this guide, or contact your sales representative to order these publications. Orders can be placed directly with:

Cisco Systems, Inc.
1525 O'Brien Drive
Menlo Park, CA 94025 USA

1-800-553-NETS or 1-415-326-1941

`customer-service@cisco.com`

Chapter 1
Hardware Overview

Cisco Systems' internetworking products include three chassis types, each of which is designed to accommodate a wide variety of connectors, appliques, and interface and controller cards. The modular design of these products allows you to customize a system with the components you need, in a chassis of the appropriate size. The three main chassis sizes are: the A-type chassis, which is Cisco's largest chassis; the M-chassis, a medium-sized chassis; and the C-chassis, a compact chassis for systems with limited configurations. This chapter describes configuration guidelines and physical specifications for each chassis type. The products based on these basic chassis are categorized as follows:

- The network server series: the AGS+, AGS, MGS, and CGS models
- The communications server series: the ASM and MSM
- The Cisco Protocol Translator (CPT)
- The TRouter, a combination terminal server and router

Configure a server by first selecting the appropriate chassis size to meet your current and future needs, then adding the modular interfaces with the desired capabilities. This modular approach allows you to configure a network server precisely tailored to your needs.

Each product is further described in the following publicatios.

- The IGS fixed-configuration network server is described in the *IGS Hardware Installation and Reference* publication.
- The STS-10x fixed-configuration communications server is described in the *STS-10x Hardware Installation and Reference* publication.
- Additional reference sources and documents are listed in the section titled "Obtaining Additional Information" in the front of this publication.

Note: This document uses the terms *router* or *server* when referring to any of Cisco Systems' network server products. The products were called gateway servers or gateway systems in earlier documentation.

Network and Communications Server Descriptions

The Cisco Systems network servers are multiprotocol, multimedia network-level routing devices that can also function as layer-2 (MAC-layer) local and remote network bridges. The servers comply with RFC 1009, *Internet Gateway Requirements*.

The Cisco Systems terminal servers are communications processors that connect asynchronous devices to any local or wide area network that uses TCP/IP, LAT, or SLIP. All of the Cisco terminal servers can be configured to interface with Ethernet Local Area Networks (LANs). Additionally, the larger ASM and MSM models can be configured to support Token Ring LANs or synchronous serial network connections. Cisco Systems produces several chassis models which can be configured as communications or network servers by adding the appropriate hardware. The chassis are identified by their size, capacity, physical characteristics, components, and configuration. All products described in this publication are built on the four chassis: A+, A, M, and C. Table 1-1 provides a summary of Cisco Systems' chassis models.

Table 1-1 Cisco Chassis Model Summary

Chassis:	A+	A	M	C
Bus Slots	9	9	4	2
Size	10x17.5x20 in.	10x17.5x20 in.	5.25x17.5x20 in.	3.5x15x18 in.
Weight	56 lbs.	50 lbs.	35 lbs.	15 lbs.
Connectors	4 lrg., 6 ind.	4 lrg., 6 ind.	2 sml., 4 ind.	1 sml., 4 ind.
Addsitional Hardware	19" rack-mount kit, switch guard	19" rack-mount kit, switch guard	19" rack-mount kit, 19" slide-mount kits	none

lrg. = large; ind. = individual; sml. = small

The connector sizes (large, individual, and small) refer to the size of the plates on the rear of the chassis. Refer to the photographs in the following sections that show these connector areas.

Environmental Specifications

The following is a list of environmental design requirements for all Cisco Systems products. All products currently manufactured meet or exceed these specifications.

Design Specification	Minimum	Maximum
Ambient Operating Temperature	0°C (32°F)	40°C (104°F)
Ambient Nonoperating Temperature (Storage)	-40°C (-6°F)	75°C (167°F)
Ambient Operating Humidity	5% RH, noncondensing	95% RH, noncondensing
Ambient Nonoperating Humidity (Storage)	5% RH noncondensing	95% RH, noncondensing
Altitude Operating	-500 ft. (-150 M)	10,000 ft. (3050 M)
Altitude Nonoperating	-1000 ft. (-305 M)	30,000 ft. (9150 M)
Vibration Operating	5-500 Hz, 0.5 G, 0.1 oct/min.	
Vibration Nonoperating	5-100 Hz, 1 G,.0.1 oct/min. 100-500 Hz, 1.5 G, 0.2 oct/min. 500-1000 Hz, 1.5 G, 0.2 oct/min	

A+ Chassis: AGS+ Model

The A+ chassis, shown in Figure 1-1, is Cisco Systems' largest chassis. The AGS+ system supports from 2 to 32 network ports. The front of the A+ chassis contains an access panel, which is easily removed to expose the system card cage.

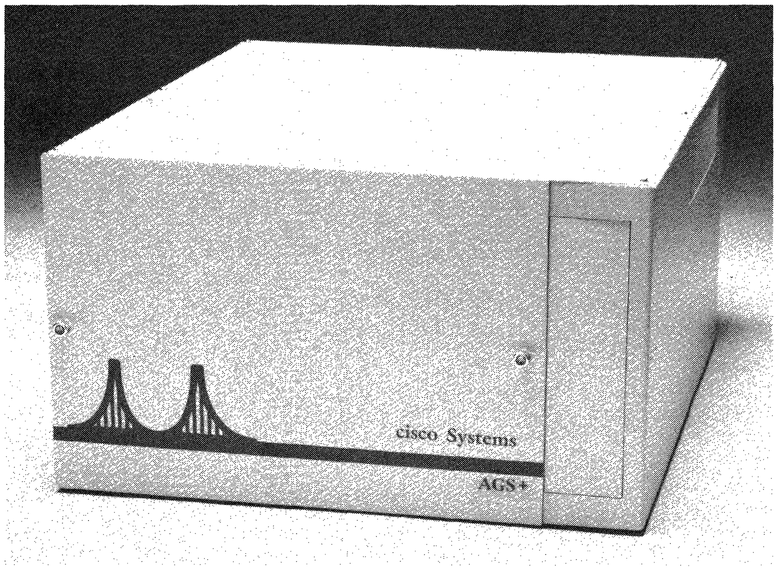


Figure 1-1 The A+ Chassis — Front View

The rear of the chassis, shown in Figure 1-2, contains all of the hardware for the external interface connections, which are provided with connectors and *appliques*. Appliques are the connector-mounting hardware and associated electronics (on a circuit card) that translate communication signals into the specified electrical attachment—FDDI, HSSI, RS-232, V.35, or RS-449.

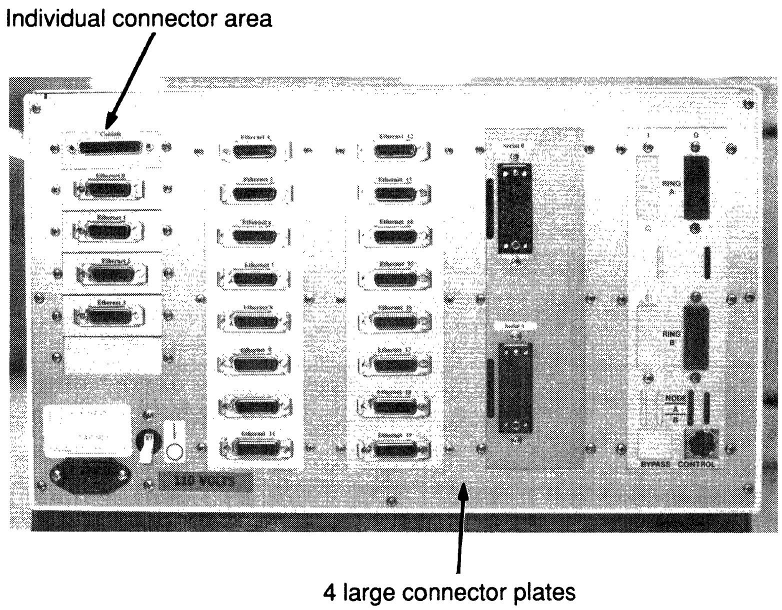


Figure 1-2 The A+ Chassis — Rear View

The connectors and appliques on a new system are installed at the factory according to customer specifications. New interfaces or different configurations can be added later. Chapter 4 describes how to install new connectors and appliques.

The AGS+ system card cage is shown in Figure 1-3. In the system card cage, a five-slot cBus resides within the nine-slot system bus. The AGS+ system includes the CSC/3 processor card and the CSC-ENVM environmental monitor card. There are two types of interface cards available for the AGS+: medium-speed and high-speed. The medium-speed cards include the MCI, SCI, and Token Ring cards. These cards use system bus slots. The high-speed interface cards are the CSC-HSCI, the control card for high-speed serial interface (HSSI) options; the CSC-FCI, which is the control card for the single- and multimode fiber optic options; and the Multiport Ethernet Controller (MEC) cards. All of the high-speed interface cards use the cBus, a high-speed bus that occupies a portion of the system bus in the AGS+.

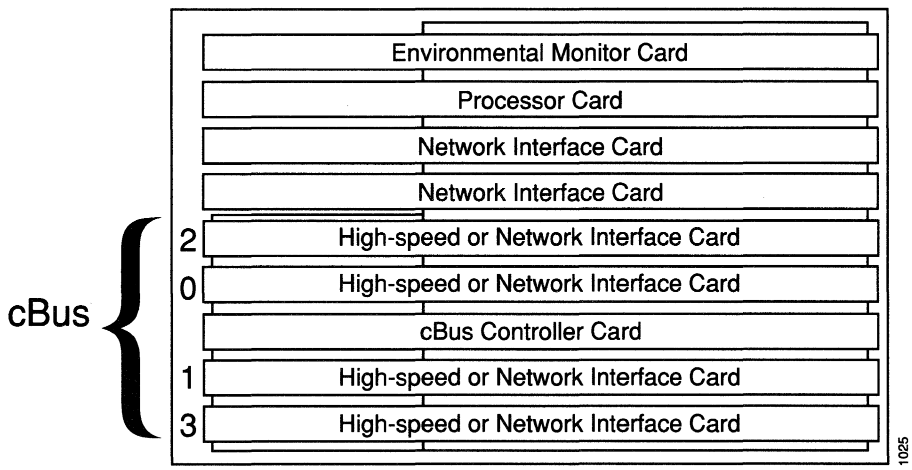


Figure 1-3 The AGS+ Backplane Configuration

Connectors and appliques are mounted on the rear of the AGS+ chassis with connector plates or with applique card cage faceplates. Depending upon the connector type, each connector plate can support up to eight connectors or appliques. The applique card cage, which is required for the FDDI and HSSI interfaces, supports two appliques. Due to space limitations, a maximum of two applique card cages can be installed in the AGS+. As shown in Figure 1-3, four large connector plate areas are available; each applique card cage, if installed, occupies the space of one large connector plate. Table 1–2 shows the maximum number of appliques and connectors that can be attached to the AGS+ based upon the space available on the rear of the chassis. Other factors, such as power consumption and traffic, can limit the number and types of interfaces; these factors are described in Chapter 5.

Table 1-2 AGS+ Back Panel Plates

Connectors/ Appliques	Individual Connectors	Large Plate 1	Large Plate 2	Large Plate 3	Large Plate 4
Token Ring	3	4	4	4	4
Ethernet	4	8	8	8	8
FCI	—	—	—	2	2
HSSI	—	—	—	2	2
UltraNet	—	—	—	2	2
RS-232	—	6	8	8	8
RS-449	—	—	4	4	4
V.35 std.	—	—	4	4	4
V.35 small	—	6	8	8	8
V.35 (dual-mode)	—	—	4	4	4

The A+ chassis power switch and power receptacle are located on the back panel. Table 1-3 describes the power and cooling specifications for the A+ chassis.

Table 1-3 A+ Chassis Specifications

Maximum Power Specifications	
Consumption:	500 watts (1705 BTU/hour)
Input:	110/220VAC (standard); (U.K. 220/240VAC)
Frequency:	47 to 63 Hz
Current Rating:	7A @ 110V; 3.5A @ 220V (U.K. 4A @ 230V)
	U.S. 55A for +5V; 10A for +12V; 6A for -5V; 10A for -12V
Available:	*U.K.* 60A for +5V; 10A for +12V; 6A for -12V; 6A for -5V
Cooling	
One 160 cubic feet/minute (CFM) blower and exhaust vent.	

Table 1-4 lists the components included with the A+ chassis.

Table 1-4 A+ Chassis Component Descriptions

Component	Description
Chassis:	9-slot system bus, or 4 slots system bus and 5 slots cBus.
Processor:	MC68020 processor.
System Controller:	cBus controller card.
Interface Cards:	Up to seven interface controller cards. Specific restrictions exist on number and type of controller cards that can be used. Please consult the "Network Interface Controller Subsystems" section in Chapter 5 for these restrictions.
System Memory:	Nonvolatile RAM is standard on all Cisco A+ chassis products. Nonvolatile RAM is supplied to the A+ chassis by the CSC-ENVM environmental monitor card.
External Connectors:	Mounting plates with connectors for attachment to various types of networks. Consult Chapter 4 for restrictions on the number of connectors of each type per system.
Accessories:	Rack-mount kit that includes screws and two flanges for mounting the chassis in a standard 19-inch rack.
	Optional switch guard to prevent inadvertent tripping of the power switch.
Documentation:	*Router Products Configuration and Reference* and *Hardware Installation and Reference* publications.

A-Chassis: AGS and ASM Models

The A-chassis, shown in Figure 1-1, is one of Cisco Systems' largest chassis. The AGS system supports from 2 to 16 network ports. The ASM system supports from 16 to 96 RS-232 devices, including one Ethernet, one Token Ring, or one synchronous serial port with non-volatile memory and optional parallel printer card.

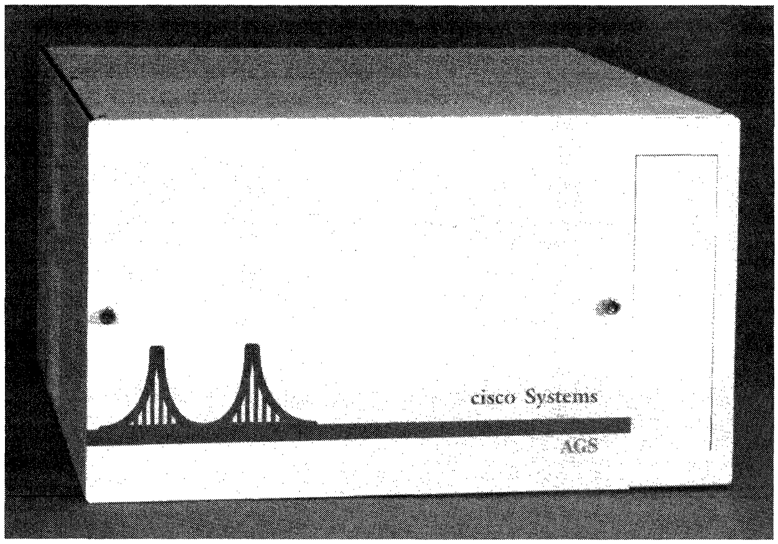


Figure 1-4 The A-Chassis — Front View

The A-chassis back panel, shown in Figure 1-5, features four large connector plates and one large connector area with space for six individual connectors.The individual connection area must contain one console port connector, which leaves five spaces available for Ethernet, synchronous, or Token Ring attachments.

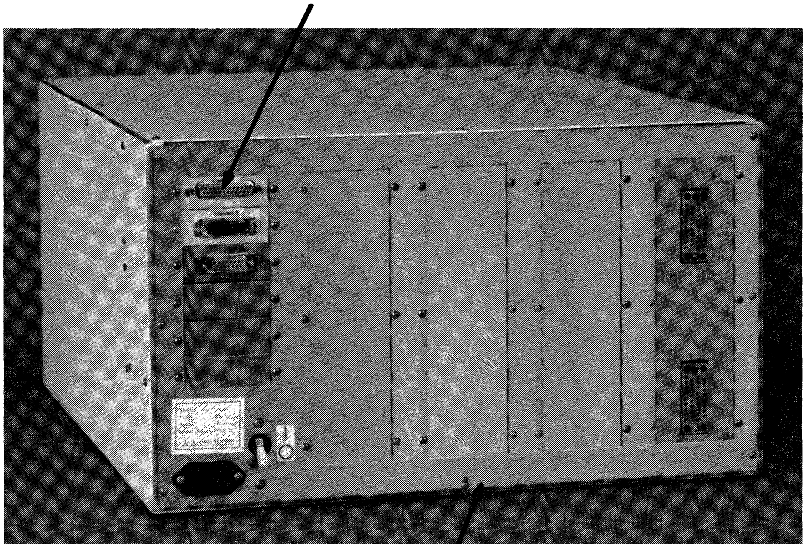


Figure 1-5 The A-Chassis — Rear View

Table 1-5 describes the power and cooling specifications for the A-chassis.

Table 1-5 A-Chassis Specifications

Maximum Power Specifications	
Consumption:	350 watts (1193.5 BTU/hour)
Input:	110/220 VAC (standard); (U.K. 220/240 VAC)
Frequency:	47 to 63 Hz
Rating:	5A @ 110V; 2.5A @ 220V
Current	*U.S.* 35A for +5V; 4A for +12V; 1.5A for -5V; 1.5A for -12V
Available:	*U.K.* 30A for +5V; 7A for +12V; 5A for -12V; 1A for -5V
Cooling	
One 160 cubic feet/minute (CFM) blower and exhaust vent	

Table 1-6 lists the components included with the A-chassis.

Table 1-6 A-Chassis Component Descriptions

Component	Description
Chassis:	9-slot system bus.
Processor:	MC68020 processor.
Interface Cards:	Up to five network interface controller or up to eight synchronous interface cards. Specific restrictions exist on number and type of controller cards that can be used. Please consult the "Network Interface Controller Subsystems" section in Chapter 5 for these restrictions.
System Memory:	Nonvolatile RAM is provided by one of the following:
	CSC-MC extended memory card connected to an MCI card, OR
	CSC-MT enhanced memory card for systems configured with CSC-R or CSC-P cards.
External Connectors:	Mounting plates with connectors for attachment to various types of networks. Consult Chapter 4 for restrictions on the number of connectors of each type per system.
Accessories:	Rack-mount kit that includes screws and two flanges for mounting the chassis in a standard 19-inch rack. Optional switch guard to prevent inadvertent tripping of the power switch.
Documentation:	*Router Products Configuration and Reference,* or *Terminal Server Configuration and Reference,* and the *Hardware Installation and Reference* publications.

M-Chassis: MGS and MSM Models

The M-chassis, shown in Figure 1-6, is Cisco Systems' midsize chassis. The MGS system supports from 2 to 11 network ports. The MSM model supports 16 or 32 RS-232 devices.

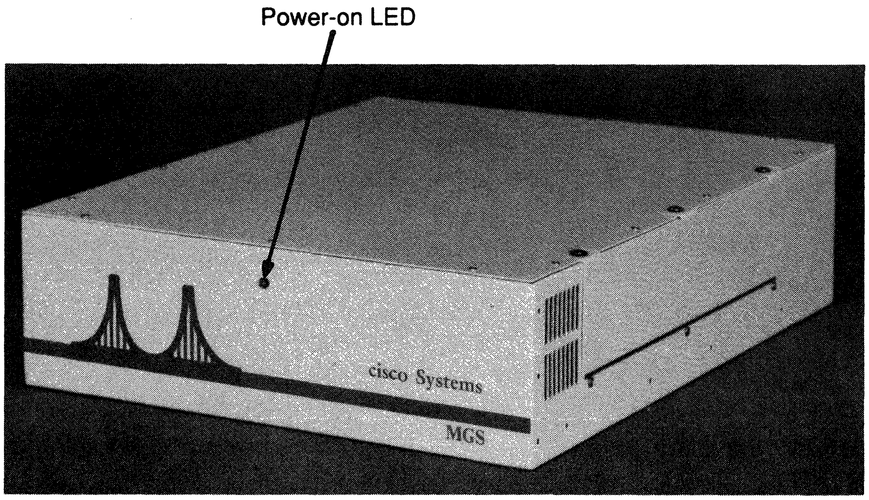


Figure 1-6 The M-Chassis — Front View

The M-chassis has a removable side panel that allows access to the card cage. The M-chassis backpanel, shown in Figure 1-7, contains two small connector plates and one connection area with space for four individual connectors. The individual connection area must contain at least one console port connector, which leaves three spaces available for Ethernet, synchronous, or Token Ring attachments.

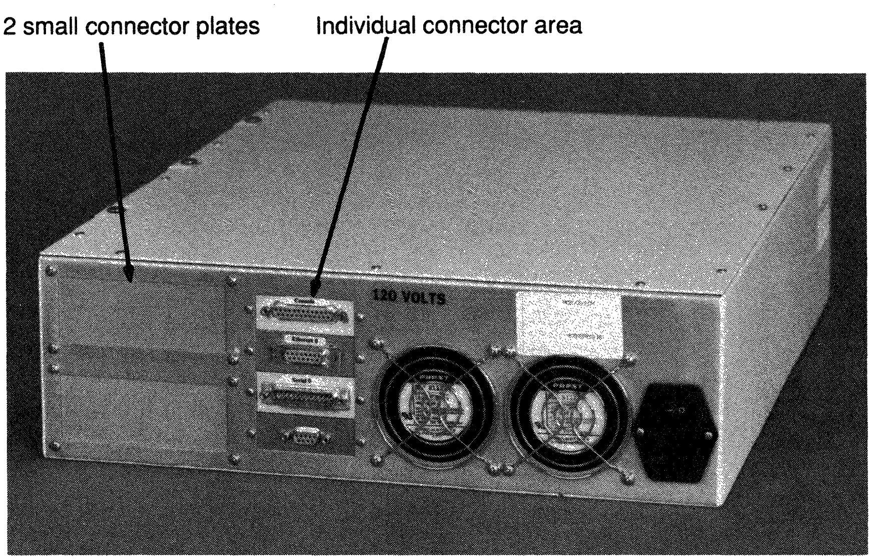


Figure 1-7 The M-Chassis — Rear View

The small connector plates are used to attach multiple or larger connectors (37-pin RS-449, 34-pin V.35, synchronous 25-pin RS-232, 50-pin Telco, or RJ-11).

The M-chassis backpanel also features outlets for two internal fans and a combination power-on switch, fuse, and power receptacle.

Table 1-7 describes the power and cooling specifications for the M-chassis. Table 1-8 lists the components included with the M-chassis.

Table 1-7 M-Chassis Specifications

Maximum Power Specifications	
Consumption:	270 watts (920.7 BTU/hour)
Input:	90 to 265 VAC, Universal Input power supply
Frequency:	47 to 63 Hz (auto ranging)
Rating:	2.3A @ 120V/1.2A @ 240V
Output Voltage:	*U.S.* 25A for +5V; 2A for -5V; 1A for -5V; 2.5A for and Current+12V; and 2A for -12V *U.K.* 20A for +5V; 2A for +12V; 1A for -12V; 1A for -5V.
Cooling	
Sixty cubic feet per minute proviced by two fans and an exhaust vent.	

Table 1-8 M-Chassis Component Descriptions

Component	Description
Chassis:	4-slot system bus.
Processor:	MC68020 processor.
Interface Cards:	Up to three network interface controller cards or up to two synchronous interface cards. Note: Specific restrictions exist on number and type of controller cards that can be used in an MGS. Please consult the "Network Interface Controller Subsystems" section in Chapter 5 for these restrictions.
System Memory:	Nonvolatile RAM is provided by one of the following: CSC-MC extended memory card connected to an MCI card, or CSC-MT enhanced memory card for systems configured with CSC-R cards.
External Connectors:	Mounting plates with interface connectors for attachment to various types of networks. Consult Chapter 4 for restrictions on the number of connectors of each type per system.
Accessories:	Rack-mount kit that includes screws and two flanges for mounting the chassis in a standard 19-inch rack. The M-chassis slide-mount kit is optional.
Documentation:	*Router Products Configuration and Reference* or *Terminal Server Configuration and Reference*, and *Hardware Installation and Reference* publications.

C-Chassis: CGS Model

The compact C-chassis, shown in Figure 1-8, is Cisco Systems' smallest chassis. The CGS model provides up to four network ports.

The C-chassis is designed for use where a limited number of network connections are needed. There is no external access to the card cage on the C-chassis.

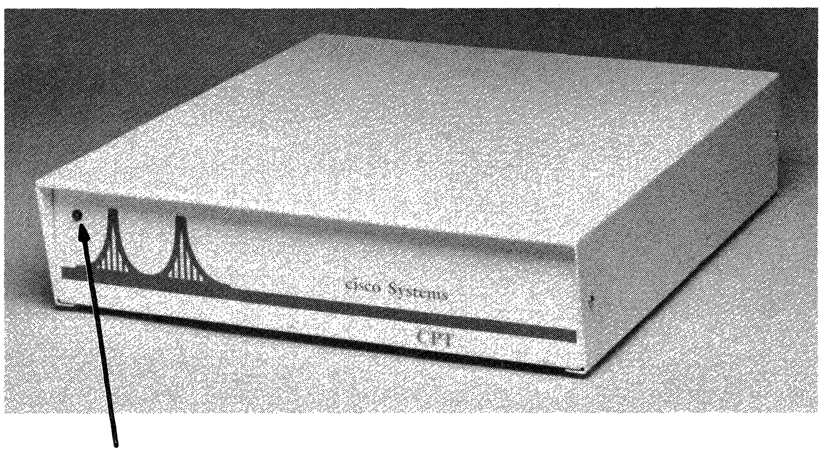


Figure 1-8 The C-Chassis — Front View

A power-on LED is located on the front panel of the C-chassis. The C-chassis back panel, shown in Figure 1-9, contains one small connector plate and one connection area with space for four individual connectors. It also contains a vent for an internal fan and a combination power-on switch, fuse, and power receptacle. Table 1-9 describes the power and cooling specifications for the C-chassis. Table 1-10 lists the components included with it.

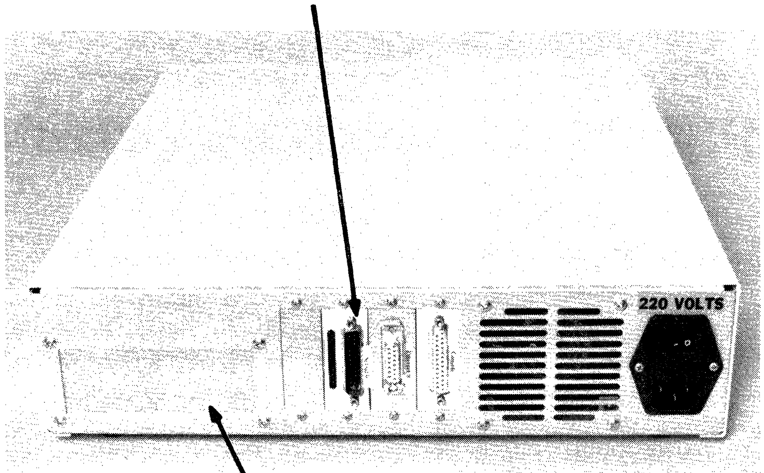


Figure 1-9 The C-Chassis — Rear View

Table 1-9 C-Chassis Specifications

Maximum Power Specifications	
Consumption:	150 watts (510 BTU/hour)
Input:	90 to 265 VAC, Universal Input power supply
Frequency:	47 to 63 Hz (auto ranging)
Rating:	2.3A @ 120V; 1.2A @ 240V
Output Voltage	*U.S.* 25A for +5V; 2A for -5V; 1A for -5V; 2.5A for +12V; and Current2A for -12V
	U.K. 20A for +5V; 2A for +12V; 1A for -12V; 1A for -5V
Cooling	
Thirty cubic feet per minute provided by one fan and an exhaust vent.	

Table 1-10 C-Chassis Component Descriptions

Component	Description
Chassis:	2-slot system bus.
Processor:	MC68020 processor.
Interface Cards:	One MCI interface controller card. Specific restrictions exist on number and type of connections available in the CGS. Please consult the "Network Interface Controller Subsystems" section in Chapter 5 for these restrictions.
System Memory:	Nonvolatile RAM is provided by the CSC-MC extended memory card connected to an MCI card.
External Connectors:	Mounting plates with interface connectors for attachment to various types of networks. Consult Chapter 4 for restrictions on the number of connectors of each type per system.
Documentation:	*Router Products Configuration and Reference*, and *Hardware Installation and Reference* publications.

TRouter

The TRouter is a special configuration M-chassis unit (see Figure 1-6) designed for customers who want the capabilities of a terminal server and a router in a single unit. The TRouter supports 16 asynchronous serial lines and two network ports.

This is a fixed configuration unit. The software will *not* operate if an alternative configuration is used. Table 1-11 lists the components included with the TRouter.

Table 1-11 TRouter Component Descriptions

Component	Description
Chassis:	4-slot system bus.
Processor:	MC68020 processor.
Interface Cards:	Any two Ethernet or serial interfaces. These interfaces must be contained on a single MCI controller.
	One CSC-16 asynchronous serial line card. The terminal lines are attached at the rear of the unit using either RJ-11 or 50-pin Amphenol connectors. Please consult Chapter 5, the Network Interface Controller Subsystems section, for details.
System Memory:	Nonvolatile RAM is provided by a CSC-MC extended memory card connected to an MCI card.
External Connectors:	Mounting plates with interface connection attachment to various types of networks. Consult Chapter 4 for restrictions on the number of connectors for each type per system.
Accessories:	Rack-mount kit that includes screws and two flanges for mounting the chassis in a standard 19-inch rack. The M-chassis slide-mount kit is optional.
Documentation:	*Router Products Configuration and Reference*, *Terminal Server Configuration and Reference*, and *Hardware Installation and Reference* publications.

Cisco Protocol Translator (CPT)

The Cisco Protocol Translator (CPT) is a special configuration C-chassis unit which supports one Ethernet and one synchronous serial port with X.25 as an option.

This is a fixed configuration unit. The software will not operate if an alternative configuration is used. Table 1-12 lists the components included with the CPT.

Table 1-12 CPT Component Descriptions

Component	Description
Chassis:	2-slot system bus.
Processor:	MC68020 processor.
Interface Cards:	One each: Ethernet and X.25 serial attachments *only,* contained on a single MCI controller.
System Memory:	Nonvolatile RAM is supplied to the CPT by a CSC-MC card that is connected to an MCI card.
External Connectors:	Mounting plates with interface connection attachment to various types of networks. The CPT comes equipped with one Ethernet port and one X.25 port.
Documentation:	*Protocol Translator Configuration and Reference,* and *Hardware Installation and Reference* publications.

Product Hardware

This section provides an overview of the printed circuit cards that are installed in the Cisco servers. The product hardware in the Cisco servers includes five types of cards, each with a specific function. Card types include:

- Processor or CPU cards
- System controller cards
- Network interface cards
- Memory cards
- Peripheral device controller cards

The combination of network interface cards in a server determines its operation. The various cards in each category are described in the following sections.

Central Processing Units

The processor card is the supervisor for a router or terminal server. It contains and executes most of the programs that control the router or terminal server.

Table 1-13 lists the specification for the central processing units used in Cisco products.

Table 1-13 CPU Descriptions

Systems	Processor Card	Description
A+ chassis	CSC/3 processor card RAM MC68020	30 MHz w/4MB
A-chassis	CSC/3 processor card RAM MC68020	30 MHz w/4MB
	or	
	CSC/2 processor card RAM MC68020	12.5 MHz w/1MB
M-chassis, C-chassis	CSC/3 processor card RAM MC68020	30 MHz w/4MB
	or	
	CSC/2 processor card RAM MC68020	12.5 MHz w/1MB

System Controllers

The cBus controller, CSC-CCTL, provides two functions for the AGS+. It connects the system bus and the cBus for routing packets from interfaces on the cBus to interfaces on the system bus. It also performs packet switching functions on the cBus using its on-board processor, rather than the system processor.The CSC-CCTL card is required for operation with Cisco's high-speed network interface cards.

The CSC-ENVM, the environmental monitor card, provides nonvolatile memory, system bus memory, and environmental monitoring required for the AGS+ chassis.This card checks input air temperature, air flow through the card cage, and backplane power supplies. If the ambient temperature exceeds 104 degrees F, if intake airflow is restricted, or if any of the voltages drift away from the factory settings, an error is detected, and the ENVM shuts down all processor functions in the chassis (the fan will continue to run). Power is returned by turning off the main switch, waiting 20 seconds, and then turning on the main switch.

Network Interfaces

Network interface cards connect your Cisco Systems network server to one or more networks. Table 1-14 describes the network interface cards available for the router and terminal server products.

Table 1-14 Network Interfaces

System/Chassis	Card	Description
A+	CSC-MEC	Two, four, or six high-speed Ethernet ports; switching rates of over 20,000 pps.
A+	CSC-FCI	Fiber Distributed Data Interface controller card; provides transfer rates of up to 80,000 pps.
A+	CSC-HSCI	One high-speed synchronous serial interface ports; transmission rates of up to 52 Mbps duplex with the HSSI interface, or 125 Mbps duplex with the UltraNet interface.
A+, A, M, and C	CSC-MCI	Two Ethernet and two synchronous serial interface ports; transmission rates up to 4 Mbps on serial ports.
A+, A, and M	CSC-SCI	Four synchronous serial interface ports; transmission rates up to 4 Mbps each.
A+, A, and M	CSC-R	Token Ring interface card; 4 Mbps rate.
A+, A, and M	CSC-R16	Token Ring interface card; 4 or 16 Mbps rate, user-selectable.

Terminal Server Peripheral Device Controllers

The two terminal server interface cards attach peripheral devices to your Cisco Systems terminal server. The CSC-16 interface card supports 16 synchronous RS-232 devices. The CSC-P interface card supports up to two parallel printers, of either the Centronix or Data Products type. Table 1-15 describes the two interfaces available for the terminal server.

Table 1-15 Terminal Server Peripheral Controllers

Card	Systems	Description
CSC-16	A- and M-chassis	16-port synchronous serial line card, rates up to 38.4K baud (per interface).
CSC-P	A-chassis	Parallel printer interface card; supports up to two parallel printers.

Auxiliary Memory

Memory cards provide long term, nonvolatile storage for configuration and data. The CSC-MT enhanced memory card also contains the multibus memory needed by some of the interface cards. Table 1-16 lists the memory cards available for all server products.

Table 1-16 Memory Cards

Card	Systems	Description
CSC-MC	A-type, M-, and C-chassis	Chassis memory card for nonvolatile memory requirements
CSC-MT	A-type and M-chassis	Combination system bus and nonvolatile memory card for CSC-R Token Ring and parallel printer applications
CSC-ENVM	A+ Chassis	Nonvolatile memory and shared buffer memory for the AGS+ configuration

Chapter 2
Preinstallation

Installation of Cisco Systems' routers and terminal servers involves using standard installation procedures and basic tools. We called this chapter "preinstallation" because it provides you with information for preparing your server site, and describes the tasks you need to perform *before* starting actual system installation. Topics covered in this chapter include:

- Procedures for preventing damage from electrostatic discharge
- Tool and equipment requirements,
- Server site environment requirements
- Unpacking instructions

Also included is an installation checklist which lists all installation procedures. Make extra copies and use it as your guide through the process. You may want to start a site log or record book of procedures performed on the system. Guidelines for establishing this record are also included.

Preventing Electrostatic Discharge (ESD) Damage

ESD is a discharge of static electricity that can damage equipment and impair electrical circuitry. It occurs when electronic printed circuit cards are improperly handled and can result in complete or intermittent failures.

Always follow ESD prevention procedures when removing and replacing cards. To remove or insert a card, follow these steps:

Step 1: Slip on an ESD wrist strap, ensuring that it makes good skin contact.

Step 2: Attach the equipment end of the strap to an unpainted chassis frame surface or another proper grounding point or surface; Cisco recommends that you connect it to the inside chassis bottom, or to the back of the chassis without making contact with any appliques or connectors.

Step 3: Use the ejectors to remove the card. Handle the card by its sides. Place the card on an antistatic surface or in a static shielding bag. A defective card must remain in the static shielding bag until returned to Cisco Systems. This prevents further ESD damage.

Step 4: Handle the new card by its edges only. Avoid contact between the card and clothing. The wrist strap only protects the card from ESD voltages on the body; ESD voltages on clothing can still damage the card's integrity.

Step 5: When the card is installed and you are ready to close the chassis, disconnect the clip from the grounding point and remove the wrist strap.

To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. Use an ohmmeter to check the ESD wrist strap periodically to ensure that its conductivity is providing proper ESD protection.

Figure 2-1 and Figure 2-2 show proper grounding using both the alligator clip and the table plug setup used in some manufacturing areas. Either is an acceptable form of grounding to prevent ESD damage.

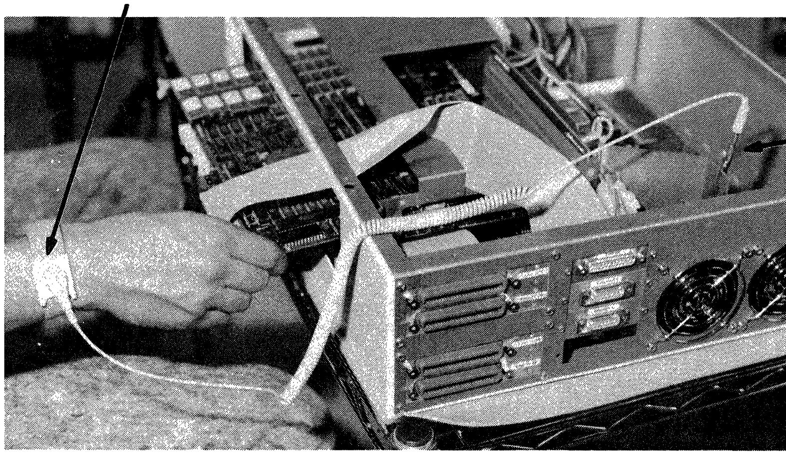


Figure 2-1 ESD Prevention — Alligator Clip

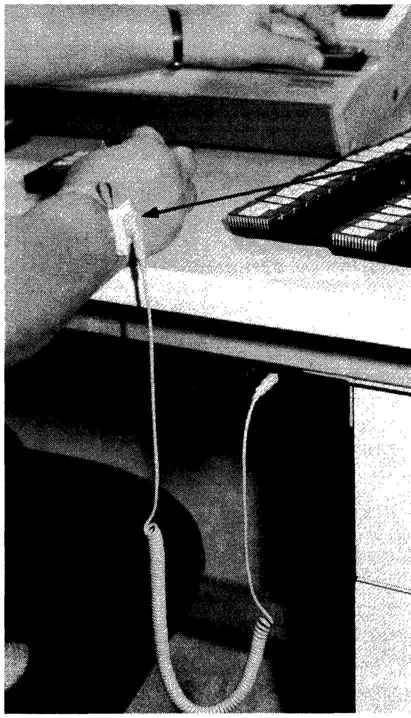


Figure 2-2 ESD Prevention — Manufacturing Table Plug

Tools and Equipment

The following tools and equipment are needed during the receiving, installation, and verification of the Cisco Systems servers:

- ESD wrist strap and, if applicable, cord
- Screwdrivers, Phillips, #0 and #1
- Screwdriver, small slot and standard size
- Chip extractor if replacing EPROMS or PALs
- Voltmeter (AC and DC)

Server Site Requirements

This section describes the requirements for the site at which you will set up your server. Read these requirements before beginning installation.

Environment

The Cisco Systems A-type chassis and M-chassis of the router and terminal server models can be used as table-top or rack-mount equipment in any data processing or lab environment. The A-type chassis has superior cooling and can occupy inhospitable environments such as phone closets or other rooms with minimal ventilation. Because the large cooling fan is rather noisy (approximately 60 decibels), the A-type chassis is designed for unattended or computer room use. The M-chassis offers flexibility in a smaller, office-adapted box. The chassis may be stacked on top of one another. However, when placing the chassis side-by-side, allow ample room between them to prevent the exhaust of one fan from blowing into the intake vent of the next chassis.

The C-chassis uses a quiet fan, and is suitable for an office or desktop environment.

The environmental specifications for all chassis models are as follows:

- Operating temperature range: 0 to 40 degrees Celsius
- Operating humidity range: 5 to 95 percent, noncondensing

Power Voltages

The router and terminal servers are factory-configured for either 110-volt or 220-volt operation. All units include a 6-foot electrical power cord. A label near the power cord indicates the correct voltage for your unit. If the voltage indicated on the label is different from the power outlet voltage, do not plug in the server.

Caution: A voltage mismatch can cause equipment damage and may pose a fire hazard.

Additional Equipment Requirement

You may need some of the following data communication equipment to complete your server installation. Your installation needs depend on many factors, including the interfaces you plan to use, as explained below.

- To install and configure the server, you need a terminal with an RS-232 DTE connector. You may detach the terminal (and cable) after the installation and configuration procedures are complete.

- To use an IEEE 802.3 or Ethernet interface at your installation, you need an 802.3 Media Attachment Unit (MAU) and an Attachment Unit Interface (AUI) cable or an Ethernet transceiver and transceiver cable.These devices may be purchased from Cisco Systems as additional equipment. Contact Cisco Systems for ordering information at the number provided in the "Service and Support" section in the front of this publication.
- To use a low-speed synchronous serial interface at your installation, you need a synchronous modem or a Customer Service Unit/Digital Service Unit (CSU/DSU) to connect to the network. Cisco Systems provides RS-232, RS-449, or V.35 connections or attachments as the electrical interface.
- To attach a server to a T1 network, you need a T1 CSU/DSU. This device converts the HDLC synchronous serial data stream of the server into a T1 data stream with the correct framing and ones density. (The term *ones density* refers to the fact that some telephone systems require a minimum number of 1 bits per time unit in a data stream.) Note that several T1 CSU/DSU combination devices are on the market. Cisco Systems offers a T1 CSU/DSU unit as additional equipment. Contact Cisco Customer Service at the number provided in the "Service and Support" section in the front of this publication. Note also that most T1 CSU/DSUs provide either a V.35 or RS-449 electrical interface to the system.

Unpacking Your System

When your system arrives, check the receiving list that accompanies all shipments to ensure you received all the pieces you ordered. Inspect all items for shipping damage.

If the chassis or any of the cards appear damaged, or if you encounter problems when installing or configuring your system, contact Cisco Systems Customer Service at the number provided in the "Service and Support" section in the front of this guide.

Installation Checklist

Table 2-1 lists all the procedures for initial hardware installation of Cisco servers. Although there may be minor variations between the router and server installation steps, the general procedures are the same.

Make a copy of this checklist and mark your entries as each procedure is completed. Include a copy of the checklist for each system in the site log.

Table 2-1 Cisco Products Installation Checklist

Task	Verified by	Date
Installation checklist copied		
Background information placed in site log		
Required tools available		
Additional equipment available		
Environmental specifications verified		
Router/server power voltages verified		
Installation site pre-power check completed		
Router/servers received		
Documentation received		
Chassis components verified		
Software version verified		
Initial electrical connections established		
RS-232 ASCII terminal attached to console port		
Signal distance limits verified		
Startup sequence steps completed		
Initial system operation verified		

Site Log

The site log provides a historical record of all actions relevant to the system. You may want to start such a document and keep it in a common place near the chassis where anyone who performs tasks has access to it. Site log entries might include:

- Installation progress—Make a copy of the installation checklist and insert it into the site log. Entries should be made on the installation checklist as each procedure is completed.
- Upgrades and Removal/Replacement Procedures—Use the site log as a record of on-going system maintenance and/or expansion history. Each time any procedure is performed on the system, update the site log to reflect:
  - Additional cards
  - Removal or replacement of cards
  - Configuration changes
  - Maintenance schedules and requirements
  - Corrective maintenance procedures performed
  - Intermittent problems
  - Other related comments

Chapter 3
Installation Considerations

This chapter describes electrical connections and cabling limitations you need to consider when planning your network, such as distance and interference considerations, and terminal wiring and connections. For initial configuration information and samples, refer to the *Router Products Getting Started, Terminal Server Configuration and Reference, Protocol Translator Configuration and Reference,* or the *Router Products Configuration and Reference* publications.

This chapter also provides instructions for connecting specific interfaces to the individual Cisco chassis.

Terminal Server Cabling Considerations

When setting up your system, you need to consider a number of factors related to the cabling required for your connections. When using RS-232 connections, be aware of the distance limitations for signaling; electromagnetic interference may also be a factor. For Telco connections, there are a variety of modular connectors from which to choose. Each of these cabling considerations is described in the following sections.

Distance Limitations

As with all signaling systems, RS-232 signals can travel a limited distance at any given bit rate; generally, the slower the data rate, the greater the distance. Table 3-1 shows the standard relationship between bit rate and distance.

Table 3-1 IEEE Standard RS-232C Speed Versus Distance

Data Rate (bps)	Distance (Feet)	Distance (Meters)
2400	200	60
4800	100	30
9600	50	15
19200	25	7.6
38400	12	3.7
56000	8.6	2.6

Interference Considerations

When wires are run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. This fact has two implications for the construction of terminal plant wiring:

- Bad practice can result in radio interference emanating from the plant wiring.
- Strong electromagnetic interference, especially as caused by lightning or radio transmitters, can destroy the RS-232 drivers and receivers in the routers and terminal servers.

If you use twisted-pair cables in your plant wiring with a good distribution of grounding conductors, the plant wiring is unlikely to emit radio interference. When exceeding the distances listed in Table 3-1, use a high quality, twisted-pair cable with one ground conductor for each data signal.

To predict and remedy strong electromagnetic interference, you may need to consult experts in radio frequency interference (RFI).

If you have wires exceeding the distances in Table 3-1, or you have wires that pass between buildings, give special consideration to the effect of a lightning strike in your vicinity. The electromagnetic pulse caused by lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices. If you have had problems of this sort in the past, you may want to consult experts in electrical surge suppression and shielding.

Most data centers cannot resolve the infrequent but potentially catastrophic problems just described without pulse meters and other special equipment. These problems can cost a great deal of time to identify and resolve. Therefore, take precautions to avoid these problems by providing a properly grounded and shielded environment, with special attention to issues of electrical surge suppression.

Terminal Wiring

The following sections contain considerations which may be helpful when planning modular wiring systems.

Modular Connectors

Three types of small connectors used on telephone sets are also used to construct terminal plant wiring:

- A medium-sized six-position connector, with four contacts
- A medium-sized six-position connector, with six contacts
- A large eight-position connector

Note: The medium-sized six-position connector is sometimes called an RJ-11 connector, and the large eight-position connector is sometimes called an RJ-45 connector. Strictly speaking, the "RJ" designation applies only to jacks provided under U.S. telephone tariffs; however, whether connectors or jacks are meant is usually clear from the context.

Generally, you can use the medium-sized connector with four contacts to connect a device that does not need modem control signals. You must use the medium-sized connector with six contacts to connect a device that needs modem control signals, or to provide modem control as an option. Figure 3-1 shows a male six-position connector plug from the front—its noncable end. When this connector is used to carry only four signals, positions 1 and 6 are not used.

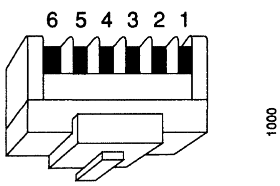


Figure 3-1 Six-Position Modular Plug — Front View

Appendix C lists the usual correspondence between inside plant (wall-box) wiring and the modular-plug pin numbers in Figure 3-1. When you first use modular equipment from a particular manufacturer, check that the wire colors match the color code in Appendix C. Occasional variations are possible; for example, a manufacturer may substitute a slate (grey) wire for a white wire, or may reverse the order of the wires in the wire pairs.

Modular Wiring Systems

Using a standard modular cord between two standard modular connectors reverses the sense of the wire pairs. As a result, the signal attached to pin 3 at one female jack is connected to pin 4 at the other end. Similarly, the signal attached to pin 1 at one female jack is connected to pin 6 at the other end.

These reversals have little importance for voice circuits, but may produce surprising effects for data circuits. To circumvent these effects, follow telephone industry practice throughout the terminal plant wiring and compensate for the pair reversal in the modular-to-DB-25 adapters at the terminal end.

Making Electrical Connections

The Cisco Systems routers and terminal servers employ a modular system of connector panels. The number and types of connectors installed on your system depend on the number of interface cards installed and the connection options chosen. The backpanels of your chassis can accomodate a wide variety of connectors. The positions of these connectors vary with the chassis and the number of connectors of the various types used.

The following sections describe the basic connections required before initial system startup. Refer to the rear-view figures of each chassis in Chapter 1, "Hardware Overview." Complete installation information is found in Chapter 4, "Installing Connectors and Appliques," and Chapter 5, "Installing Interface and System Cards."

Making Connections to the A-Type Chassis

Note: The connector locations described in this section will vary according to the types of interface options selected for your system.

When viewed from the rear, the power cable and power switch (which is also a circuit breaker) appear on the left side of the A-type chassis. The system console port, Ethernet ports, and high-speed serial line ports (if any) appear on connector panels above or to the right of the power cable and switch.

The top, far left RS-232 connector (above the power cable and switch) is the system console port. The auxiliary port, if present, is located directly below.

Ethernet ports are located either to the right of, or below, the console port. The top Ethernet port is labeled *Ethernet 0,* the next port down is labeled *Ethernet 1,* and so on. All standard 15-pin Ethernet transceiver cables and IEEE 802.3 AUI cables mate with these connectors.

Token Ring ports are located either to the right of, or below, the console port. The top Token Ring port is labeled *TokenRing 0,* the next port down is labeled *TokenRing 1,* and so on. All standard 9-pin IEEE 802.5 AUI cables mate with these connectors.

Serial interface ports are located either to the right of, or below, the console port. The top serial port is labeled *Serial 0,* the next port down is labeled *Serial 1,* and so on. Serial ports appear as either V.35, RS-232, or RS-449, or HSSI connectors mounted on either the large or individual backpanel plates, depending on the sizes and numbers of the configured interfaces.

FDDI connectors are located on the right side of the A+ chassis when viewed from the rear.

Making Connections to the M-Chassis

Note: The connector locations described in this section will vary according to the types of interface options selected for your system.

When viewed from the rear, the power cable and power switch (which is also a circuit breaker) appear on the right side of the M-chassis. The system console port, Ethernet ports, and high-speed serial line ports (if any) appear on connector panels to the left of the power cable and switch, in the center of the backpanel.

The top RS-232 connector to the left of the exhaust fan is the system console port. The auxiliary port, if present, is located directly below.

Ethernet ports are located either to the left of or below the console port. The top Ethernet port is labeled *Ethernet 0,* the next port is labeled *Ethernet 1,* and so on. All standard 15-pin Ethernet transceiver cables and IEEE 802.3 AUI cables mate with these connectors.

Token Ring ports are located in the connector panels on the left. The top Token Ring port is labeled *TokenRing 0,* the next port is labeled *TokenRing 1,* and so on. All standard 9-pin IEEE 802.5 AUI cables mate with these connectors.

Synchronous serial interface ports are located adjacent to, or in place of, the Ethernet ports. The top serial port is labeled *Serial 0,* the next port is labeled *Serial 1,* and so on. Serial ports appear as either V.35, RS-232, or RS-449 connectors mounted on the small or individual backpanel plates, depending on the sizes and numbers of the configured interfaces.

Making Connections to the C-Chassis

Note: The connector locations described in the following section will vary according to the types of interface options selected for your system.

When viewed from the rear, the power cable and power switch (which is also a circuit breaker) appear on the right side of the C-chassis. The system console port, Ethernet ports, and high-speed serial line ports (if any) appear on connector panels to the left of the power cable, switch, and fan in the center of the back panel.

The far right RS-232 connector to the left of the exhaust fan is the system console port. The auxiliary port, if present, is located after the console port.

Ethernet ports are located in the connector panels after the console port. The ports are labeled as *Ethernet 0* or *Ethernet 1.* All standard 15-pin Ethernet transceiver cables and IEEE 802.3 AUI cables mate with these connectors.

The Cisco Systems token ring card is not available for the C-chassis.

Synchronous serial interface ports are located adjacent to or in place of the Ethernet ports. The far right serial port is labeled *Serial 0,* the next port is labeled *Serial 1,* and so on. Serial ports appear as either V.35, RS-232, or RS-449 connectors mounted on the small or individual back panel plates, depending on the sizes and numbers of the configured interfaces.

Terminal Server Connections

Connecting terminals to a Cisco Systems server often requires complex wiring plans. It is generally preferable to use existing telephone wiring systems because they:

- Use readily available components
- Take advantage of years of experience
- Capitalize on the availability of trained people for both initial installation and later maintenance and expansion

Refer to Appendix C, "Industry-Standard Wiring Plans," for descriptions of the wiring methods developed by AT&T for the telephone industry.

Smaller systems, especially the MSM and TRouter models, may be configured with RJ-11 jacks in place of the industry standard 25-pair Amphenol connectors. The ASM system may also be configured with RJ-11 jacks.

RS-232 Terminal Server Connections

A variety of similar signaling schemes use the name *RS-232.* The Cisco Systems scheme provides a subset of the full signaling set, which is sufficient to control most modems and hardware flow control schemes. The Cisco Systems scheme provides six signals per line, two of them outputs:

- Ground
- Transmit Data (output)
- Receive Data (input)
- Ring Indicate (input)
- Data Terminal Ready (output)
- Clear to Send (input)

The line drivers are supplied with bipolar 12-volt power; an open output signal will be near +12 or -12 volts. The Receive Data input has a 10-kilo ohm resistor to the -12-volt supply that helps prevent open lines from ringing and causing spurious input to the server. An open Receive Data line will be near -7 volts, but can vary from -6 to -10 volts depending on temperature and component variation.

Chapter 4
Installing Connectors and Appliques

This chapter describes the connectors and appliques available for your Cisco internetworking product, and the procedures to install them.

This chapter is organized as follows:

- Connector Plate Assembly Installation
- Applique Card Cage Installation
- Communications server appliques and connectors
  - RJ-11
  - DB-25 DTE and DCE
  - Telco 50-pin
- Network Server Appliques
  - High-Speed Serial Communications appliques (HSA and ULA)
  - Fiber optic transceiver appliques (single mode, multimode, dual-mode)
  - RS-232 DTE and DCE appliques
  - RS-449 DTE and DCE appliques
  - V.35 dual-mode applique (DCE and DTE)
  - V.35 DTE applique
  - Small V.35 applique
  - Auxilliary port connector

Chassis Cover Removal and Replacement

This section describes the procedures for removing and replacing the chassis covers to gain access to the connector plates on the chassis backplane. You will need screwdrivers with slot sizes 0, 2, and one standard (#1) Phillips screwdriver. Procedures for each chassis type are included.

A-Type Chassis Top Panel

This section describes how to remove and replace the top panel of the A-type (AGS+, AGS, and ASM) system chassis. You must remove the top panel to gain access to the back panel connector plates and make internal cable connections.

Refer to Figure 4-1 when performing the following procedures.

A-Type Chassis Top-Panel Removal

Step 1: Locate the seven screws securing the top panel to the chassis; three are located on each of the two sides of the cover, and one at the back.

Step 2: Remove the rear, middle screw first, then the other six screws.

Step 3: Lift the top cover up and away from the chassis.

A-Type Chassis Top-Panel Replacement

Step 1: Replace the cover with the bent lip at the front of the chassis.

Step 2: Replace the screws beginning with the back one. Turn the screws only a few turns to secure.

Step 3: Make sure the screw holes are aligned properly. When all screws are in place, tighten them.

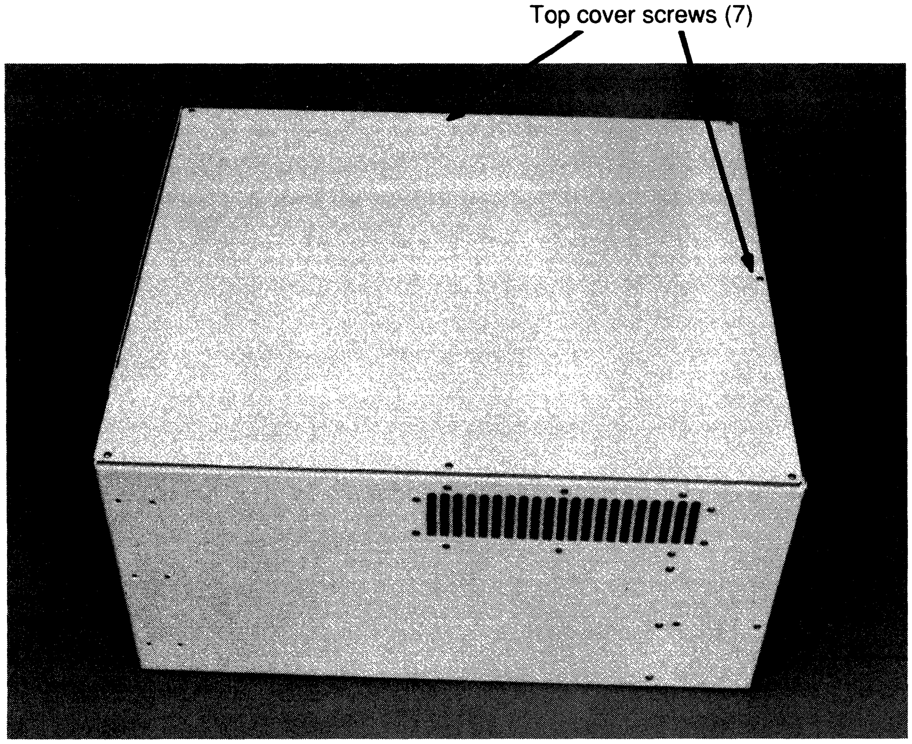


Figure 4-1 A-Type Chassis Top-Panel Removal and Replacement

M-Chassis Top Panel

This section describes how to remove and replace the top panel of the MSM and MGS system chassis. You must remove the top panel to gain access to the back panel mounting plates and make internal cable connections.

Refer to Figure 4-2 when performing the following procedures.

M-Chassis Top-Panel Removal

Step 1: Remove the card cage access panel. First loosen the three Phillips screws at the bottom of the panel, then turn the top fasteners three quarters of a turn counterclockwise.

Step 2: Locate the 14 screws which secure the top panel to the chassis; there are four on each of the two sides of the cover, three at the back, and three at the front of the chassis.

Step 3: Remove all screws beginning with the back ones.

Step 4: Lift the cover up and away from the chassis.

M-Chassis Top-Panel Replacement

Step 1: Replace the cover on the chassis, making sure to align the access panel slots with the tabs (on the right side, as viewed from the front).

Step 2: Replace the screws, beginning with the back ones. Turn the screws only a few turns to secure.

Step 3: When all screws are in place, tighten all screws.

Step 4: Replace the card cage access panel.

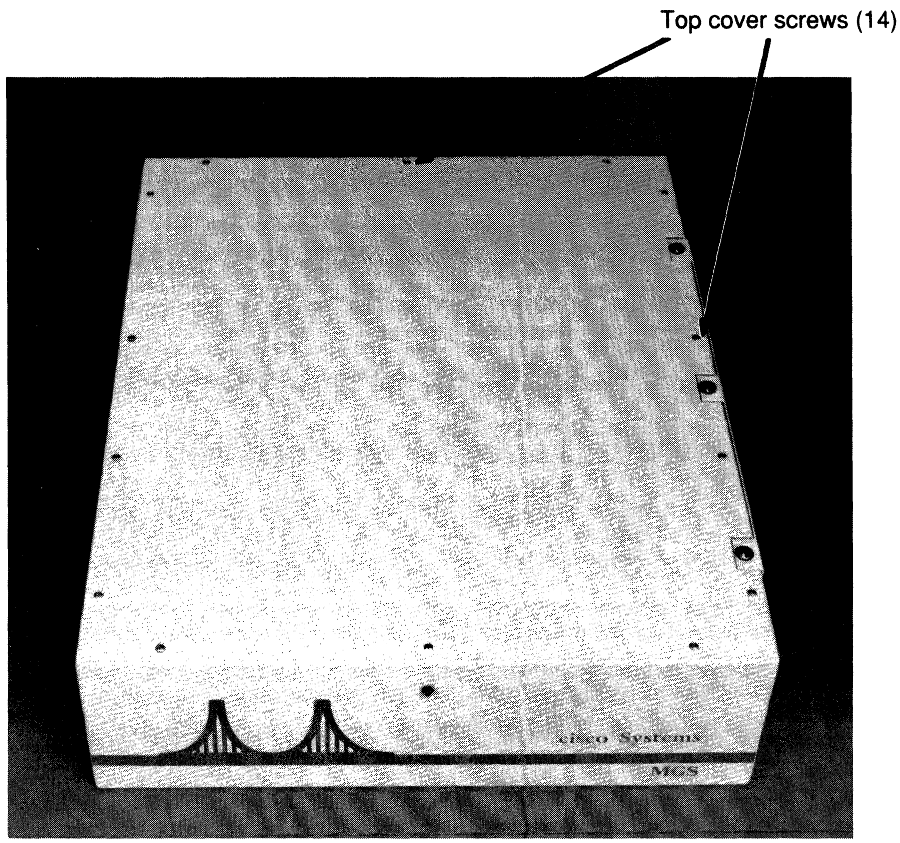


Figure 4-2 M-Chassis Top-Panel Removal and Replacement

C-Chassis Cover

This section describes how to remove and replace the cover on the CGS system chassis. There is no external access to the card cage on the C-chassis. You must remove the cover to gain access to the cards, back panel mounting plates, and internal cable connections.

Refer to Figure 4-3 when performing the following procedures.

C-Chassis Cover Removal

The cover on a C-Chassis system envelopes the chassis and is secured by ten screws, six on the bottom and two on each side.

Step 1: Remove the two screws on each of the two sides of the cover.

Step 2: Turn the system upside down and remove the six cover screws, beginning with those nearest the back.

Step 3: Use a flat-blade screwdriver to gently lift the back end of the chassis away from the cover.

Step 4: Pull the cover toward the front of the system to remove.

C-Chassis Cover Replacement

Step 1: Turn the CGS system so that the back panel is down, and the front of the chassis is pointing up.

Step 2: Position the cover so the angled end will meet the front of the frame (the squared end goes on first).

Step 3: Slip the cover over the chassis and push down firmly. You are inserting a lip at the back of the cover into a rim on the chassis. (It may be necessary to loosen the four screws securing the fan; if so, be sure to retighten the fan screws once the cover is replaced.)

Step 4: Replace the screws, beginning with those in the back. Turn the screws only a few rotations to secure.

Step 5: Make sure the screw holes are aligned properly. When all screws are in place, tighten them.

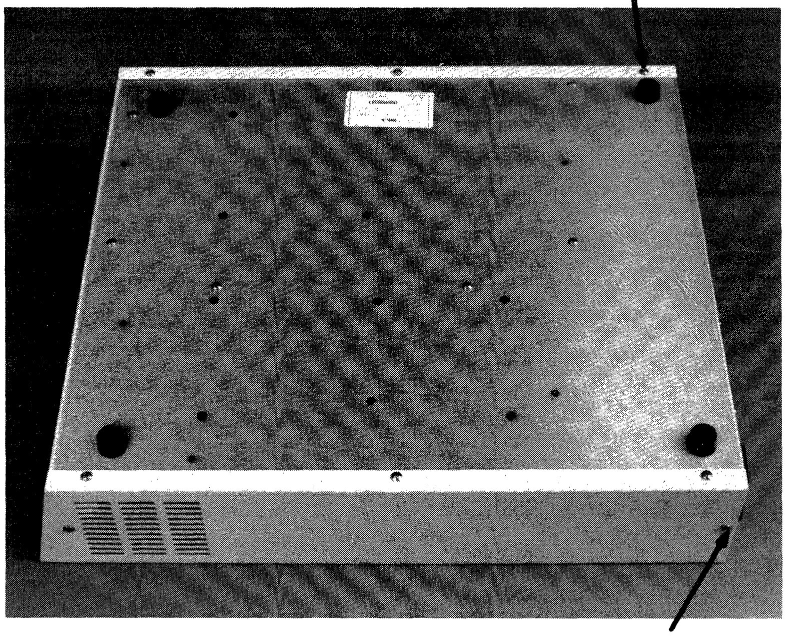


Figure 4-3 C-Chassis Cover Removal and Replacement — Bottom View

Connector Plate Assembly Installation

This section describes how to attach connector plate assemblies to the back of your Cisco system. Installation procedures for each chassis type and the individual connectors are included. This section is for installing new connectors and appliques in an existing system. You will need a standard (#1) Phillips screwdriver to perform the procedures that follow.

Note: If you are installing an FDDI or HSCI applique, you must first install an applique card cage, described in the next section.

Table 4-1 shows the maximum number of connector plates that each size chassis can accommodate.

Table 4-1 Connectors and Appliques Supported Per Chassis

Chassis	Large Plates	Small Plates	Individual	App Card Cages
A+ chassis	4*	0	6	2
A-chassis	4*	0	6	0
M-chassis	0	2	4	0
C-chassis	0	1	4	0

* On the A-chassis, the large connector spaces on the far left (as viewed from the rear of the chassis) have internal obstructions that preclude some configurations of RS-232, RS-449, and V.35 appliques, and prevent installation of an applique card cage in those two spaces.

Disconnect Power

Before starting any of the installation procedures in this chapter, turn off the chassis power switch, and unplug the power cord from the wall receptacle. When handling system cards, always take precautions to avoid electrostatic discharge damage.

A-Type Chassis Connector Plate Assemblies

As shown in Figure 4-4, the A-type chassis has four large connector areas and one large individual connection area with space for six individual connector plates. The console port connector uses one of the individual connector spaces, which leaves five plates available for Ethernet, Token Ring, or synchronous serial applique attachments. The large connector plates are used for multiple or large connector attachments. When applique card cages are installed, one or both of the right-most two plates, as viewed from the back of the chassis, are replaced by the card cage and applique face plates. When ordering spares or replacements from the factory, specify the configuration of the connectors and plates that you require.

Figure 4-5 shows the location of the screws needed for removing the filler plates and installing the connector plates on the A-type chassis.

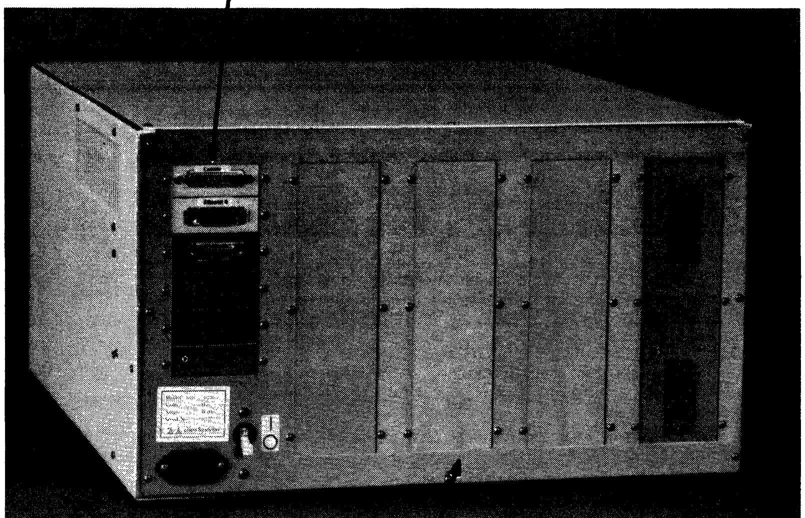


Figure 4-4 A-Type Chassis Connector Plates

Installing Large Connector Plates on the A-Type Chassis

Remove the chassis top panel before starting these procedures. Complete instructions for top-panel removal and replacement begin on page 4-3.

Step 1: Remove the six screws securing the filler plate to the back panel. Hold the plate from inside the chassis when removing the last two screws.

Step 2: Place the connector plate assembly on the inside of the back panel and align the screw holes.

Step 3: Replace the six screws to secure the connector plate in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector plate. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to interfere with the airflow or electrical grounding and safety.

Step 5: Replace the chassis top panel.

Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connections.

Installing Individual Connector Plates on the A-Type Chassis

Remove the chassis top panel before starting these procedures. Complete instructions for top-panel removal and replacement begin on page 4-3.

Step 1: Remove the two screws securing the filler plate. Hold the plate from the back while removing the screws. Remove the filler plate.

Step 2: Place the connector plate assembly on the inside of the back panel and align the screw holes.

Step 3: Replace the two screws to secure the connector panel in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to restrict the airflow; always preserve the integrity of electrical grounding and safety.

Step 5: Replace the chassis top panel.

Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connections.

M-Chassis Connector Plate Assemblies

As shown in Figure 4-5, the M-chassis has two small connector plates and one individual connection area with space for four connectors. The console port connector uses one of the individual connector plate spaces, which leaves three plates available for Ethernet, Token Ring, or synchronous serial attachments. The small connector plates are used for multiple or large connector attachments. When ordering spares or replacements from the factory, specify the configuration of connectors and connector plates that you require.

Figure 4-5 shows the location of the screws for removing the connector plates and installing the appliques on the M-chassis.

Figure 4-5 M-Chassis Connector Plates

Installing Small Connector Plates on the M-Chassis

Remove the chassis top panel before starting these procedures. Complete instructions for chassis top-panel removal and replacement begin on page 4-3.

Step 1: Remove the four screws securing the filler plate to the back panel. Hold the plate from the back when removing the last two screws. Remove the filler plate.

Step 2: Place the connector plate assembly at the inside of the back panel and align the screw holes.

Step 3: Replace the four screws to secure the connector plate in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector plate. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to restrict the airflow; always preserve the integrity of electrical grounding and safety.

Step 5: Replace the chassis top panel.

Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connection.

Installing Individual Connector Plates on the M-Chassis

Remove the chassis top panel before starting these procedures. Complete instructions for chassis top-panel removal and replacement begin on page 4-3.

Step 1: Remove the two screws securing the filler plate. Hold the plate from the back while removing the screws. Remove the filler plate.

Step 2: Place the connector plate assembly inside of the back panel and align the screw holes.

Step 3: Replace the two screws to secure the connector plate in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to restrict the airflow; always preserve the integrity of electrical grounding and safety.

Step 5: Replace the chassis top panel.

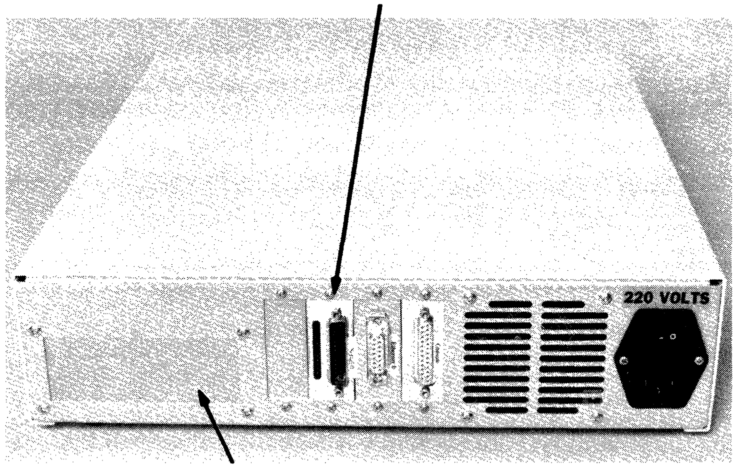
Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connections.

C-Chassis Connector Plate Assemblies

As shown in Figure 4-6, the C-chassis has one small connector plate and one individual connection area with space for four connectors. The console port connector uses one of the individual connector plate spaces, which leaves three plates available for Ethernet or synchronous serial attachments. The small connector plate is used for multiple or large connector attachments. When ordering spares or replacements from the factory, specify the configuration of connector and plates that you require.

Figure 4-6 also shows the location of the screws for removing the filler plate and installing the applique on the C-chassis.

Individual connector area



Small connector plate

Figure 4-6 C-Chassis Connector Plate

Installing a Small Connector Plate on the C-Chassis

Step 1: Remove the chassis cover before starting these procedures. Complete instructions for chassis cover removal and replacement begin on page 4-4. Remove the four screws securing the plate to the back panel. Hold the plate from the back when removing the last two screws.

Step 2: Place the connector plate assembly at the inside of the back panel and align the screw holes.

Step 3: Replace the four screws to secure the connector plate in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector plate. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to restrict the airflow; always preserve the integrity of electrical grounding and safety.

Step 5: Replace the chassis top cover.

Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connection.

Installing Individual Connector Plates on the C-Chassis

Remove the chassis top cover before starting these procedures. Complete instructions for chassis cover removal and replacement begin on page 4-4.

Step 1: Remove the two screws securing the filler plate. Hold the plate from the back while removing the screws. Remove the filler plate.

Step 2: Place the connector plate assembly at the inside of the back panel and align the screw holes.

Step 3: Replace the two screws to secure the connector plate in place.

Step 4: Internally, attach the cable from the appropriate card or port to the inside of the connector. In general, route cables under the card cage through the space provided, and then up to the controller card where they attach. Be careful not to restrict the airflow; always preserve the integrity of electrical grounding and safety.

Step 5: Replace the chassis top cover.

Step 6: Externally, attach the appropriate interface cable from the applique connector to your network connection.

Applique Card Cage Installation

The applique card cage is required for installation of the HSA and ULA appliques, part of the HSCI option, and for single-mode and multimode fiber appliques, part of the FDDI options available for AGS+ system. This card cage replaces an older card cage configuration, which is now obsolete. All appliques for the HSCI and FDDI options are now shipped with the new card cage.

Caution: This card cage requires a unique face plate for each applique. If you are replacing an old card cage with a new one, the old card cage should contain one applique. That applique needs a new face plate in order to fit into the new card cage. Before beginning this procedure, ensure that you have the correct face plate for each applique. If you are not certain you have the correct face plates, contact Cisco Systems Customer Service at the number provided in the "Service and Support" section in the front of this guide.

Before installing this card cage, determine if you must replace an older card cage in your system, if any. Both the old and new card cages can each contain either one or two appliques. An existing card cage is replaced only when it currently contains only one applique, and a second applique is being added. It is not necessary to replace existing card cages that already contain two appliques. If the chassis currently contains only one card cage, the new card cage is installed without disturbing the existing one. Use the following scenarios to determine whether or not you need to replace an existing card cage.

- *The chassis currently contains only one card cage in which one FDDI applique is already installed, and you are installing one new applique.* The existing card cage is replaced with a new card cage. A new face plate (shipped with the new card cage) is attached to the existing FDDI applique. Both appliques are installed in the new card cage.
- *The chassis currently contains two card cages, one of which has only one FDDI applique installed, and you are installing one new applique.* The card cage with one applique is replaced with a new card cage. A new face plate (shipped with the new card cage) is attached to the existing FDDI applique, which is installed in the new card cage along with the new applique. The older card cage, which already contains two appliques, remains as-is.
- *The chassis contains two card cages, both of which contain two appliques.* No additional appliques can be installed. The chassis already contains the maximum number possible.

Opening the Chassis

Before removing any cables or fasteners from the chassis, be sure to turn off the chassis power switch, and unplug the power cord from the wall receptacle. As screws or other fasteners are removed, put them aside in a safe place; they are needed to reassemble the chassis and install the new card cage.

Before proceding, remove the top cover of the chassis by removing the seven screws on the top of the chassis and loosening (not removing) the two thumb fasteners on the front panel.

Removing the Old Card Cage

The steps in this section are necessary only if you are replacing an existing card cage that contains an applique. If you are installing a new card cage into unoccupied space, skip this section and proceed to the next section, "Installing a New Card Cage."

Step 1: You will have to disconnect all of the external cables which are attached to the applique in the card cage that is to be replaced. Before doing so, label each cable to avoid crossing them later.

Step 2: Disconnect all external cables from the applique.

Step 3: Label the internal cables connected to the applique to be removed.

Step 4: If you are removing an FDDI (LMM, LMS, LSM, or LSS) applique, disconnect the four internal cables from the connectors on the system card.

Caution: Do not attempt to disconnect the cables from the applique; they are permanently attached!

Step 5: If you are removing an HSA or ULA applique, disconnect the internal ribbon cables from the applique connector.

Step 6: Remove the card cage by removing the six screws that secure it to the back panel of the chassis.

Step 7: Remove the applique from the old card cage by firmly grasping the edge of the card, and sliding it (pulling it) towards the front of the chassis.

Step 8: If necessary, install the new face plate on the applique you just removed.

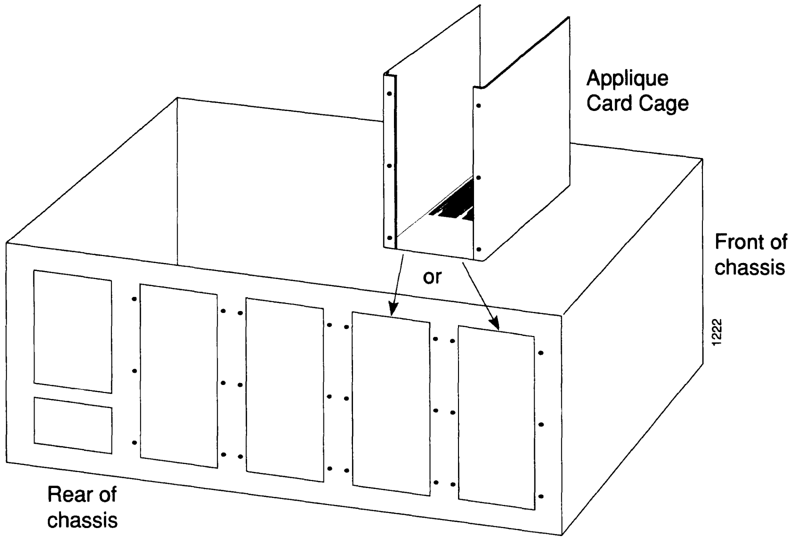


Figure 4-7 Applique Card Cage Placement

Installing a New Card Cage

The applique card cages are installed in the empty space in the rear of the chassis, on the right side as viewed from the rear of the chassis, as shown in Figure 4-7. Up to two applique card cages can be installed in this space.

Step 1: For each card cage you are installing, remove one large filler plate from the back of the chassis.

Note: If *replacing* an applique card cage, place the new card cage in the same location the old one occupied.

Step 2: Remove the top cover of the applique card cage by loosening the four fasteners that secure it.

Step 3: Install an applique, with its attached face plate, into the left side of the card cage (as viewed from the rear of the chassis, shown in Figure 4-7). Ensure that the tab on the bottom of the applique card face plate is inserted into the slot in the bottom of the applique card cage, and that the card is seated in the card guide (see Figure 4-8).

Step 4: Place the applique card cage inside the rear of the chassis. Align the holes in the chassis back panel and those in the applique card cage, and secure the card cage with the screws removed in step 1.

Step 5: Connect the appropriate internal ribbon cables to the applique.

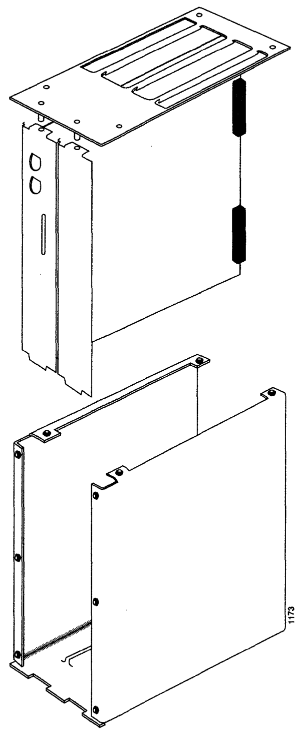


Figure 4-8   Applique Card Cage

Step 6: If you are installing a second applique, install it into the right side of the card cage by sliding it down so that the face plate interlocks with the face plate of the applique on the left of the card cage. As with the first applique, ensure that the tab on the bottom of the applique card face plate is inserted into the slot in the bottom of the applique card cage, and that the card is seated in the card guide (see Figure 4-8). If you are installing only one applique, install a blank filler plate on the right side of the card cage, sliding it down so that the edge interlocks with the face plate of the applique on the left.

Step 7: Replace the top cover of the applique card cage. Ensure correct alignment of the cover with the two guide pins on the bottom of the cover, which should pass through the tabs on the top of each face plate and filler plate (see Figure 4-8). Secure the top cover to the card cage and tighten the four fasteners.

Step 8: If you are reinstalling an applique, reconnect the cables as they are labeled.. If you are installing a new applique, refer to its accompanying documentation for cabling instructions.

Step 9: Replace the top cover of the chassis.

Step 10: Replace and/or install the external cables on the back of the chassis.

Communications Server Appliques and Connectors

Cisco Systems terminal servers support a variety of connection formats for RS-232 asynchronous terminal lines. These connectors attach to the back of your chassis, and provide connections for the CSC-16 serial line card. Table 4-2 shows the different connector formats available as well as chassis port availability. Appendix B lists the pinouts for each connector.

Table 4-2 RS-232 Terminal Server Line Limitations

Connector Type	Chassis	Maximum No. Ports
RJ-11	ASM	96
RJ-11	MSM	32
DB-25 DTE (enclosed male)	ASM	32
DB-25 DCE (enclosed female)	ASM	32
Telco (50-pin)	ASM	96
Telco (50-pin)	MSM	32

RJ-11

Cisco Systems also supports RJ-11 appliques, which replace the Telco and harmonica (Telco to RJ-11) connectors for smaller systems. Figure 4-9 shows the large RJ-11 applique for the A-type chassis; Figure 4-10 shows the small version for the M-chassis. The RJ-11 jacks are available in groups of 16 or 32 for the small and large connector plates, respectively.

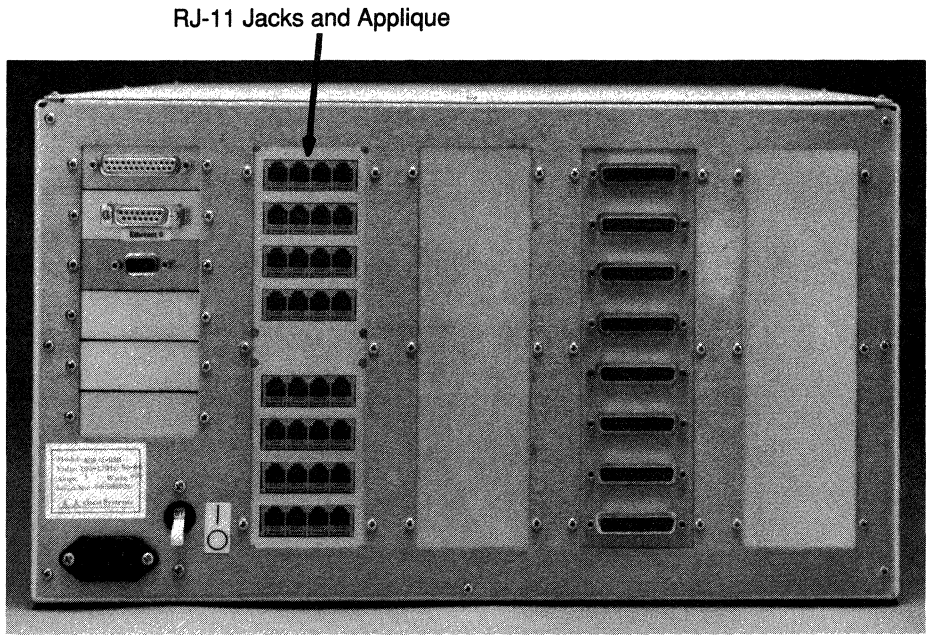


Figure 4-9 RJ-11 Jacks and Applique, Large Connector Plate

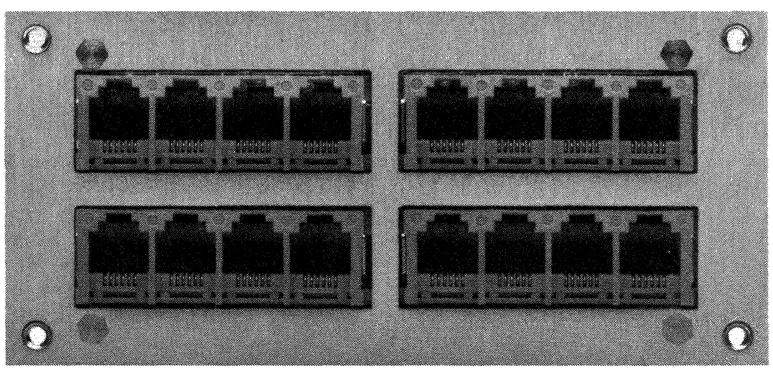


Figure 4-10 RJ-11 Jacks and Applique, Small Connector Plate

DB-25

In addition, Cisco Systems offers the enclosed DB-25 connectors, also known as the DB-25 DTE applique. This applique supports eight ports in either DTE or DCE configurations. The enclosed DB-25 connectors are available on the A-type chassis only. "Enclosed DB-25" refers to a connector plate assembly that holds eight RS-232 (DTE or DCE) connections only. Figure 4-11 shows the enclosed DB-25 connectors.

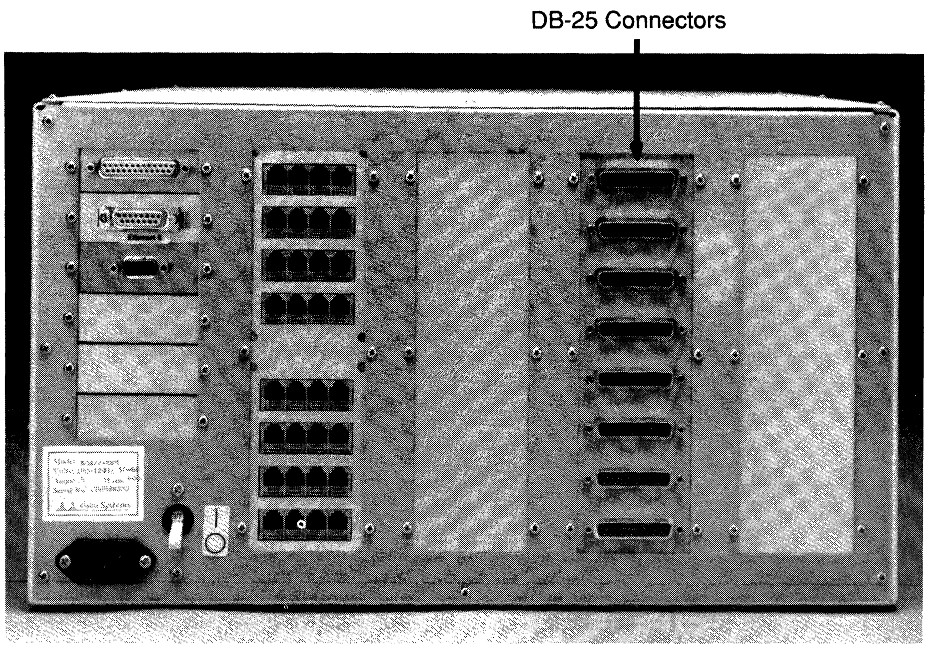


Figure 4-11 Enclosed DB-25 Connectors and Applique

Optional octopus connectors (Telco to DB-25) from Cisco Systems expand one Telco connector into eight male or female DB-25 connectors. The Telco connector, shown in Figure 4-13, provides one 50-pin connector that controls eight DB-25 male or female connectors.

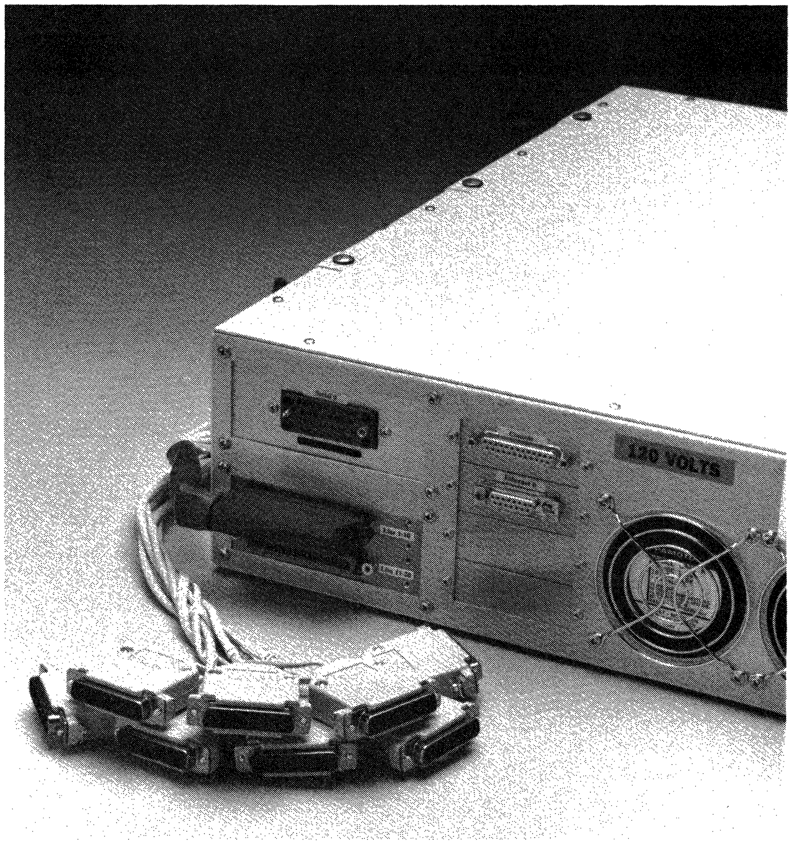


Figure 4-12 Telco Connector Assembly

Telco 50-pin

The Telco 50-pin connector, shown in Figure 4-13, mates to a high-density cable that supports eight lines per connector. The Telco connector is also referred to as the 50-pin Amphenol connector. It is intended for connection to a building wiring plant, usually composed of Telco type-66 punchdown blocks. The terminal server side of the Telco connector cable is secured by a velcro strap as seen in Figure 4-14.

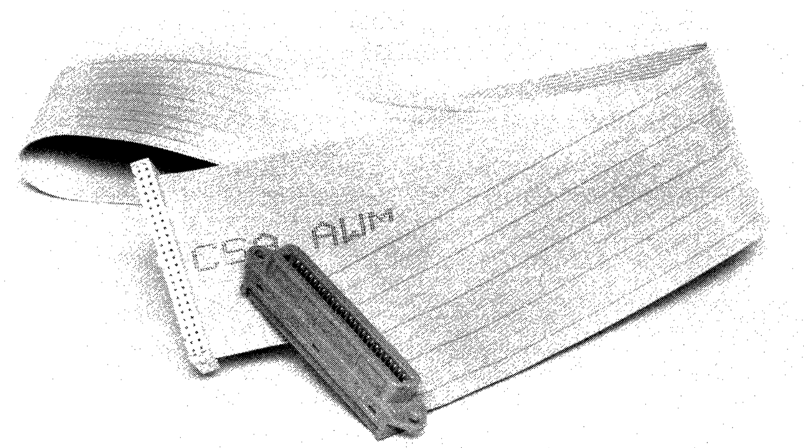


Figure 4-13 Telco Connector

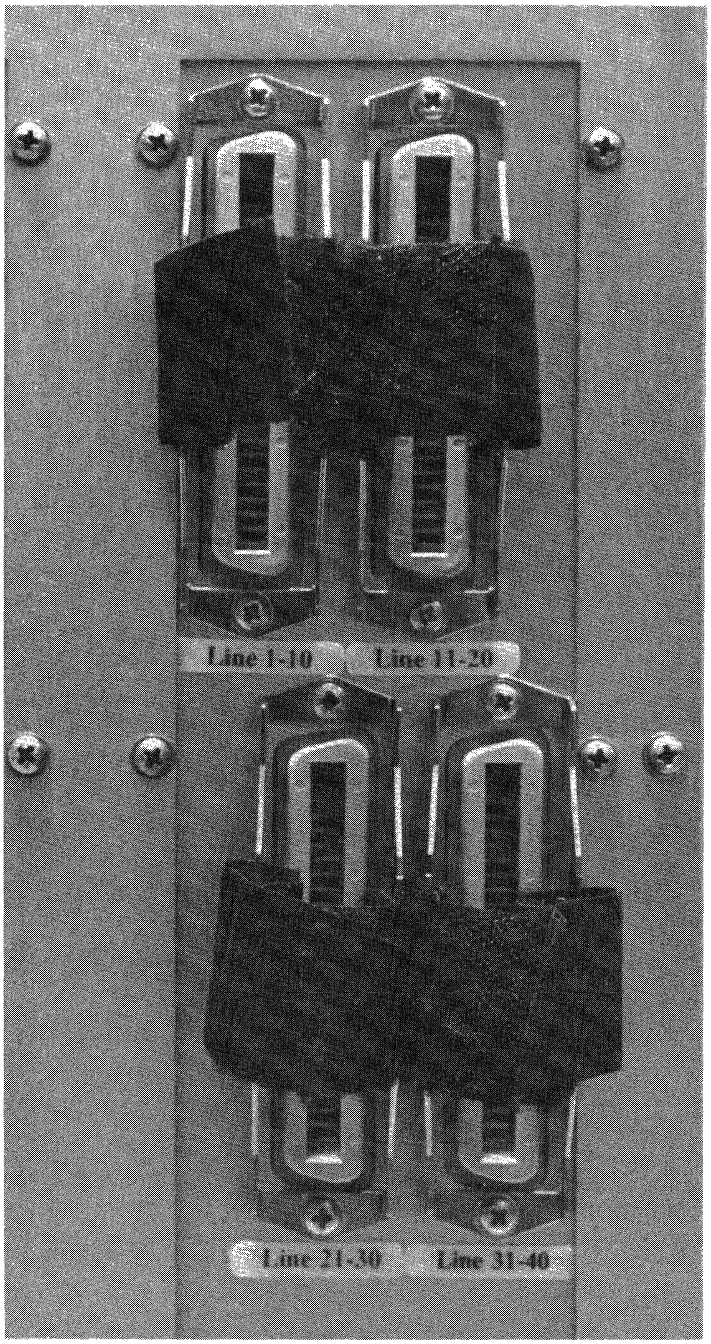


Figure 4-14 Telco Connector Velcro Strap

Network Server Appliques and Connectors

Appliques are assembled units which contain a circuit card and connector hardware, and which are mounted on the back of the chassis to provide the connection to a specific network. Inside the chassis, a ribbon cable connects each applique to a network interface card inside the system card cage.

In the AGS+ chassis, the FDDI, HSA, and ULA appliques are mounted in an applique card cage, which is mounted in the rear of the AGS+ chassis. Each applique card cage can hold one or two FDDI, HSA, or ULA appliques. Other appliques, and all appliques in the smaller M- and C-chassis, are mounted on connector plates on the rear of the chassis. Depending on the applique type and the size of your system, from one to eight appliques can be mounted on a single connector plate. Three plate sizes are available: large, small, and individual. A ribbon cable connects these appliques to a serial network interface card inside the system card cage.

At present, Cisco Systems manufactures the following appliques in conformance to industry standards:

- Fiber optic transceivers for multimode and single-mode FDDI
- High-Speed Communications Interface appliques for HSSI and UltraNet networks
- RS-232 (DTE and DCE) appliques
- RS-449 (DTE and DCE) appliques
- V.35 dual-mode applique (DTE and DCE)
- V.35 DTE applique

The RS-232 and RS-449 appliques come in both DTE and DCE formats. Cisco's first V.35 applique was DTE only. Cisco also manufactures a V.35 dual-mode applique, which supports both DTE and DCE in a single unit. The mode is set by the type of cable that is connected to it, DTE or DCE. RS-232 is recommended for speeds of 64 kilobits per second and below. Above these speeds, you should use the V.35 or RS-449 appliques. Table 4-3 shows the number and type of appliques that each size connector plate can support.

Table 4-3 Network Interface Appliques Supported Per Connector Plate

Applique	Large	Small	Individual
FDDI (A+ chassis only)	2 (w/card cage)	0	0
HSA (A+ chassis only)	2 (w/card cage)	0	0
ULA (A+ chassis only)	2 (w/card cage)	0	0
RS-232	8, 6, 4, 2	4, 2	1
RS-449	4, 3, 2, 1	2, 1	0
V.35 (small)	8, 6, 4, 2	4, 2	1
V.35	4, 3, 2, 1	1	0

Attaching an RS-232, RS-449, or V.35 applique to a modem or CSU/DSU almost always requires the DTE format. The DCE format attachment is also available from Cisco Systems.

Some interface types do not require the signal translation that an applique provides. For example, in the case of Ethernet or Token Ring, there is a specialized internal cable that connects the interface card to the connector on the back of the chassis. Attached to the end of the cable is a connector appropriate for the kind of interface supported.

Table 4-4 shows the number of interface connectors that each size connector plate can accommodate.

Table 4-4 Network Interface Connectors Supported per Connector Plate

Interface Connectors	Large Plates	Small Plates	Individual
Ethernet	8, 6, 4, 2	4, 2	1
Token Ring	2,4,6	0	1

Applique Descriptions

This section describes the following types of industry-standard appliques manufactured by Cisco Systems: HSSI, fiber optic, RS-232 (DTE and DCE), RS-449 (DTE and DCE), V.35 DTE, and V.35 dual-mode applique. It includes the specific limits on the number of each type of applique attachments that each chassis supports, jumper settings, and cabling limitations. Appendix B lists the pinouts for the applique connectors.

Fiber-Optic Transceiver Applique

The Cisco fiber-optic module is made up of the CSC-FCI controller card and the fiber-optic transceiver appliques. The CSC-FCI card is described in general in Chapter 1, "Hardware Overview," and in more detail in Chapter 5, "Installing Interface and System Cards."

The fiber-optic transceivers, which reside on appliques, provide the interface between external network connections and the internal FDDI network interface card. The four applique configurations are shown in Figure 4-15 through Figure 4-18; each provides a unique combination of FDDI media interfaces. The four mode combinations are:

- PHY-A multimode, PHY-B multimode (APP-LMM)—see Figure 4-15.
- PHY-A multimode, PHY-B single mode (APP-LMS)—see Figure 4-16.
- PHY-A single mode, PHY-B multimode (APP-LSM)—see Figure 4-17.
- PHY-A single mode, PHY-B single mode (APP-LSS)—see Figure 4-18.

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

The single-mode transceiver provides connectivity to single-mode FDDI fiber for distances up to 10 kilometers. The connector is a simplex FC-type interface that accepts standard 8.7- to 10/125-micron single mode fiber-optic cable.

The multimode connectors are FDDI-standard Physical Sublayer (PHY) connectors that serve to encode and decode the data into acceptable formats for transmission. The connectors accept FDDI standard 62.5/125 micron multimode fiber-optic cable using the Media Interface Cable (MIC). With appropriate cable terminators, the applique can accept 50/125 micron fiber-optic cable.

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

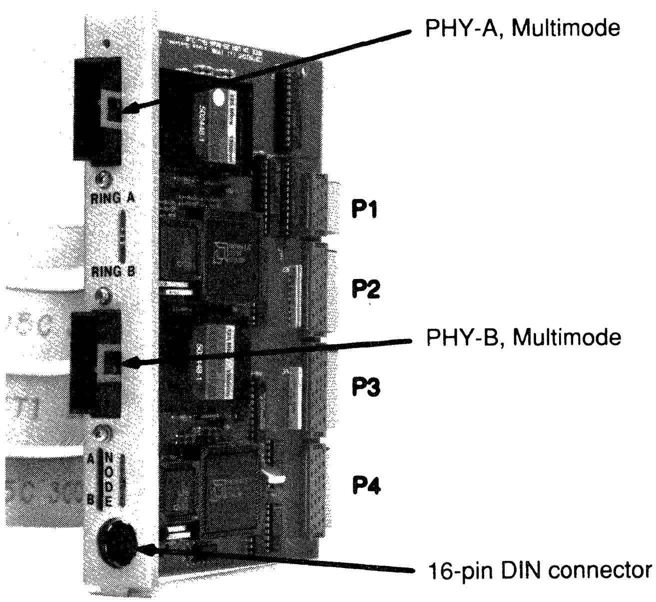


Figure 4-15 FDDI Applique, Multimode/Multimode

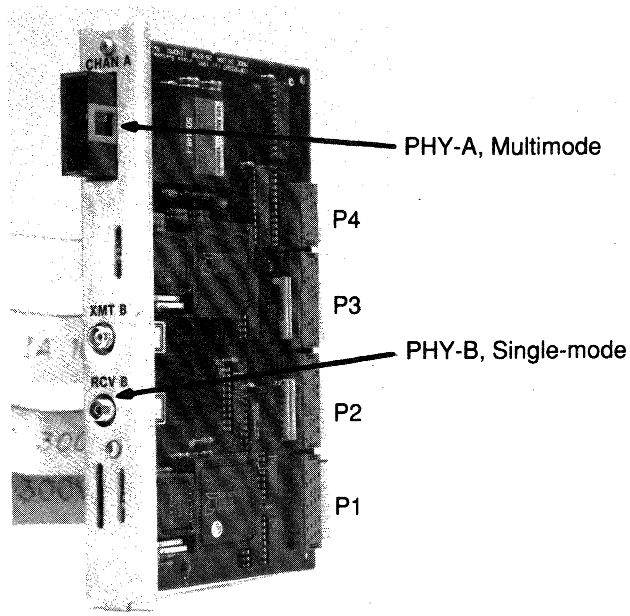


Figure 4-16 FDDI Applique, Multimode/Single Mode

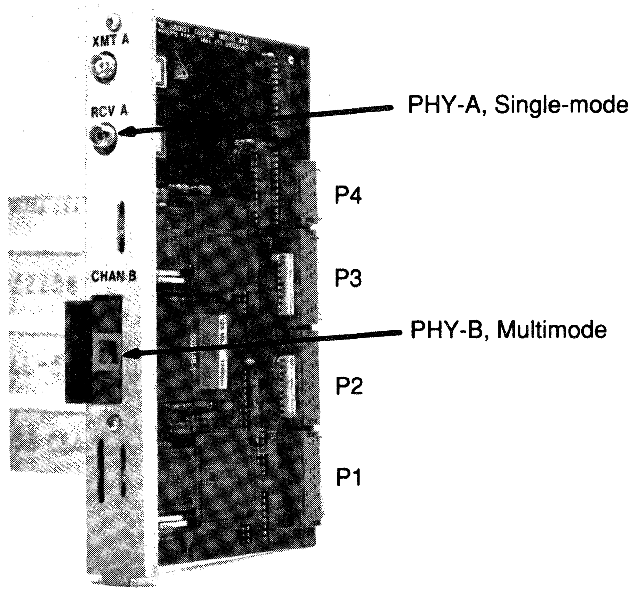


Figure 4-17 FDDI Applique, Single Mode/Multimode

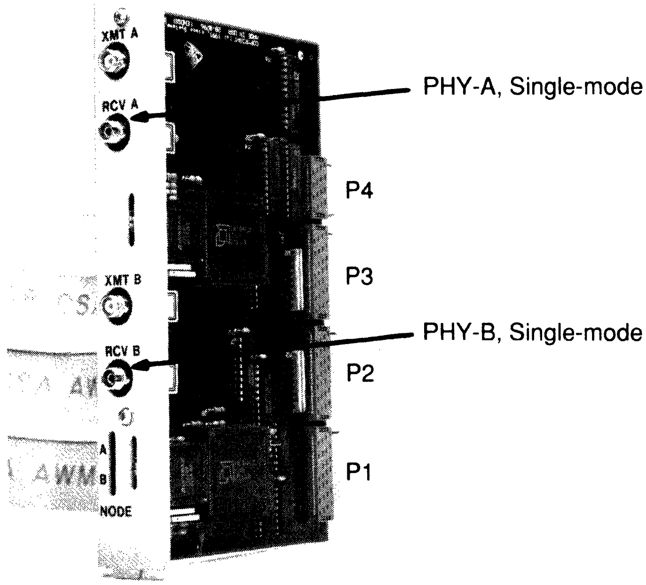


Figure 4-18 FDDI Applique, Single Mode/Single Mode

Installing the Fiber-Optic Transceiver Applique

You will need a standard (#1) Phillips screwdriver and an ESD-prevention wriststrap to perform the procedures that follow.

Warning: INVISIBLE LASER RADIATION WHEN OPEN — DO NOT STARE INTO BEAM. This product contains a Class A semiconductor laser, which complies with 21CFR Chapter 1, Subchapter J, Class 1 of Federal Regulation Rules.

The FDDI applique is installed in an applique card cage, which should already be installed in your AGS+. One or two applique card cages can be installed in an AGS+, and each cage can hold one or two appliques. Refer to the section titled "Applique Card Cage Installation," earlier in this chapter, for further information.

Step 1: Remove the top cover of the AGS+.

Step 2: Remove the top cover of the applique card cage by loosening the four thumb fasteners that secure it.

Step 3: If the card cage is empty, remove both filler plates from the rear. If an applique is currently installed, leave it intact and remove only the filler plate.

Step 4: Internally, the four ribbon cables are fixed to the applique, and must be routed and attached to ports on the CSC-FCI control card.The ribbon cables are labeled P1-P4 at the control card end; the correct control card port for each cable is provided inTable 4-5.To avoid crossing cables, individually route each cable under the main card cage through the space provided, and then up to the corresponding controller card connector. Be careful not to restrict the airflow and always preserve the integrity of electrical grounding for safety.

Step 5: If the card cage is empty, install the FDDI applique, with its attached face plate, into the left side of the card cage. Position the applique so the status LEDs are on the bottom. Ensure that the tab on the bottom of the applique face plate is inserted into the slot in the bottom of the applique card cage, and that the applique is seated in the card guide (see Figure 4-8). If you are installing only one applique, replace the blank face plate on the right side of the card cage, sliding it down so that the edge interlocks with the face plate of the applique on the left.

Step 6: If the FDDI is the second applique in the card cage, install it in the right side of the card cage by sliding it down so that the face plate interlocks with the face plate of the applique on the left of the card cage. Insert the applique into the card cage with the status LEDs on the bottom. Ensure that the tab on the bottom of the applique card face plate is inserted into the slot in the bottom of the applique card cage, and that the applique is seated in the card guide.

Table 4-5 FDDI Cable Designations

Connect Cable:	To Control Card Port:
FDDI A	P3
FDDI B	P2
FDDI C	P1
FDDI D	P4

Step 7: Replace the top cover of the applique 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 applique and face plate assembly (see Figure 4-8). Secure the top cover to the card cage with the four thumb fasteners loosened in step 1.

Step 8: If you have an optical bypass switch, plug the bypass switch into the DIN connector on the multimode/multimode applique (see Figure 4-15), then plug the fiber-optic cables into the MIC connectors on the optical bypass switch. Up to 100 milliamperes of current may be supplied to the optical bypass switch.The pinouts for the DIN connector are provided in Appendix B.

Step 9: Replace the top cover of the chassis and secure it with the seven screws on the top of the chassis and the two thumb fasteners on the front panel.

Step 10: Replace the chassis top panel.

Step 11: Externally, attach the fiber-optic network interface cables from the FDDI network to the PHY-A and PHY-B connectors on the appliques; see Figure 4-15 through Figure 4-18.

Step 12: Turn on the system and check the installation.

Description of LEDs on Fiber-Optic Transceiver Applique

There are a series of nine LEDs located on each applique. They are used to indicate the current line state of each of the two ports on the card. Table 4-6 matches lines states to the LEDs.

When the ring is operational (in other words, line protocol up), the LEDs 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 in detail the meaning of these line states.

Table 4-6 Line State Indications for PHY-A or PHY-B LEDs

PHY-X LED			
0	1	2	State
on	on	on	LSU Line State Unknown
on	on	off	HLS Halt Line State
on	off	on	MLS Master Line State
on	off	off	ALS Active Line State
off	on	on	NLS Noise Line State
off	on	off	QLS Quiet Line State
off	off	on	ILS Idle Line State
off	off	off	OVUF Elasticity Buffer Underflow/Overflow

HSA and ULA High-Speed Serial Appliques

The Cisco High-Speed Serial Interface (HSSI) complex comprises the High-Speed Serial Communications Interface (HSCI) system card and the HSSI applique (HSA). The HSSI complex provides the connection to a DS3 (44.736Mbps) or E3 (34.368) Mbps data service unit (DSU). The HSCI network interface card is described in Chapter 5, "Installing Interface and System Cards."

The UltraNet complex comprises the HSCI system card and the ULA applique. The UltraNet complex interconnects a Cisco router to an UltraNetwork hub. The UltraNetwork product line is used for supercomputer interconnection. The ULA applique for the Cisco AGS+ is shown in Figure 4-19.

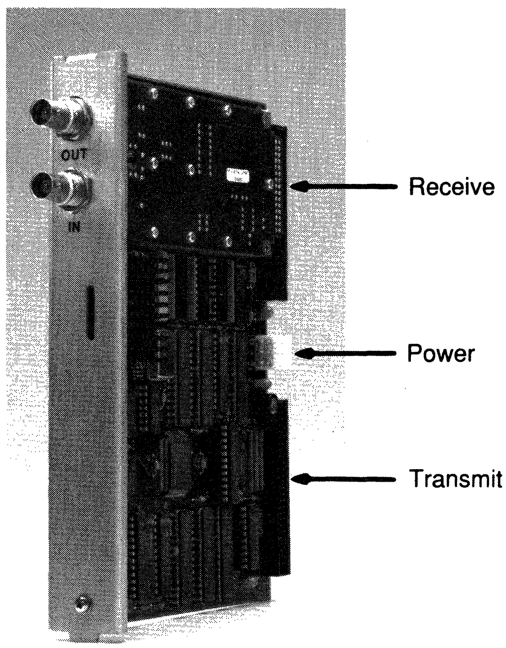


Figure 4-19 ULA Applique

The HSA applique, shown in Figure 4-20, contains one HSSI 50-pin connector, which provides a single port for a high-speed data communications of up to 52 Mbps. Internally, the HSA is connected to the HSCI controller card via a 6-pin power cable, a 34-pin control cable (HSA only), and two 50-pin ribbon cables, transmit and receive, respectively. Externally, the connector mates to an HSSI interface cable, which in turn connects the AGS+ to an external DSU. The HSSI cable is secured to the chassis connector with a spring latch located in the cable connector housing.

Pinouts for the HSSI interface cable are provided in Appendix B, "Signal Summaries." The HSA also contains a bank of 12 LEDs, visible from the back of the chassis, which indicate power and operating status of the HSCI module.

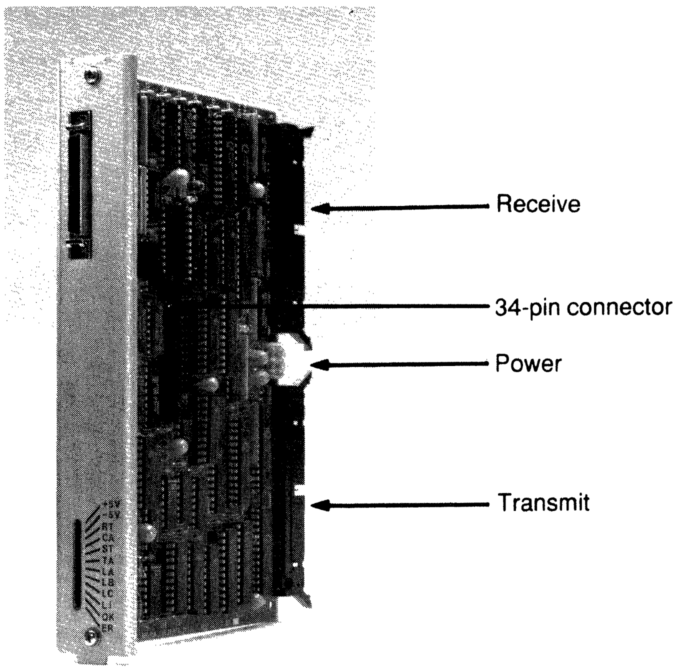


Figure 4-20 HSA Applique

Clock Rates

The HSSI port will accept any clock rate up to 52 Mbps. Clock timing may be continuous or gapped; *clock gapping* refers to a technique used by some DSUs to reduce bandwidth by deleting clock pulses.

Installation

The HSA and ULA appliques are installed in the rear of the chassis; access to the rear of the chassis requires removing the front panel and top cover from the chassis. The appliques must be installed in an applique card cage, which is described earlier in this chapter.

Caution: Be sure to follow the ESD prevention procedures described in Chapter 2, "Pre-installation." Failure to do so may cause intermittent or immediate equipment failure.

Before removing any cables or fasteners from the chassis, be sure to turn off the power and unplug the power cord from the wall receptacle. As screws or other fasteners are removed, put them aside in a safe place; they are needed to reassemble the chassis.

Step 1: Remove the AGS+ top cover.

Step 2: Remove the top cover of the applique card cage by loosening (not removing) the four thumb fasteners that secure it.

Step 3: If the card cage is empty, remove both filler plates from the rear (see Figure 4-8). If an applique is currently installed, remove the blank filler plate.

Step 4: Connect the 6-pin power cable to the 6-pin connector on the applique, shown in Figure 4-20. Carefully thread the other end of the cable under the system card cage (in which the HSCI resides) to the front of the chassis. Connect this end of the cable to the 6-pin connector on the HSCI card.

Step 5: HSA applique only—Connect the 34-pin cable to the 34-pin connector on the HSA applique. Thread the other end of the cable under the system card cage to the front of the chassis. Connect the cable to the 34-pin connector on the HSCI card.

Step 6: Connect one of the 50-pin cables to the 50-pin Receive (R) connector on the applique, shown in Figure 4-20. Thread the other end of the cable under the system card cage to the front of the chassis. Connect this end of the cable to the 50-pin Receive (R) connector on the HSCI card.

Note: The Receive and Transmit connectors may not be marked on the ULA Applique. Use the representation of the ULA shown in Figure 4-19 to locate the connectors.

Step 7: Connect the other 50-pin cable to the 50-pin Transmit (T) connector on the applique, shown in Figure 4-20. Thread the other end of the cable under the system card cage to the front of the chassis. Connect this end of the cable to the 50-pin Transmit (T) connector on the HSCI card.

Step 8: Install the applique in the card cage, as described on page 4-15.

Step 9: Replace the top cover of the applique card cage, then the top cover of the AGS+ chassis.

Step 10: Affix the appropriate label (HSSI 0, ULA 0, HSSI 1, and so on) to the lower part of the applique face plate, where it is visible.

Step 11: Turn on the chassis and check the installation.

LEDs

The HSA applique contains 12 LEDs, which are positioned as shown in Figure 4-21. The mnemonic, normal state, and signal name for each indicator are shown in Table 4-7.

Table 4-7 HSA LEDs

Direction Mnemonic	State at Turn On	Normal (I/F is Up)	Signal Name	HSSI DCE ↔ DTE
+5	on	on	VCC	X
-5	on	on	VEE	X
RT	on	on	Receive timing	——>
ST	on	on	Send timing	——>
CA	on	on	DCE Available	——>
TA	on	on	DTE Available	<——
LA	off	off	Loopback A	<——
LB	off	off	Loopback B	<——
LC	off	off	Loopback C	——>
LI	on	off	Loopback, Internal (diag)	X
OK	off	on	SW OK (set by software)	X
ER	off	off	Ribbon cable error	X

*DSU is DCE, Cisco router is DTE

ST and RT indicate send timing and receive timing, respectively. The LEDs indicate that a clock signal is present inside the HSA transmitter and receiver. The clock source is external during normal operation, and internal during loopback.

CA indicates the DCE (DSU) is prepared to send and receive data to and from the DTE (Cisco). TA indicates the DTE (Cisco) is prepared to send and receive data to and from the DCE (DSU). Data transmission can begin only after both CA and TA have been asserted.

When lit, LA, LB, LC, and LI indicate that the system is in an internal or external loopback diagnostic mode. These loopbacks enable the system diagnostics to verify the links between the DTE and DCE. LA, LB, and LC are software-controlled functions. LI indicates that the hardware loopback diagnostic test is in process (this test is described in Chapter 5 with the HSCI network interface card description).

The green OK indicator lights after the software has performed its startup verification. The red ER indicator lights when an internal ribbon cable, between the HSCI system card and the HSA applique, is installed incorrectly.

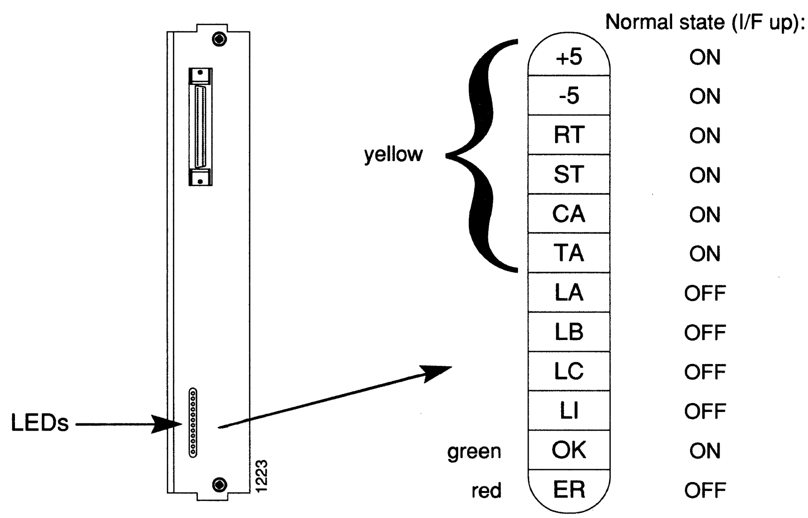


Figure 4-21 HSA LEDs

RS-232 Synchronous Serial Appliques

Cisco Systems provides RS-232 synchronous serial appliques and cables for all of its synchronous serial interface controllers. In general, RS-232 links should be used only for speeds of 64 kilobits and below.

The RS-232 applique produced by Cisco Systems comes in both DTE and DCE versions and is labeled on the card as RS232 DTE or RS232 DCE. It is distinguished from older Cisco-supplied RS-232 appliques by the presence of status LEDs. The DTE applique has a male 25-pin D-connector; the DCE applique has a female 25-pin D-connector. Figure 4-22 shows the new RS-232 appliques installed in a large mounting plate.

Note: Appliques produced by Cisco Systems work only with the MCI and SCI controller cards. In addition, for the DCE clocking mechanism to work correctly, the MCI must be of microcode version 1.5 or later; however, all revisions of SCI code work with the DCE applique. In addition, the clock source jumpers on the MCI or SCI cards must be properly positioned.

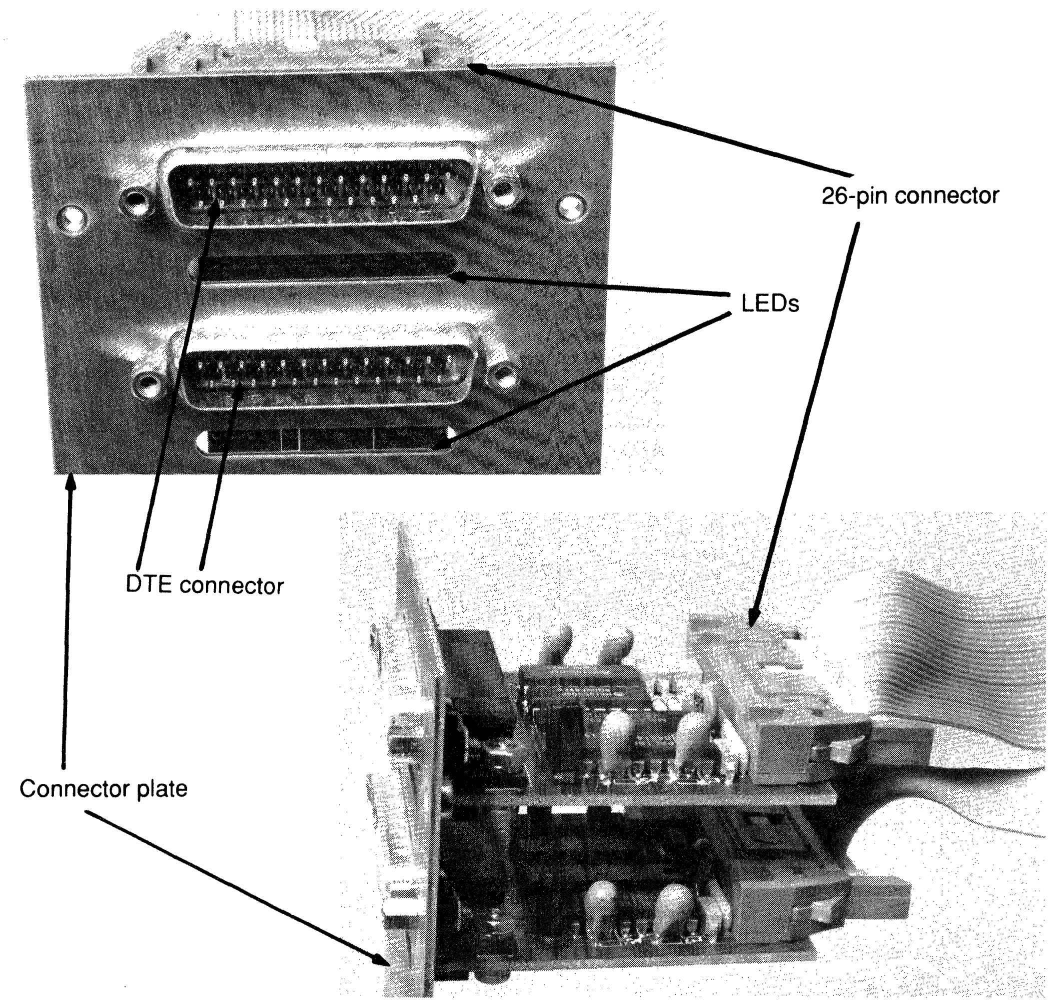


Figure 4-22 Standard DTE RS-232 Applique

Chassis Limitations

The synchronous serial RS-232 applique built by Cisco Systems fits in all chassis.

Jumper Settings

On all Cisco-designed, synchronous serial RS-232 appliques, jumper field W1 connects signal ground to chassis ground when the jumper is inserted. No other configuration options are available on the applique.

LEDs

All newer appliques designed by Cisco Systems have the lamp pattern shown in Table 4-8. Depending on the space available on a particular back panel insert, the lamp pattern orientation may begin at the top, bottom, left, or right. In every case, the green LEDs at one end of the row are used for orientation.

Table 4-8 Applique LEDs

RS-232, RS-449 V.35 DTE Mnemonic	Lamp Color	Signal Name	RS-232 DTE RS-449 DTE V.35 both	RS-232 DCE RS-449 DCE
RXD	Red	Receive Data	To Cisco	From Cisco
RXC	Red	Receive Clock	To Cisco	From Cisco
TXD	Red	Transmit Data	From Cisco	To Cisco
TXC	Red	Transmit Clock	To Cisco	From Cisco
DTR	Red	Data Terminal Ready	From Cisco	To Cisco
RTS	Red	Request to Send	From Cisco	To Cisco
CTS	Red	Clear to Send	To Cisco	From Cisco
RLSD	Red	Receive Line Signal Detect	To Cisco	From Cisco
LT	Red	Software Loopback	From Cisco	To Cisco
+5V	Green	+5V present	–	–
+12V	Green	+12V present	–	–
-12V	Green	-12V present	–	–
OK	Green	Applique Test Okay	–	

Using the RS-232 DCE Applique

Jumper Settings

The following jumper settings apply to the RS-232 DCE, RS-449 DCE, and V.35 dual-mode appliques.

To use the RS-232 DCE applique with the MCI card, the MCI card must have microcode Version 1.5 or later, and you must set the jumpers on the MCI card according to Table 4-9.

Table 4-9 MCI Jumper Settings for Synchronous Serial Appliques

Move Jumper	For Serial Port Address
W53 to W51	serial 0
W43 to W41	serial 1

Clock Rates

You may configure the clock rate on the serial interface of the MCI card to a different bit rate using the **clockrate** configuration command. The applique must be DCE to generate the clock signals.

The **clockrate** command is entered in configuration command collection mode, as shown in the following sample session:

```
#config
interface serial 0
clockrate 64000
^Z
```

See your system manual for more information about the configuration command collection mode.

Following are the acceptable clock rate settings, in bits per second.

1200	2400	4800
9600	19200	34800
56000	64000	72000
125000	148000	500000
800000	1000000	1300000
2000000	4000000	

Note that the fastest speeds may not work if your cable is too long, and speeds faster than 148,000 bits per second are too fast for RS-232 signaling. Cisco recommends you only use the synchronous serial RS-232 at speeds up to 64,000 bits per second (bps). To permit a faster speed, you should use RS-449 or V.35 signaling.

Using the RS-232 DTE Applique

To use the standard RS-232 DTE applique with the Cisco interface cards, ensure that the standard jumper configuration for the MCI or SCI controller card is selected according to Table 4-9 and Table 4-10. Appendix B lists the pinouts for the RS-232 DTE standard appliques.

Table 4-10 SCI Jumper Settings for Synchronous Serial Appliques

Move Jumper	For Serial Port Address
W24 to W22	serial 0
W28 to W26	serial 1
W14 to W12	serial 2
W18 to W16	serial 3

RS-449 Synchronous Serial Appliques

The RS-449 appliques produced by Cisco Systems come in both a DTE and a DCE format and are labeled either RS449 DTE or RS449 DCE. They are distinguished from the older appliques by having fewer jumpers (two at most, compared with six or eight on the older appliques).

These DCE appliques work only with the MCI and SCI controllers cards. In addition, for the DCE clocking mechanism to work correctly, the MCI must be of microcode version 1.5 or later; all revisions of the SCI code work with the DCE applique. The RS-449 interface is used in U.S. and European applications and is suitable for all speeds supported by the controller card attached to it.

Appendix B shows the pinouts necessary for constructing an X.21 to RS-449 transition cable for UK and Germany applications.

Figure 4-23 shows an RS-449 DTE applique.

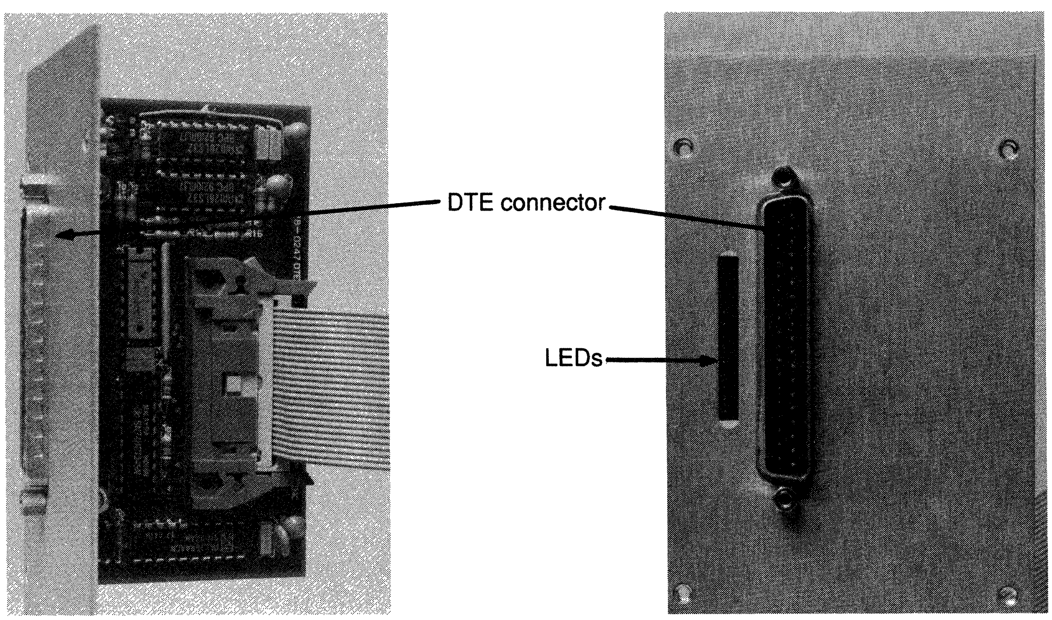


Figure 4-23 RS-449 DTE Applique

Figure 4-24 shows an RS-449 DCE applique.

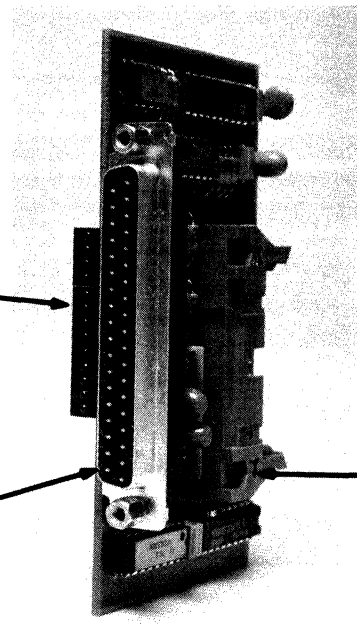


Figure 4-24 RS-449 DCE Applique

Chassis Limitations

The RS-449 applique built by Cisco Systems fits into all chassis.

Jumper Settings

On all Cisco-designed appliques, jumper field W1 connects signal ground to chassis ground when the jumper is inserted. In addition, the RS-449 DCE applique has another jumper to select the transmit data clock source. Pins one and two of jumper field W2 are jumpered together. This causes the applique to expect to see the transmit clock on the TT (SCTE) lines of the interface cable. This is the factory default and Cisco recommends this setting for reliable operation at high data rates. See the section "Clock Rates," on page 4-34, for information about setting the clock rate.

If the DTE device does not return a clock on TT, connecting pins two and three of jumper field W2 together will cause the RS-449 DTE applique to use the outgoing clock ST (SCT) instead of TT (SCTE). The sequence of LEDs indicate the state of the applique.

No other configuration options are available on the applique. The remaining jumper settings are the same for both the RS-232 DCE and the RS-449 DCE appliques.

To use the RS-449 DCE applique with the MCI card, the MCI card must have microcode Version 1.5 or later, and you must set the jumpers on the MCI card according to Table 4-9.

The LED indicators are the same as those for the RS-232 applique, and all other Cisco-built appliques (see Table 4-8). Depending on the space available on a particular back panel insert, the lamp pattern may begin at the top, bottom, left, or right. In each case, the green LEDs at one end of the row may be used for orientation.

V.35 Synchronous Serial Appliques

As with the RS-449 appliques, the Cisco V.35 appliques are supported on the MCI and SCI controller cards and are suitable for all speeds supported by the card. The Cisco V.35 DTE applique shown in Figure 4-25 has a series of LEDs which indicate its various states. These are the same LEDs for all Cisco appliques. See Table 4-8 for a description of these LEDs.

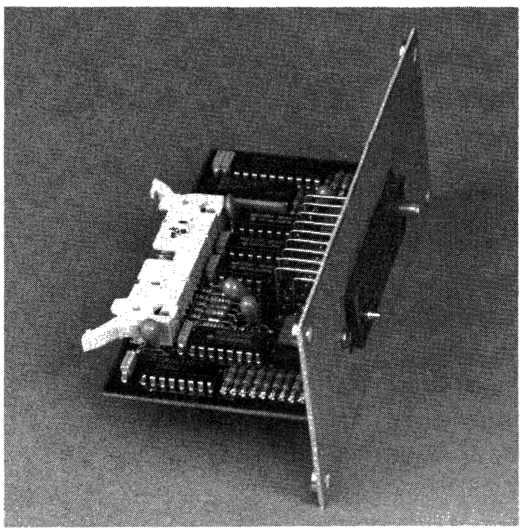


Figure 4-25 Cisco V.35 DTE Applique

The small V.35 applique is shown in Figure 4-26. This smaller connector allows more connections on a connector plate than the large version. It carries the same signals as the large, 35-pin standard V.35 connector, but provides them on a smaller, 26-pin D-type connector. A V.35 transition cable with one small and one large V.35 connector is shown in Figure 4-27.

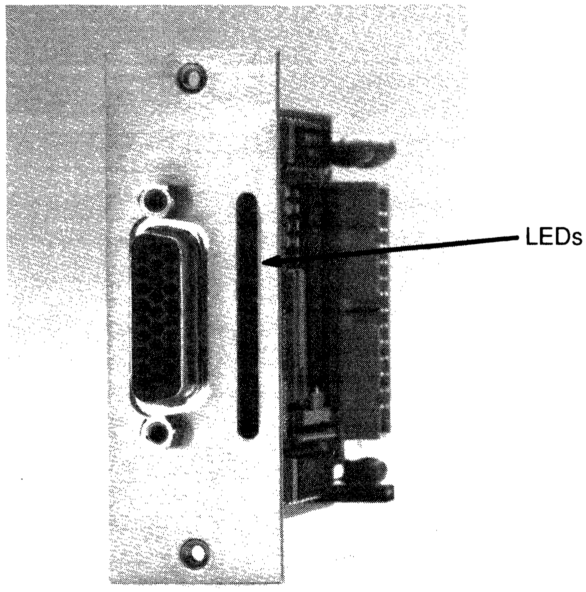


Figure 4-26 Small V.35 Applique

The Cisco V.35 dual-mode applique supports both DTE and DCE. The mode of the applique (DTE or DCE) is determined by the cable that is connected to it. The V.35 dual-mode applique contains a 3-row, 26-pin D-shell connector, which must be used with the adapter cable shown in Figure 4-27 to provide a standard V.35 connection. The pinouts for this cable are provided in Appendix B, "Signal Summaries."

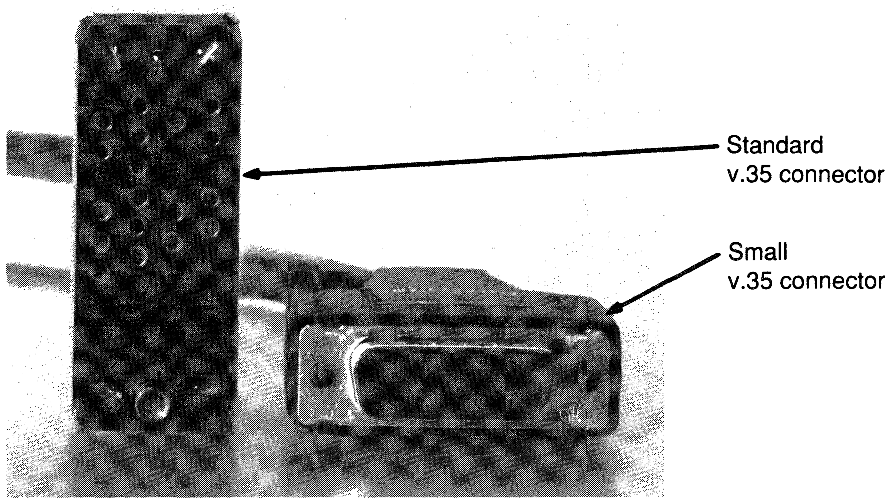


Figure 4-27 V.35 Transition Cable

Jumper Settings

There is only one jumper on the V.35 DTE applique, which ties frame to signal ground; it should not be removed.

The V.35 dual-mode applique has only one jumper, which selects SCT (from Cisco) or SCTE (to Cisco) as the timing source for SD when the applique is in DCE mode. The default is SCTE, selected with the jumper in. To select SCE, remove the jumper.

To use the V.35 dual-mode applique in DCE mode with the MCI or SCI cards, the cards must be running microcode Version 1.5 or later, and you must set the jumpers on the cards according to Table 4-9 for the MCI card, and Table 4-10 for the SCI card.

Note: When tightening the jackscrews on the V.35 cable, be careful not to use too much force as it may crack the connector. The problem results from the design of the V.35 connector; the screwdriver slot on top of the jackscrews is larger than necessary. Use a smaller screwdriver and gently tighten the jackscrews. They are there simply to prevent the cable from falling out accidentally, not to support any load.

Other appliques do not have this problem as their screws are significantly smaller. Any excessive force would just twist the head off the screw rather than break the connector.

Chassis Limitations

The V.35 applique built by Cisco fits in all chassis.

Table 4-11 V.35 Dual-Mode Applique LEDs, DCE Mode

V.35 DCE Mnemonic	Lamp Color	Signal Name	Direction
TXD	Red	Transmit Data	To Cisco
TXC	Red	Transmit Clock	From Cisco
RXD	Red	Receive Data	From Cisco
RXC	Red	Receive Clock	From Cisco
RLSD	Red	Receive Line Signal Detect	From Cisco
CTS	Red	Clear to Send	From Cisco
RTS	Red	Request to Send	To Cisco
DTR	Red	Data Terminal Ready	To Cisco
LT	Red	Software Loopback	To Cisco
+5V	Green	+5V present	–
+12V	Green	+12V present	–
-12V	Green	-12V present	–
OK	Green	Applique Test Okay	–
DCE	Red	DCE Mode	–

Individual Connectors

Individual connectors provide ports on the chassis back panel for attachment to your network. Unlike the synchronous serial applique assemblies, these are passive devices and, therefore, provide no signal translation.

The types of individual connectors supported by Cisco Systems include:

- Ethernet connector
- Token Ring connector

Each connector is described in the following sections.

Ethernet Connector

Cisco Systems uses the standard Ethernet and IEEE 802.3 (AUI) 15-pin connection with slide latch for all Ethernet or IEEE 802.3 connections. An Ethernet connector is shown in Figure 4-28.

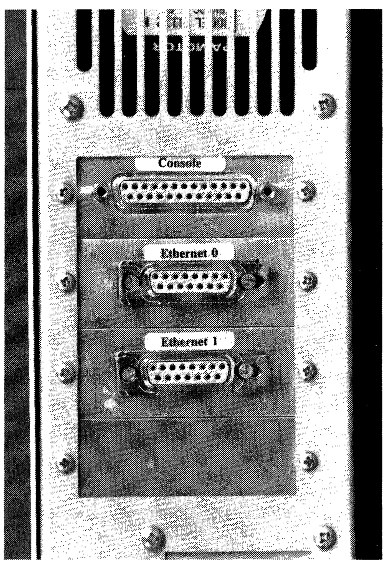


Figure 4-28 Ethernet Connector

A transceiver must be used with all Cisco Systems' Ethernet interface cards. Transceivers are available from a variety of sources for thick Ethernet, thin Ethernet, twisted-pair Ethernet, and other media; all are supported by the Cisco Ethernet network attachment cards. Appendix B gives the pinout designations.

Token Ring Connector

Cisco Systems uses a standard female DE-9 (PC-type) Token Ring attachment shown in Figure 4-29. This requires a Token Ring adapter cable (not supplied). Appendix B shows the pinout table for this (female) DB-9 connector.

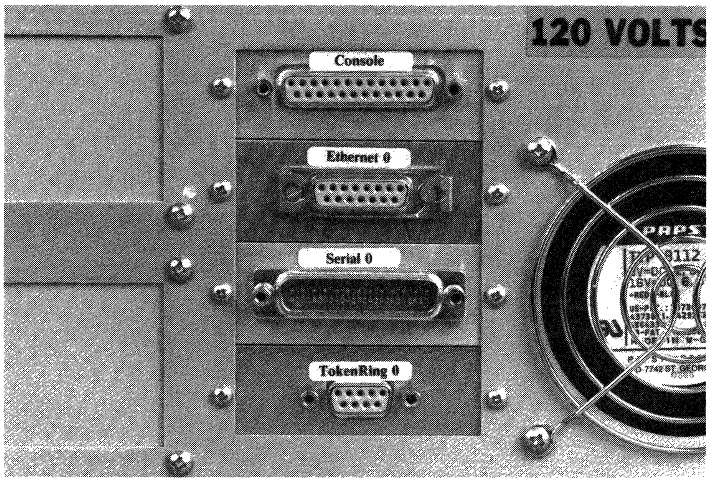


Figure 4-29 Token Ring Connector

Auxilliary Port Connector

An optional auxilliary port, an RS-232 male connector, can be added to any chassis with a CSC/2 or CSC/3 processor card. This is a DTE port to which a CSU/DSU or network analyzer can be attached. The auxilliary port is connected to the same ribbon cable as your console port; at the other end, the ribbon cable is attached to the CSC/2 or CSC/3 processor card. In the A-type and M chassis, the auxiliary port is mounted below the console port; in the C chassis, it is mounted to the left of the console port.

To use the auxiliary port, you need a special cable that has both connectors and the applique for the auxiliary port. For ordering information, contact Cisco Systems Customer Service at the number provided in the "Service and Support" section in the front of this guide.

Chapter 5
Installing Interface and System Cards

Your Cisco Systems server is complete and ready for installation and start-up when it leaves the factory. However, as your data communication requirements change, you may want to upgrade your server.

This chapter describes the procedures for installing additional interface and system cards. Each card is also described briefly, including illustrations, LED descriptions, jumper settings, and cabling instructions.

Note: Cisco Systems provides Spares Installation sheets with each additional card ordered. The Spares sheets contain a description of the part and installation procedures.

Cisco Systems classifies cards according to the *subsystem* they support. This results in cards being grouped into five distinct categories: processor, system controller, memory, network interface controller, and peripheral device controller.

This chapter describes the installation procedures for the following cards:

- Processor Subsystem:
  - CSC/3 Processor card
  - CSC/2 Processor card
- System Controller Subsystem:
  - CSC-CCTL cBus controller card
  - CSC-ENVM Environmental Monitor card
- Memory Subsystem:
  - CSC-MC chassis memory card
  - CSC-MT enhanced memory card
- Network Interface Controller Subsystem:
  - CSC-FCI Fiber Distributed Data Interface card
  - CSC-HSCI High-Speed Serial Communications Interface card
  - MEC Multiport Ethernet Controller card
  - SCI Serial-Port Communications Interface card

- MCI Multiport Communications Interface card
  - CSC-R Token Ring Interface card
  - CSC-R16 16Mbps Token Ring Interface card
- Peripheral Device Controllers:
  - CSC-16 Terminal Server Line card
  - CSC-P Printer interface card

Power Requirements

All Cisco Systems power supplies are tested under a sustained load before shipment.The +5V output is adjusted to fall between +5.05 and +5.10V with a load of 10A. In the field, the voltage may vary somewhat; however, any voltage from +4.95 to +5.10V is acceptable.

The auxiliary outputs (+12, -12, and -5V) may not be independently adjustable, and any voltage within ten percent of nominal is acceptable. If there is no appreciable load on a given output, that output may vary by more than ten percent.

In terminal server applications, the +/-12V supplied are used only for the RS-232 asynchronous line drivers which are specified to operate between +/-3 and +/-25V. For Ethernet applications, the +12V supply need only be in the range of +9 to +15V. Serial network appliques require that the +/-12V supplies not exceed +/-15V. If a field unit in otherwise working order exceeds the +15V limit, a load resistor may be attached to the power supply terminals (contact Cisco Systems for more information).

The AGS+ chassis is equipped with the CSC-ENVM environmental monitor card.This card checks input air temperature and air flow through the card cage, and backplane power supplies. It also provides nonvolatile and system bus memory for the system. If the ambient room temperature exceeds 104 degrees Farenheit, or if air intake is restricted, or if any of the power input supplies drift from the nominal settings an error is detected and the CSC-ENVM shuts down the power supply. If this occurs, turn off the main power switch, wait 20 seconds, and then turn it back on.

Table 5-1 lists the power requirements for the Cisco cards.Values may vary depending upon system load.

Table 5-1 Card Power Requirements

Card	@+5V	@-5V	@ +12V	@ -12V
CSC/3	5.9A			
CSC/2	7.6A			
CSC-16	1.5A			
CSC-FCI	9.5A			
CSC-CCTL	5.5A			
CSC-ENVM	4.5A	0.01A	0.6A	0.4A
MEC	4.5A			
SCI	5.5A			
HSCI	9.5A	1A		
MCI	5.5A			
CSC-R	6A			
CSC-R16	6A			
CSC-P	1.1A			
CSC-MC	1.3A			
CSC-MT	1.3A			

Note: Each Ethernet transceiver may draw up to 250mA typical from +12V, and up to 450mA within Ethernet standards.

When measuring voltages in any of the chassis, it is best to measure between the power and ground of a processor card chip. If this is not possible, then measure the voltage between any red and black wire where they connect to the backplane. Voltages between +4.95 and +5.10V are acceptable. When setting the voltage on the system card cage backplane, it is best to set it slightly over +5.00V. The pair of pins on the configuration register (located three from the left when the processor is in the backplane) are 50mV below that of the backplane voltage. These pins are easily accessible. The configuration register is described in Appendix A.

Note: For more information on adjusting voltages, refer to the Cisco Systems *Field Service Manual*, Chapter 5, "Removal and Replacement Procedures."

cBus Configuration

The AGS+ system card cage, shown in Figure 5-1, has nine slots. Three of the slots contain cards required for operation (the environmental monitor card, the CSC/3 processor card, and the cBus controller card), and six are available for interface cards.

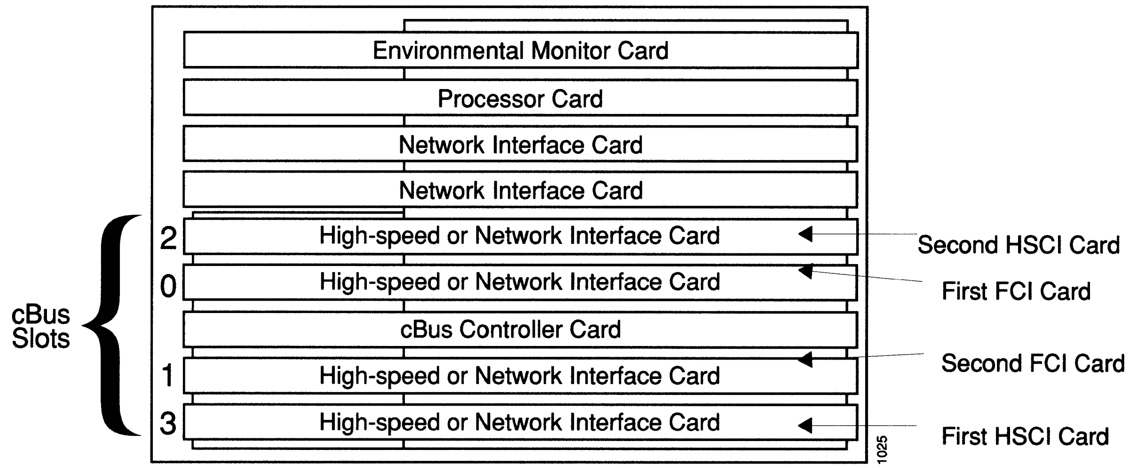


Figure 5-1 AGS+ System Card Cage

The cBus occupies the bottom five slots in the system card cage. The center cBus slot contains the cBus controller; the remaining four are for high-speed or other network interface cards. The physical slot number assignments, 0 through 3, are shown in Figure 5-1. High-speed network interface cards are placed in specific cBus slots, according to a hierarchical scheme. Within this scheme, slot 0 receives the highest priority to bus access, slot 3 receives the lowest. Priority asignments are set to accomodate the amount of traffic generated by each interface and the amount of card buffering necessary.

Configuration Limits

The cBus may contain any mix of interfaces, provided the combination is within the guidelines of the power requirements, and the individual card and port limits do not exceed those provided in Table 5-2.

Table 5-2 AGS+ Ports Limits

No. of Cards	Card Type	Interface Type	Max. No. of Ports
7	SCI, 4 serial	RS-232	28
7	SCI, 4 serial	RS-449	14
7	SCI, 4 serial	V.35	28
4	MEC 6 (+1 MCI 4E)	Ethernet	28
3	CSC-R	4Mbps Token Ring	3
7	CSC-R16	4/16Mbps Token Ring	7
2	CSC-FCI	FDDI	2
4	HSCI	HSSI	4

- 4 MEC 6 cards—Each card provides the interface for six high-speed Ethernet connections
- 4 FDDI cards—Each card provides the interface for two FDDI connections
- 4 HSSI cards—Each card provides the interface for one HSSI connection
- 1 Ultra card when other cBus slots are occupied, *or* 2 Ultra cards if the other two cBus slots are not in use—Each Ultra card provides the interface for one UltraNetwork connection.

Card Numbering

All AGS and AGS+ systems contain a multibus, the nine-slot system bus shown in Figure 5-1. Only an AGS+ system contains a cBus, which occupies the bottom five slots of its multibus. In both cases, installed cards are recognized, and priorities and interface numbers are assigned when the system is initialized. The multibus and the cBus have unique ways of discovering the installed cards, determining the priority to each, and then numbering their network interfaces accroding to the priority of each. The busses perform three tasks:

- The cBus uses a *slot ordering* scheme. The priority of the card is determined by the cBus slot it occupies. These cards, the FCI, HSCI, and MEC, can only reside on the cBus.
- The multibus uses *unit numbers* to assign priorities. The unit numbers are assigned with a hardware switch on the CCTL, MCI, SCI, and CSC-R16 cards. These cards are called "control cards," and can reside on the multibus or the cBus.
- Both busses assign a unique *interface number* to each network interface. The numbers are assigned sequentially, in order of the cards' priority. These numbers are unique for each type of interface, for example, on an MCI card, the Ethernet interfaces would be assigned the numbers E0, E1, and serial interfaces would be assigned S0, S1.

cBus Slot Ordering

The cBus is used only in the AGS+. It occupies the bottom five card slots of the multibus, as shown in Figure 5-1. The center cBus slot always contains the cBus controller card (CCTL). The four available slots in the cBus are filled in accordance with the heirarchical priority scheme. Each slot is assigned a priority, and each interface is placed in a specific slot with regard to other cBus interface cards (if any). Within this hierarchy, Ultra interfaces have lowest priority, HSSI interfaces have higher priority, and FDDI and MEC interfaces have highest priority. cBus slot 3 is the lowest-priority, and slot 0 is the highest. Therefore, the first Ultra interface card, if any, is placed in slot 3, then the first HSSI interface card is placed in slot 2. The slot-ordering guidelines for placement of each interface are as follows:

Step 1: Place the first Ultra interface in slot 3, the second in slot 2. If two Ultra interfaces are installed, the remaining two cBus slots must remain empty.

Step 2: Place the first HSSI interface in slot 3 if it is the first card in the cBus, or slot 2 if an Ultra interface is present. Place subsequent HSSI interfaces in slots 2, then 1, then 0.

Step 3: Place FDDI and MEC interfaces in the remaining slots, in any order.

Step 4: If multibus slots 3 and 4 are filled, you can place additional interface cards (MCI, SCI, CSC-R, or CSC-R16) in any remaining cBus slots; they will be recognized as multibus interfaces cards.

Unit Numbering

The multibus uses unit numbers (card switches) to control the area of communications across the multibus. The assignment of unit numbers is controlled by the switch on each CCTL, MCI, SCI, and CSC-R16 card. These cards are known as control cards. Each control card must have a unique unit number assigned with the hardware switch, in order for the multibus to recognize the card and operate properly.

The cBus controller card switch setting must be unique from any MCI/SCI card switch. Interface numbers for MCI/SCI interfaces will always be lower than cBus interfaces.

Each cBus interface card is also asssigned a unit number by firmware routines in the cBus controller card, so you don't have to physically set a number on the cards. The unit number is assigned according to the slot in which you place the card.

A hypothetical AGS+ multibus is depicted in the following example. All multibus and cBus slots are filled. The progress of the system at startup is described in the steps below the example.

Example:

cBus slot #	multibus slot #	card name	unit # assigned by system	interface #s assigned by system
	1	ENVM		
	2	CSC/3		
	3	MCI	unit 1	E0, S0, E1, S1
	4	SCI	unit 2	S2 - S5
2	5	CSC-R16	unit r0	R0
0	6	MEC 2	cBus 1	E4, E5
CCTL	7	CCTL	unit 0/cBus 0	
1	8	MEC 6	cBus 2	E6 - E11
3	9	MCI	unit 3	E2, S6, E3, S7

Step 1: When the system is powered on, the MCI, SCI, and CSC-R16 controllers, all multibus cards, are discovered first, before the system checks for the presence of a CCTL in the cBus.

Step 2: If MCI or SCI cards are installed in the multibus, the system checks each slot in decending order. When if finds the first network interface, it begins assigning interface unit numbers sequentially, beginning with 0, for each interface it finds. Multibus interfaces are numbered first, in the order of their assigned unit numbers. Then cBus interfaces are numbered, in the order of their slot position.

Step 3: After the MCI/SCI interfaces on the system bus are numbered, the system searches for a cBus controller. The cBus controller, if present, should be assigned unit number 0; the first MCI or SCI will then be unit 1, and so on.

Step 4: After the CCTL is discovered, the system checks the remaining cBus slots according to their cBus slot # (lowest number to highest).

Step 5: In the example above, the system checks each slot and assigned interface numbers for each interface on each card.

This slot numbering scheme notes the order in which the cBus card slots are scanned. Use the **show controller cbus** EXEC command to display configuration information about installed interfaces.

System Card Cage Access

The system card cage in the A-type and M-chassis is accessed by removing front or side panels. Access to the C-chassis requires removing the cover. The procedures for accessing the system card cage in each chassis type are provided in the following sections, along with illustrations which provide internal views of the chassis. Refer to these figures as necessary when reading through the installation procedures that follow. Note especially the card placement and cable positioning.

A-Type Chassis Front Panel

The A-type chassis features a removable front panel that exposes the card cage. To gain access to the cards, remove the front panel as follows:

Step 1: Loosen, but do not attempt to remove, the two thumb fasteners shown in Figure 5-2.

Step 2: Grasp these fasteners to pull the panel forward, exposing the card cage.

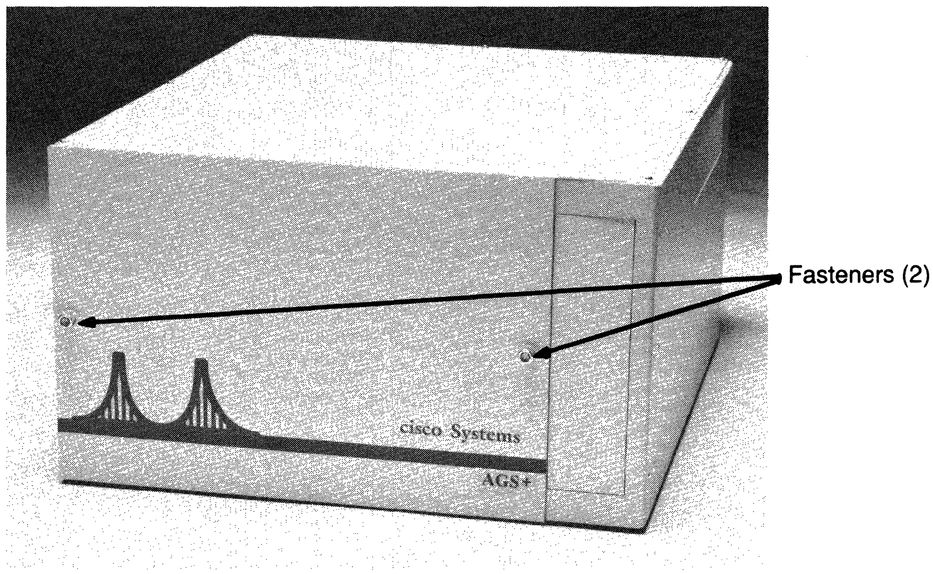


Figure 5-2 A-Type Chassis Access Panel Fasteners

Before turning on system power, replace the panel and tighten the fasteners. Figure 5-3 provides an internal view of the A+ chassis system card cage and cBus.

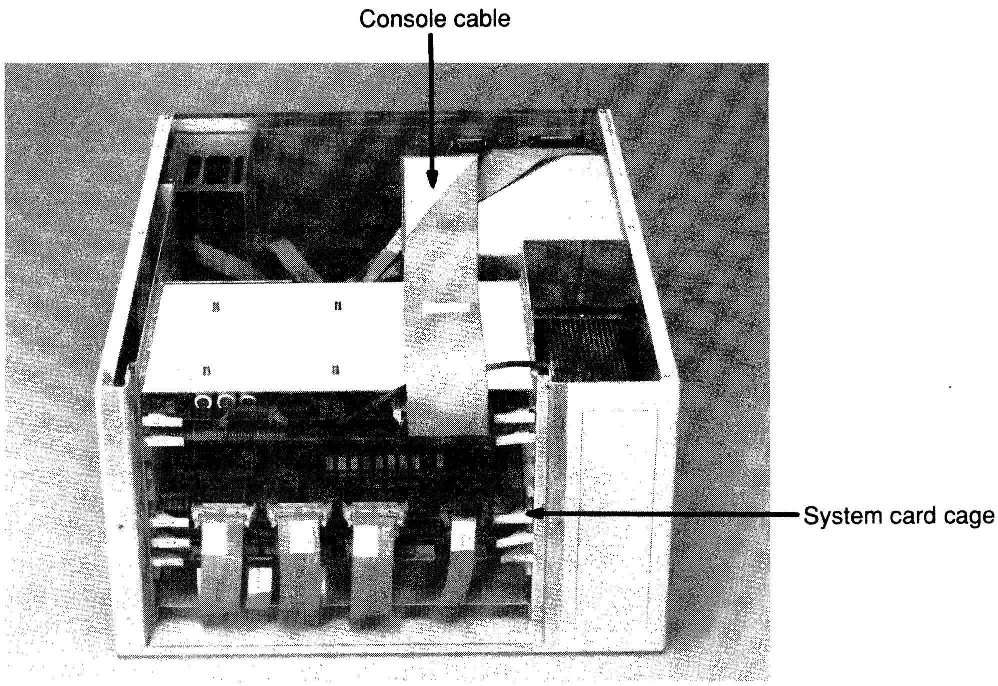


Figure 5-3 A+ Chassis — Internal View

Figure 5-4 provides an internal view of the A-chassis. Note the card placement and cable positioning.

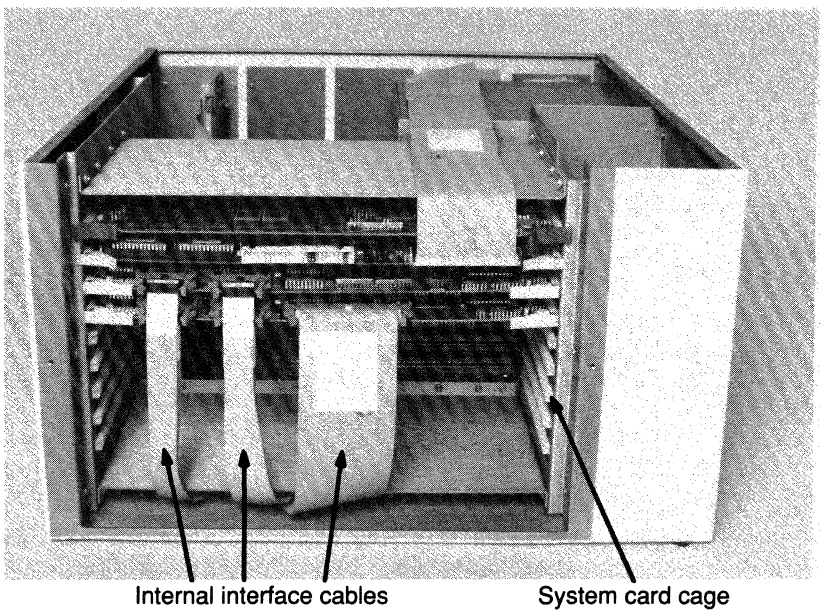


Figure 5-4 A-Chassis — Internal View

M-Chassis Side Card Cage Panel

On the M-chassis, access to the card cage is provided by a panel located on the side of the chassis. Refer to Figure 5-5 when performing the following procedures. To open the panel:

Step 1: Loosen, but do not remove, the three Phillips screws located at the bottom of the side panel.

Step 2: Turn the large screws on the top of the side panel one-quarter turn each, counter clockwise.

Step 3: Lift the side panel straight up about one-half inch; this frees the bottom lip.

Step 4: Pull the side panel away from the unit to expose the card cage.

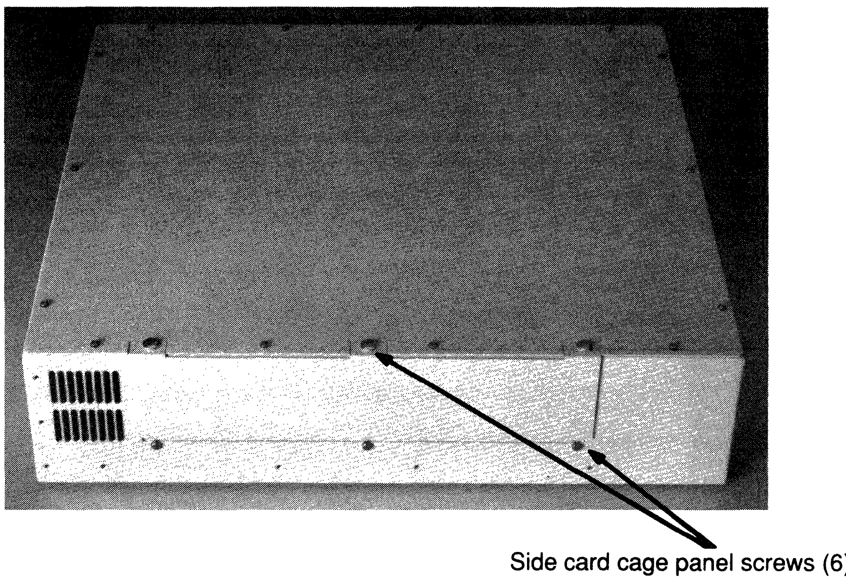


Figure 5-5 M-Chassis Side Card Cage Panel

Figure 5-6 provides an internal view of the M-chassis. Note the card placement and cable positioning.

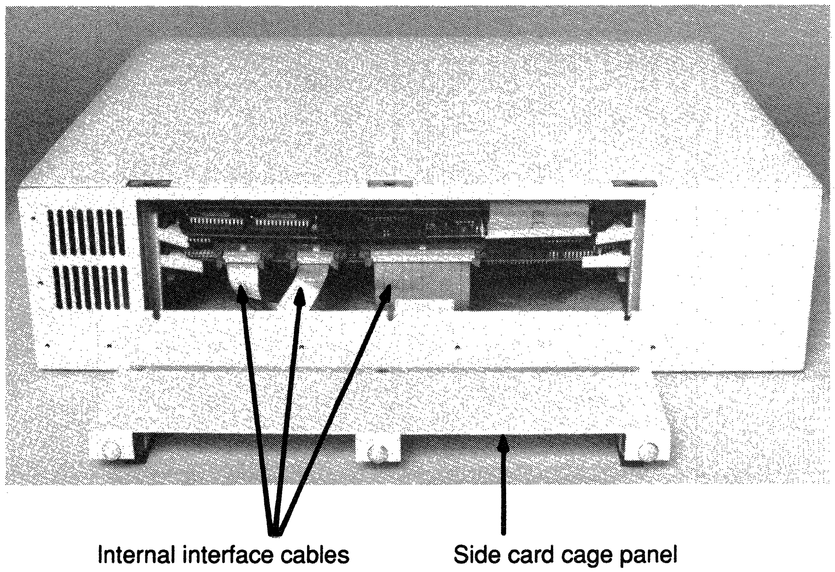


Figure 5-6 M-Chassis — Internal View

C-Chassis Cover Removal and Replacement

This section describes how to remove and replace the cover on the CGS system chassis. There is no external access to the card cage on the C-chassis. You must remove the cover to gain access to the system card cage.

Refer to Figure 5-7 when performing the procedures in this section.

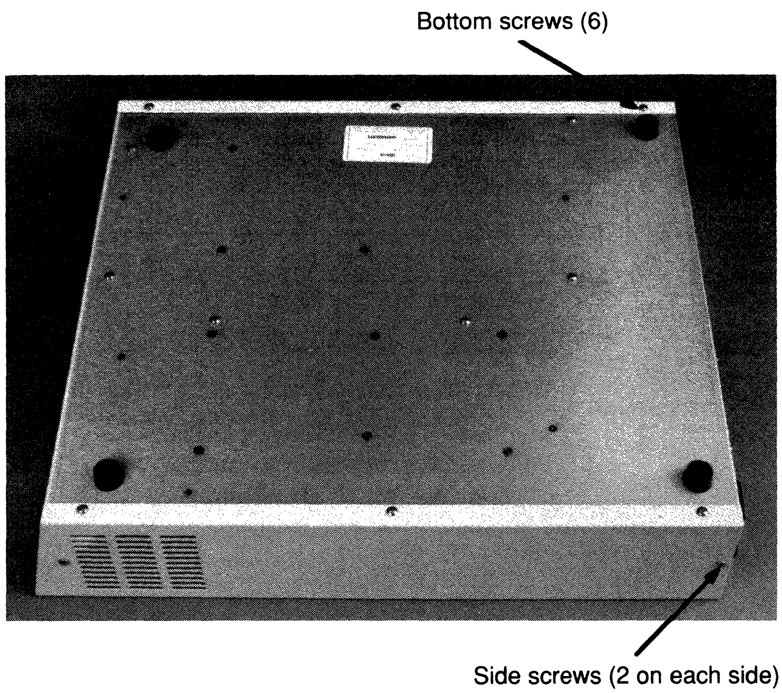


Figure 5-7 C-Chassis Cover Removal and Replacement — Bottom View

C-Chassis Cover Removal

The cover on a C-chassis system envelopes the chassis and is secured by ten screw: six on the bottom and two on each side.

Step 1: Remove the two screws on each of the two sides of the cover.

Step 2: Turn the system upside down and remove the six screws beginning with those nearest the back.

Step 3: Use a flat-blade screwdriver to gently lift the back end of the chassis away from the cover.

Step 4: Pull the cover toward the front of the system to remove.

C-Chassis Cover Replacement

Step 1: Turn the CGS system so that the back panel is down, and the front of the chassis is pointing up.

Step 2: Position the cover so the angled end will meet the front of the frame (the squared end goes on first).

Step 3: Slip the cover over the chassis and push down firmly. You are inserting a lip at the back of the cover into a rim on the chassis. (It may be necessary to loosen the four screws securing the fan; if so, be sure to retighten the fan screws once the cover is replaced.)

Step 4: Replace the screws beginning with the back screws. Turn the screws only a few rotations to secure.

Step 5: Make sure the screw holes are aligned properly. When all screws are in place, tighten all screws.

Figure 5-8 provides an internal view of the C-chassis. Note the card placement and cable positioning.

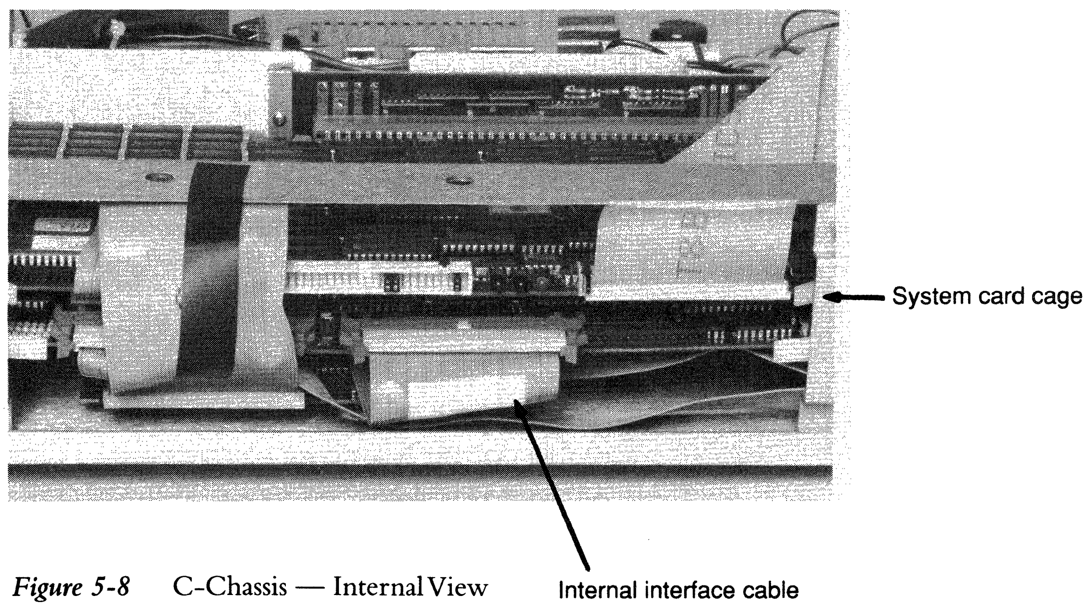


Figure 5-8 C-Chassis — Internal View

Card Removal and Replacement

All Cisco Systems printed circuit cards have ejector tabs which allow them to be easily extracted from their slots. When extracting a card, opening both ejectors simultaneously releases the card from its slot. When inserting a card, the ejectors close automatically when the card is properly seated.

To remove a card, use your thumbs to pull the ejector tabs out and away from the card. Open both ejectors at the same time. Use care not to strain any flat cables still attached to the card as it is being removed.

To insert a card, using your thumbs to push the ejector tabs, push the card in firmly until it snaps in place and is firmly seated in the slot. Because the high performance cards that connect to the cBus require significant force to insert into an A-type chassis, ensure that the chassis is firmly mounted on a stable surface.

Note: Be sure to follow the ESD procedures described in Chapter 2, "Preinstallation."

Before installing any new cards, be sure to read the following procedures for configuring each interface card for proper operation. For example, a card added to the system may require modification of a jumper or switch setting.

Processor Subsystem

Cisco Systems currently offers two processor cards for its family of internetworking products:

- The CSC/3 card contains an MC68020 processor running at 30 MHz, with four megabytes of RAM and up to two megabytes of ROM.
- The CSC/2 card contains an MC68020 processor running at 12.5 MHz, with one megabyte of RAM and up to two megabytes of ROM.

The system console port is attached to the processor card console port via ribbon cable. The processor cards also contain configuration registers that can be configured to set up special system functions such as boot file names and different console baud rates. The system processor contains the bootstrap program that initializes the system, but also provides diagnostics that can be run on the system and its memory. Refer to Appendix A for more information about the configuration registers and the CPU bootstrap program. The procedure for connecting a terminal to the console port is described in Chapter 3.

Auxiliary Port

The processor cards also provide an auxiliary port, which can be used to connect to CSU console ports. On the CSC/2 and CSC/3 processor cards, the auxiliary port is connected to the same ribbon cable as the system console port. To use the auxiliary port, you need a special cable that has both connectors and the applique for the auxiliary port. For ordering information, contact Cisco Systems Customer Service at the number provided in the "Service and Support" section in the front of this guide.

Note: Throughout the following card descriptions, the orientation of the cards in the referenced illustrations is as viewed from the component side, with the bus connector edge at the bottom.

Installing the CSC/3 Processor Card

The CSC/3 processor card contains a 30 MHz MC68020 central processor unit and four megabytes of dynamic RAM, and supports two megabytes of ROM. The CPU also has three LEDs to indicate its operational state.

The CSC/3 can be used in Cisco Systems servers with the standard system bus and with Cisco's AGS+ model featuring the high-speed cBus backplane.

Figure 5-9 is a line drawing of the CSC/3 processor card viewed from the component side. Jumper settings can be found at the end of this section. Immediately following the card installation steps are the EPROM replacement procedures for the CSC/3 processor card.

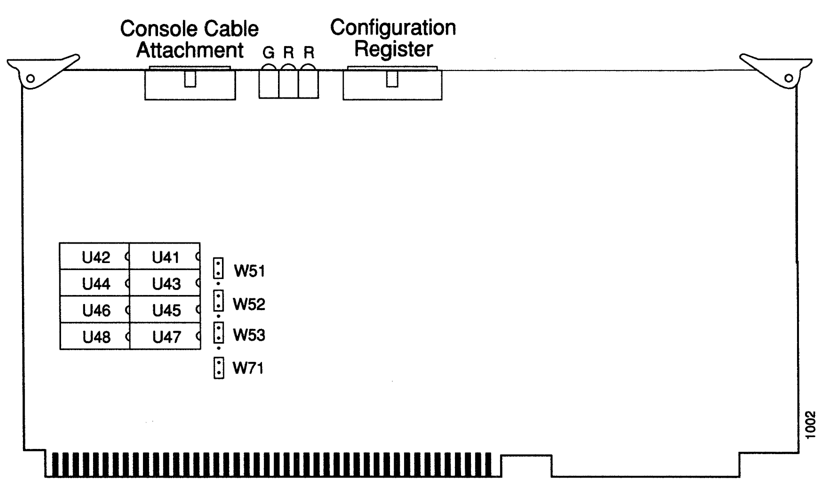


Figure 5-9 CSC/3 Processor Card — Component Side View

Procedure:

Install the CSC/3 card in a chassis as follows:

Step 1: Turn off the unit, but leave the power cord plugged into the wall outlet.

Step 2: Remove the card-access panel (A-type and M-chassis) or the cover (C-chassis) to gain access to the card cage. Remove the existing processor card, if any.

Step 3: The jumpers are set at the factory for correct operation. Figure 5-10 illustrates the factory defaults and configuration options for EPROMs on the processor card.

Step 4: Insert the CSC/3 card into the second slot from the top in the card cage.

Note: If you are installing the CSC/3 in a system other than an AGS+, the first (top) slot in the bus may be empty. If so, install the CSC/3 in the top slot.

Step 5: Attach the internal cables. In general, route cables under the card cage through the space provided, and then up to the card where they attach. Be careful not to restrict the airflow or destroy the integrity of the electrical grounding or power supply.

Note: Follow the same cabling pattern established at the factory. For sample views of the internal cabling for each chassis, refer to Figure 5-3, Figure 5-6, and Figure 5-8.

Step 6: Connect the console cable (cable ends are keyed) to the console port on the CSC/3 card (see Figure 5-9).

Step 7: Connect the opposite end of the cable to the console port on the inside of the chassis back panel.

Step 8: Attach the console terminal cable to the console connector on the outside of the chassis back panel.

Step 9: Turn on the system for an installation check.

Step 10: Check the LEDs. The green LED on the left is a software-programmable run light. It is lit when the system is running. The middle red LED is the processor halt light. It is on whenever the processor is in a halt state. The red LED on the right is a software-programmable status light. It is lit during initialization, flashes if there is an error, and is off under normal conditions.

Step 11: Turn off system power and replace the card access panel or cover. Turn on the system power and reboot.

Step 12: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter additional comments about the procedure in the site log, if desired.

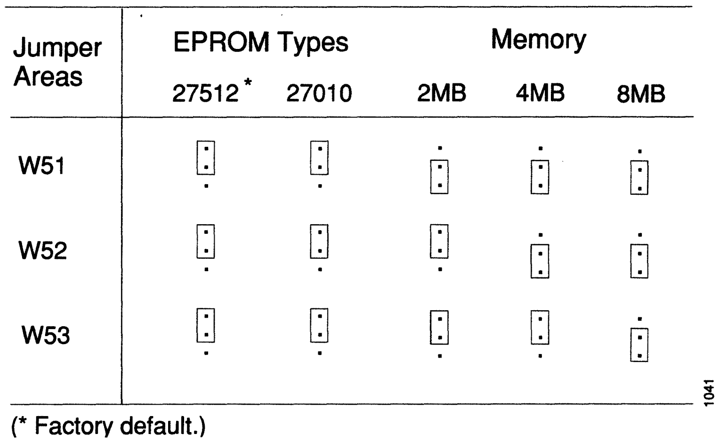


Figure 5-10 CSC/3 Jumper Settings

Note: If you are replacing your CSC/1 processor card with a CSC/3 processor card, note that the CSC/3 draws more power than a CSC/1. Be sure that the voltage of the +5V power supply is still within the operating limits of +4.95V to +5.1V. This is not an issue if you are replacing a CSC/2 with a CSC/3 card, as the CSC/3 draws less power than a CSC/2.

If you are replacing your CSC/2 processor card with a CSC/3 processor card, *adjustments must be made to the SCI, MCI, and CSC-16 interface cards to correctly operate with the faster processor on the CSC/3 card.* Both the SCI and the MCI cards may be modified in the field. See the following section for specific procedures. The CSC-16 card must be modified at the factory. Also note that the older Cisco CSC-S serial interface card *will not operate* with the CSC/3 processor card.

Modifications to MCI and SCI Cards When Upgrading to a CSC/3

Both the MCI and SCI cards require one PAL (a socketed part) to be replaced with a new revision of that logic function. The PALs are shipped as part of a CSC/3 processor card upgrade package. The modifications to the MCI and SCI cards are described in the following sections.

MCI Modification

The PAL to be changed on the MCI card is numbered U112, and is located next to the crystal oscillator in the lower left corner of the card (see Figure 5-11). The old PAL is labeled with either the legend 13/107A or the part number 17-0038.

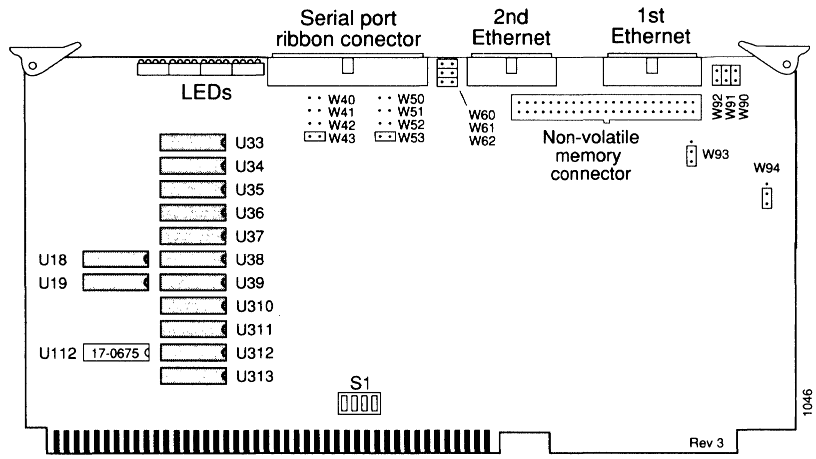


Figure 5-11 MCI Card — Placement of PALs

Remove this part, and replace it with the new PAL numbered 17-0675. Be sure to orient the new PAL the same way in its socket as the old one; the notches on the PALs must be in the same position shown in Figure 5-11. Also be careful not to bend any legs during the insertion.

SCI Modification

The PAL to be changed on the SCI card is numbered U213, and is located in the lower left corner of the card (see Figure 5-12). The old PAL is labeled with either the legend 13/107A or the part number 17-0038.

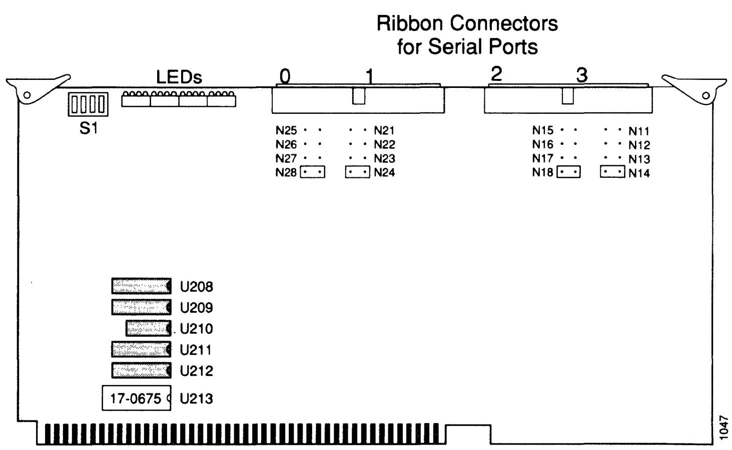


Figure 5-12 SCI Card — Placement of PALs

Remove this part, and replace it with the new PAL numbered 17-0675, being sure to orient the new PAL the same way in its socket as the old one, and being careful not to bend any legs during the insertion.

EPROM Replacement Procedures for the CSC/3

Software for each system is distributed in the form of EPROMs. Use the following instructions to remove EPROMs from your CSC/3 card and replace them with EPROMs containing upgraded software.

Refer to Figure 5-9 for placement of the EPROMs on the CSC/3 processor card.

Caution: The correct placement of the EPROM is crucial. If improperly positioned, the EPROM may be damaged when the system is powered on. It is imperative that you read through all of the instructions before proceeding. Also, to prevent damage to the EPROMs from electrostatic discharge, be sure to follow the ESD procedures described earlier in this manual when handling the cards and their components.

Be sure to remove all EPROMs from their sockets before starting these procedures. If the software comes in a set of four EPROMs, the EPROMs are inserted into the even-numbered sockets—U42, U44, U46, and U48 only. If the software comes in a set of eight EPROMs, the EPROMs are inserted into all eight sockets.

The EPROMs are labeled with the appropriate socket U-number. The sockets have labels too, although obscure, on the silkscreen portion of the processor card.

Each EPROM has a notch cut in one end to indicate its proper orientation. Each EPROM must be placed so that its notch is aligned with the notch in the EPROM socket, as shown in Figure 5-9. Do not rely on the orientation of the EPROM labels. See step 4, below, for specific installation instructions.

Tools Required:

The following tools may be required when replacing EPROMs on the CSC/3 processor card:

- Chip extractor
- Needle-nosed pliers
- Slotted screwdriver

Procedure:

Follow these steps to upgrade the EPROMs in the CSC/3 processor card.

Step 1: Turn off power to the server, then gain access to the card cage. Refer to the section "System Card Cage Access," earlier in this chapter, for access procedures.

Step 2: Remove the processor card from the card cage. All cards have ejectors that allow them to be easily extracted from their slots. Use your thumbs to pull the ejectors out and away from the card. Open both ejectors at the same time. Use care not to strain any flat cables still attached to the card as it is being removed.

Step 3: Remove all EPROMs from their sockets with a chip extractor. If a chip extractor is not available, use the tip of the screwdriver blade to gently rock the EPROMs out of their sockets.

Step 4: To insert a new EPROM, align the EPROM notch with the notch in the appropriate socket. *If the EPROM is shorter than its socket, insert pins starting with the sockets farthest from the notch and allow the extra space to fall between the notches.* When inserting, be very careful not to bend or crush any of its pins. If this happens, use needle-nosed pliers to straighten them out.

Step 5: When all EPROMS have been replaced, check for proper jumper settings. The factory default settings shown in Figure 5-10 are correct for both 512 kilobit and one megabit EPROM configurations.

Step 6: Replace the card in the card cage following the card removal and replacement procedures described earlier.

Step 7: To insert the card, push the card firmly in the card cage until it snaps in place and is firmly seated in the slot. The ejectors close automatically when the card is properly seated.

Step 8: Turn on power and test the installation.

If you turn on a system when one or more of the EPROMs is incorrectly inserted, the system may either halt and light its red halt light, or may print a message on the console port complaining of a checksum error. When this happens, locate the offending EPROM pin, straighten it, then re-insert the EPROM and try again.

Step 9: When the CSC/3 processor card tests successfully, turn off power. Then replace the panel or cover and reboot the system.

Installing the CSC/2 Processor Card

The CSC/2 processor card contains a 12.5 MHz MC68020 central processor unit and one megabyte of dynamic RAM, and supports two megabytes of ROM. The CPU also has three LEDs to indicate its operational state.

Figure 5-13 is a line drawing of the CSC/2 processor card viewed from the component side. Jumper settings can be found at the end of this section. Immediately following the card installation steps are the EPROM replacement procedures for the CSC/2 processor card.

Note: If you are replacing your CSC/1 processor card with a CSC/2 processor card, note that the CSC/2 draws more power than a CSC/1. Be sure that the voltage of the +5V power supply is still within the operating limits of +4.95V to +5.1V.

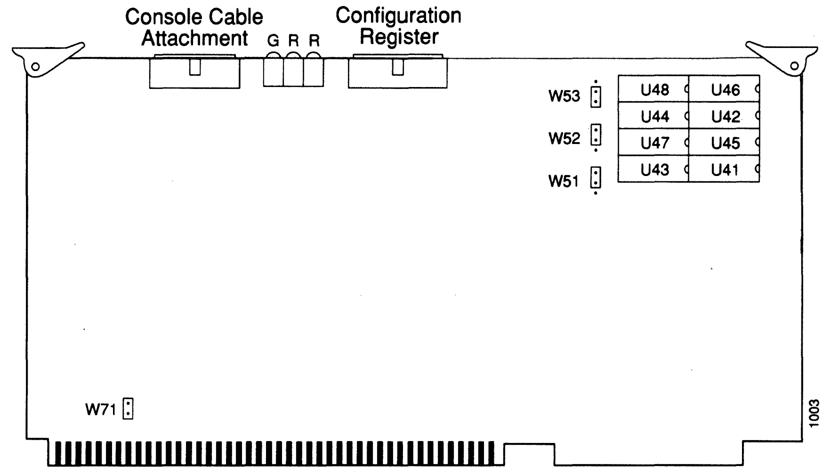


Figure 5-13 CSC/2 Processor Card — Component Side View

Procedure:

Install the CSC/2 processor card in a chassis as follows:

Step 1: Turn the chassis power switch off, and unplug the power cord from the wall socket.

Step 2: Remove the card access panel (A-type and M-chassis) or the cover (C-chassis) to gain access to the card cage.

Step 3: If you are removing an existing card, unplug the ribbon cable from the console cable connector on the card. Grasp the card at the edges and the ejector tabs and pull it toward you and out of the card cage.

Step 4: The jumpers are set at the factory for correct operation. Figure 5-14 shows the factory defaults and configuration options for EPROMs on the processor card.

Step 5: Insert the CSC/2 card into the second slot from the top in the card cage if the CSC-MT is installed, or into the first slot if the CSC-MC card is installed.

Step 6: Attach cables the internal ribbon cables. In general, route cables under the card cage through the space provided, and then up to the card where they attach. Be careful not to restrict the airflow or destroy the integrity of the electrical grounding or power supply.

Note: Follow the same cabling pattern established at the factory. For sample views of the internal cabling for each chassis, refer to Figure 5-3, Figure 5-6, and Figure 5-8.

Step 7: Connect the console cable (cable ends are keyed) to the console cable attachment port on the CSC/2 card (see Figure 5-13).

Step 8: Connect the opposite end of the cable to the console port on the inside of the chassis back panel.

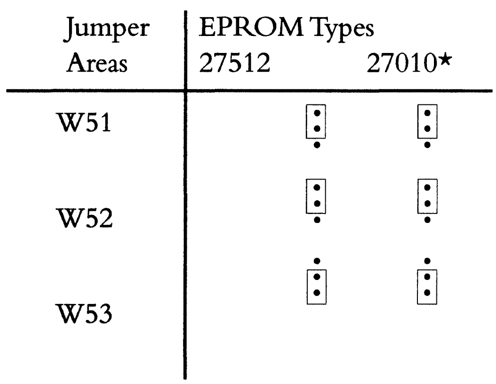
Step 9: Attach the console terminal cable to the console connector on the outside of the chassis back panel.

Step 10: Turn on the system for an installation check.

Step 11: Check the LEDs. The green LED is a software-programmable run light. It is lit when the system is running. The middle red LED is the processor halt light. It is on whenever the processor is in a halt state. The red LED on the right is a software-programmable status light. It is lit during initialization, flashes if there is an error, and is off under normal conditions.

Step 12: Replace the card access panel or cover.

Step 13: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.



*Factory default for both 512 MB and 1 MB memory configurations

Figure 5-14 CSC/2 Jumper Settings

EPROM Replacement Procedures for the CSC/2

Software for each system is distributed in the form of EPROMs. Use the following instructions to remove the EPROMs from the CSC/2 card and replace them with EPROMs containing upgraded software.

Refer to Figure 5-13 for placement of the EPROMs on the CSC/2 processor card.

Caution: The correct placement of the EPROM is crucial. If improperly positioned, the EPROM may be damaged when the system is powered on. It is imperative that you read through all of the instructions before proceeding. Also, to prevent damage to the EPROMs from electrostatic discharge, be sure to follow the ESD procedures described earlier in this manual when handling the cards and their components.

Be sure to remove all EPROMs from their sockets before starting these procedures. If the software comes in a set of four EPROMs, the EPROMs are inserted into the even-numbered sockets—U42, U44, U46, and U48 only. If the software comes in a set of eight EPROMs, the EPROMs are inserted into all eight sockets.

The EPROMs are labeled with the appropriate socket U-number. The sockets have labels too, although obscure, on the silkscreen portion of the processor card.

Each EPROM has a notch cut in one end to indicate its proper orientation. Each EPROM must be placed so that its notch is aligned with the notch in the EPROM socket, as shown in Figure 5-13. Do not rely on the orientation of the EPROM labels. See step 4, below, for specific installation instructions.

Tools Required:

The following tools may be required when replacing EPROMs on the CSC/2 processor card:

- Chip extractor
- Needle-nosed pliers
- Slotted screwdriver

Procedure:

Follow these steps to upgrade the EPROMs in the CSC/2 processor card.

Step 1: Turn off power to the server, then gain access to the card cage. You may gain access to the cards in the A-type and M-chassis by removing front or side panels. You may gain access to cards in the C-chassis by removing the cover.

Step 2: Remove the processor card from the card cage. All cards have ejectors that allow them to be easily extracted from their slots. Use your thumbs to pull the ejectors out and away from the card. Open both ejectors at the same time. Use care not to strain any flat cables still attached to the card as it is being removed.

Step 3: Remove all EPROMs from their sockets with a chip extractor. If a chip extractor is not available, use the tip of a screwdriver blade to gently rock the EPROMs out of their sockets.

Step 4: To insert a new EPROM into its socket, align the EPROM notch with the notch in the appropriate socket. If the EPROM is shorter than its socket, insert pins starting with the sockets farthest from the notch and allow the extra space to fall between the notches. When inserting, be very careful not to bend or crush any of its pins. If this happens, use a needle-nosed pliers to straighten them out.

Step 5: When all EPROMs have been replaced, check for proper jumper settings. The factory default settings shown in Figure 5-13 are correct for both 512 kilobit and one megabit EPROM configurations.

Step 6: Replace the card in the card cage following the card removal and replacement procedures described earlier.

Step 7: To insert the card, push the card firmly in the card cage until it snaps in place and is firmly seated in the slot. The ejectors close automatically when the card is properly seated.

Step 8: Turn on power and test the installation.

If you turn on a system when one or more of the EPROMs is incorrectly inserted, the system may either halt and light its red halt light, or may print a message on the console port complaining of a checksum error. When this happens, locate the offending EPROM pin, straighten it, then re-insert the EPROM and try again.

Step 9: When the CSC/2 processor card tests successfully, turn off power. Then replace the panel or cover and reboot the system.

System Controller Subsystems

This section describe the following system controller cards, which were introduced for use in the AGS+:

- CSC-CCTL cBus controller card
- CSC-ENVM environmental monitor card

The CSC-ENVM functions as a memory slave board, serving the memory functions of the CSC-MT board, thus making the Cisco memory cards (the CSC-MT and the CSC-MC) unnecessary in the AGS+.

Installing the CSC-CCTL cBus Controller Card

The Cisco cBus Controller card (CSC-CCTL) provides two functions for the AGS+ router: It serves to interconnect the system bus and the cBus for routing packets from interfaces on the cBus to interfaces on the system bus. It also performs packet-switching functions on the cBus using its on-board processor, instead of the system's processor. The CSC-CCTL features a 16 million instructions per second (MIPS) processor to provide high-speed, autonomous switching of data packets on the cBus.

The CSC-CCTL card is required for operation when Cisco's cBus network interface cards (such as the CSC-FCI and CSC-MEC cards) are installed.

Figure 5-15 is a line drawing of the CSC-CCTL card viewed from the component side.

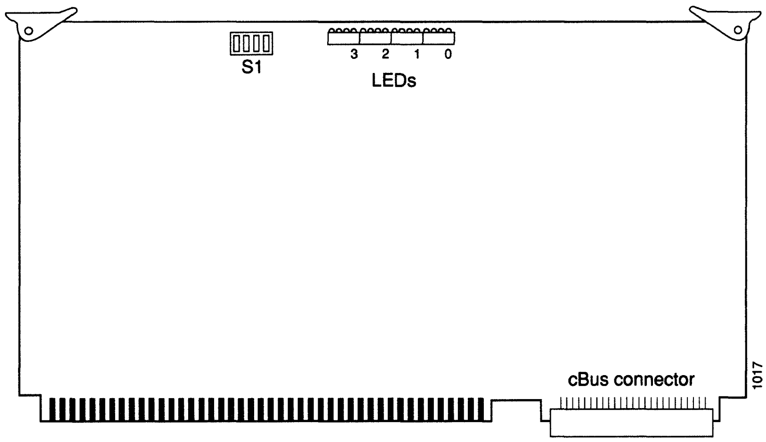


Figure 5-15 CSC-CCTL Card — Component Side View

Procedure:

Install the CSC-CCTL card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the AGS+ card access panel to gain access to the card cage.

Step 3: Check that the unit address has been set to 0. Switch S1 (see Figure 5-14 for location) assigns the unit number address used by the system processor card. This unit number address controls the area of communication across the multibus. The CCTL unit number switch should always be set to 0. Table 5-3 describes the settings for the card unit numbers when the switch is oriented with the cBus connector at the top, facing the component side of the card.

Note: The unit numbers of the CCTL and any MCI, SCI, and CSC-R16 cards must be unique. This is not true for the older Token Ring card, the CSC-R.

Table 5-3 CSC-CCTL Switch S1 Settings for Card Unit Numbering

Card Unit	S1-1	S1-2	S1-3	S1-4
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on
6	off	on	on	off
7	off	on	on	on

Step 4: Insert the CSC-CCTL into the middle cBus slot (the seventh slot from the top.) See Figure 5-1 for an illustration of slot placement.

Caution: This is an important step. Failure to place the CSC-CCTL card in the correct slot prevents correct operation of your system.

Step 5: Turn on the system power for an installation check. Upon power-up, all LEDs light, indicating the card is active. Once the system is booted and the CSC-CCTL firmware has completed its discovery phase, only those LEDs which indicate a card present in a cBus slot remain lit. One light from each set will light upon detection of an interface card.

Figure 5-16 illustrates which LED will light to indicate the presence of a card in the cBus. The orientation of Figure 5-16 is the same as looking at the CSC-CCTL card installed in the card cage, edge-on, component side up. The numbers above each LED indicate the cBus number.

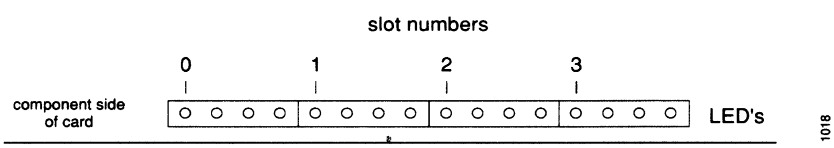


Figure 5-16 CSC-CCTL LED Indications — Edge-on View

An error condition is indicated if no LEDs light at power-up, or after the booting sequence. If this happens, check that all cards are firmly seated. If there is still no indication upon a second power-up attempt, contact Cisco Systems at the number provided in the Service and Support section in the front of this guide.

Step 6: When the card tests successfully, turn off power to the system and replace the panel. Then, reboot the system.

Step 7: Once the CSC-CCTL and interface cards are installed, use the EXEC command **show controller cbus** to display the names and unit numbers of all controller and interface cards and their microcode version numbers. Following is a partial, sample display:

```
>show controller cbus
cBus 0, controller type 3.0, microcode version 1.0
  128 Kbytes of main memory, 32 Kbytes cache memory
  Restarts: 0 line down, 0 hung output, 0 controller error
 MEC 0, controller type 5.0, microcode version 1.1
  Interface 0 is Ethernet0, station address 0000.0C00.566C
```

Installing the CSC-ENVM Environmental Monitor Card

The CSC-ENVM is included in all AGS+ configurations and is required for system operation.

The CSC-ENVM serves a number of purposes for the AGS+, including monitoring power supply voltage and monitoring air flow for high temperature conditions to protect the AGS+ from overheating. A high-temperature fault causes the system to shut down. Air flow and temperature monitors provide two levels of protection—warnings displayed by Cisco network management software as flags, and faults, which cause the system to be shut down. Network management software can also poll and display power supply voltage, air flow, and air temperature to help predict system problems through the use of sensors on the CSC-ENVM.

The CSC-ENVM card also functions as an intelligent slave I/O card, as well as a memory slave card. It serves the memory functions of the CSC-MT card, thus making the Cisco memory cards unnecessary in the AGS+.

The CSC-ENVM contains NiCad backup batteries, which save the system configuration for at least 30 days in the event power is lost. The batteries must be initially charged for a minimum of 24 hours; this is performed at the factory, before the system is shipped.

Figure 5-17 is a line drawing of the environmental monitor card viewed from the component side.

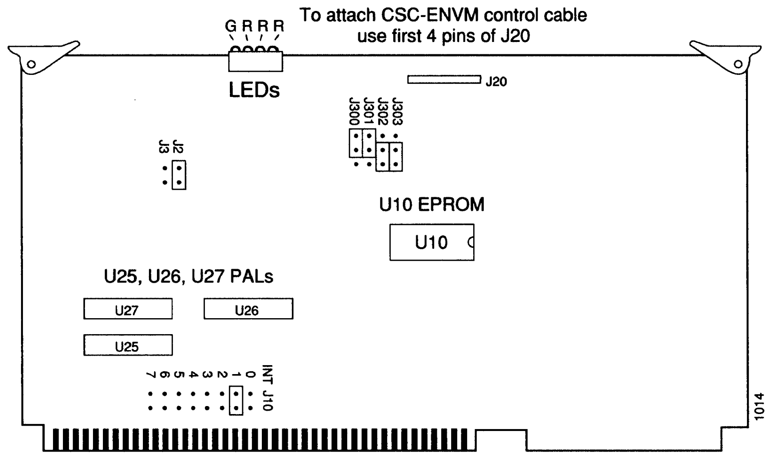


Figure 5-17 CSC-ENVM Environmental Monitor Card — Component Side View

The card provides four LEDs that indicate its operating status. These LEDs can only be observed through the front panel opening.

Warning: When the front panel is removed for more than 60 seconds, the CSC-ENVM card may sense the disruption of proper air flow, which may cause it to shut down the system. Remove the front panel briefly to check the states of the LEDs on the CSC-ENVM card.

The following list describes the meanings of the LEDs on the CSC-ENVM card. The LEDs are described from left to right using the orientation seen in Figure 5-16.

- Green—Normally ON. Lights to indicate that the card is operational (presence of +5 volts). The proper state of the RED LEDs should be observed.
- Red—Normally OFF. If lit, this LED indicates that an Interrupt request has been issued to the system processor, and that there may be a problem somewhere within the system.
- Red—Normally OFF. If lit, this LED indicates that the system processor is trying to communicate with the CSC-ENVM card.
- Red—Conditional light. This LED lights to indicate that the Reset Line has been activated. This does not indicate whether the Reset was caused by the system processor or the CSC-ENVM card, only that the reset condition has been activated.

Procedure:

Install the CSC-ENVM environmental monitor card in the A+ chassis (only) as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel from the A+ chassis to gain access to the card cage. Remove the existing card, if there.

Step 3: Check for proper jumper settings on the new CSC-ENVM card. The jumpers are set at the factory for correct operation, as shown in Figure 5-17.

Step 4: Insert the new CSC-ENVM card into the card cage following the card removal and replacement procedures described earlier.

Correct card placement order in the card cage is crucial for system functionality. CSC-ENVM cards must be installed in the top cage slot, followed by your CSC/3 processor card. All other system bus master cards (CSC-R, CSC-P) must be placed consecutively immediately below the CSC/3 card. These are then followed by the other interface cards (MCI, SCI, MEC).

Step 5: Attach the CSC-ENVM control cable to connector J20 (see Figure 5-17).

Step 6: The opposite end of the cable is attached to the analog power switch (APS) and the power supply, and should be already connected.

Step 7: Carefully route the cable through the cable space provided at the top right of the card cage (facing the unit).

Step 8: Turn on the system for an installation check.

Step 9: Check the LEDs located near the control connector (see Figure 5-17). The green LED on the left is a Power-Available light. It is lit when the system is running. The red LED next to it indicates the Interrupt status of the system processor. The middle red LED indicates new data is available when it is lit. The far right red LED indicates that the Reset line has been activated.

Step 10: Turn off system power and replace the card access panel. Turn on the system power to reboot.

EPROM Replacement Procedures for the CSC-ENVM Card

Use the following instructions to remove and replace the EPROM on your CSC-ENVM card. Refer to Figure 5-17 for placement of the EPROM on the CSC-ENVM environmental monitor card.

Caution: The correct placement of the EPROM is crucial. If improperly positioned, it may be damaged when the system is powered on. It is imperative that you read through all of the instructions before proceeding. Also, to prevent damage to the EPROMs from electrostatic discharge, be sure to follow the ESD procedures described earlier in this manual when handling the cards and their components.

The EPROM is inserted into the U10 socket. It is labeled with the appropriate socket U-number, which is also silkscreened on the CSC-ENVM card.

Each EPROM has a notch cut on one end to indicate proper orientation. It should be placed so that its notch faces the same direction as the notch in the EPROM socket, as shown in Figure 5-17. Do *not* rely only on the orientation of the EPROM labels. See step 4 below for specific installation instructions.

Tools Required:

The following tools may be required when replacing the EPROM on the CSC-ENVM Environmental monitor card:

- Chip extractor
- Needle-nosed pliers
- Slotted screwdriver

Procedure:

Follow these steps to upgrade the EPROM in the CSC-ENVM card.

Step 1: Turn off power to the server, then gain access to the card cage by removing the front panel.

Step 2: Remove the CSC-ENVM card from the card cage.

Step 3: Remove the old EPROM from its socket with a chip extractor. If a chip extractor is not available, use the tip of the screwdriver blade to gently rock the EPROM out of its socket.

Step 4: To insert a new EPROM into its socket, align the EPROM notch with the notch in the appropriate socket. If the EPROM is shorter than its socket, insert pins starting with the sockets farthest from the notch and allow the extra space to fall between the notches. When inserting, be very careful not to bend or crush any of its pins. If this happens, use needle-nosed pliers to straighten them out.

Step 5: When the EPROM has been replaced, check for proper jumper settings. The factory default settings shown in Figure 5-16 should match the settings on your card. There are no user-configurable jumpers on the CSC-ENVM card.

Step 6: Replace the card in the card cage. Turn on power and test the installation.

Note: If you turn on a system when the EPROM is incorrectly inserted, the green LED will light, indicating +5V power is available. The on-board processor will attempt to boot, but will fail because of the improper EPROM installation. The green Conditional/Reset LED (farthest from the red LED) will remain lit, and within about eight seconds the ENVM will turn off the system. When this happens, remove the EPROM, straighten its pin, then re-insert the EPROM and try again.

Step 7: When the CSC-ENVM environmental monitor card tests successfully, turn off power and replace the panel, then reboot the system.

Memory Subsystem

The Cisco Systems internetworking products are configured with external system memory. This memory comes in the form of nonvolatile memory (also called Random Access Memory, or RAM) for saving system configurations. Systems configured with the Token Ring (CSC-R) and parallel printer (CSC-P) interface cards also require additional memory. Refer to page 5-31 for a description of multibus memory.

Cisco Systems memory cards include the CSC-MC chassis memory card, and the CSC-MT enhanced memory card supply memory for systems other than the AGS+ (the CSC-ENVM provides NVRAM for the AGS+).The CSC-MT occupies a multibus slot; the CSC-MC, which is smaller, is bolted onto the card cage and is connected to the MCI card via a ribbon cable.

The CSC-MC and CSC-MT cards are described in the following sections.

The CSC-ENVM card supplies memory for the AGS+ (and is described in the section "System Controller Subsystems" earlier in this chapter).

Installing the CSC-MC Chassis Memory Card

The CSC-MC, shown in Figure 5-18, is Cisco Systems' chassis memory card for the A-type, C-, and M-chassis. It supplies nonvolatile configuration information to the system. It contains four RAM chips totaling 32 kilobytes of memory.

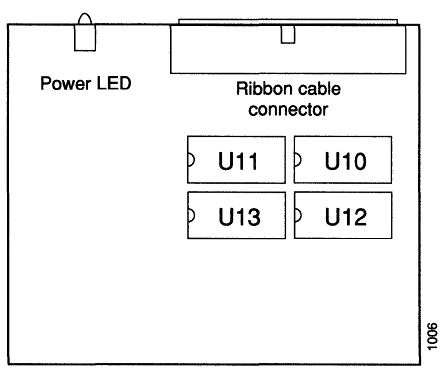


Figure 5-18 CSC-MC Chassis Memory Card — Component SideView

The CSC-MC memory card can be used by all Cisco internetworking products except the AGS+ which are not configured with the Token Ring (CSC-R) or parallel printer (CSC-P) interface cards. The CSC-MC card is connected to an MCI controller card by a 50-pin ribbon cable. In the A-type chassis,the card is anchored to the top of the card cage; in the M- and C-chassis, it is anchored to the floor of the chassis with standoff screws.

Battery Backup:

The CSC-MC card comes equipped with built-in NiCad batteries designed to last ten years.

Tools Required:

To install the CSC-MC card, you need standard Phillips screwdrivers, sizes #0 and #1

Procedure:

Install the CSC-MC chassis memory card as follows:

Step 1: Turn off the unit and unplug it.

Step 2: The CSC-MC card has no special jumpers or configuration settings.

Step 3: Remove the card access panel (A-type and M-chassis), or the chassis cover (C-chassis).

Step 4: Remove all previously installed cards from the chassis.

Step 5: Place cards on an antistatic pad.

Step 6: Locate either the four studs on the A-type chassis card cage, or the standoff screws at the bottom of the M- or C-chassis.

Step 7: Attach the 50-pin ribbon cable to the CSC-MC card before mounting it in the chassis.

Step 8: Mount the CSC-MC card with the four screws to the four studs at the bottom of the chassis.

Step 9: Install the MCI card in the slot directly above the CSC-MC card; attach Ethernet port cables to the MCI card.

Step 10: Attach the internal ribbon cable from the CSC-MC card to the MCI card. Check the clearance above the MCI card, being careful of the connectors.

Note: Follow the same cabling pattern established at the factory. For sample views of the internal cabling for each chassis, refer to Figure 5-3, Figure 5-6, and Figure 5-8.

Step 11: Reinstall remaining cards, following the previous installation order.

Step 12: Turn on the system for installation check.

Step 13: Check LEDs. The CSC-MC card has one green LED. This LED indicates whether power is correctly supplied to the card. If it is not lit during operation, check the cable between the MCI and the CSC-MC card. It may be faulty or incorrectly installed.

Step 14: Replace the card access panel or the cover.

Step 15: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Installing the CSC-MT Enhanced Memory Card

The CSC-MT is Cisco Systems' combination memory card which provides shared memory for the CSC-P and CSC-R interface cards, as well as nonvolatile memory for configuration storage. It can be used in the A-type and M-chassis.

The CSC-R interface requires system bus memory beyond that normally present on the nonvolatile memory card, as does the CSC-P card.This additional memory is called multibus memory.

A memory card so configured is referred to as an *enhanced memory card,* and can be recognized by the presence of ten large static RAM chips, as indicated by the ten large blocks in Figure 5-19.

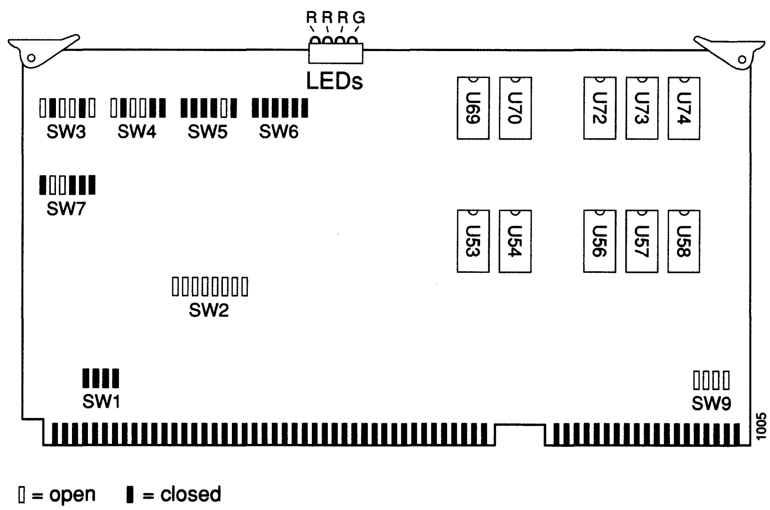


Figure 5-19 CSC-MT Enhanced Memory Card — Component Side View

Procedure:

Install the CSC-MT enhanced memory card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type and M-chassis) to gain access to the card cage.

Step 3: Confirm the switch settings shown in Figure 5-19.The CSC-MT card has no user-selectable settings. It comes preconfigured from the factory and needs no other configuration.

Step 4: Insert the CSC-MT card in the top slot of the card cage. (The CSC-MT card has no cables to attach.)

Step 5: Turn on the system for an installation check.

Step 6: Check the LEDs. The CSC-MT card has one green and three red LEDs. The red LEDs each indicate battery status. If one of the three on-board backup batteries should fail, its corresponding LED lights. The green LED indicates power is supplied to the card. It is normally on when the system is powered up.

Step 7: Replace the card access panel or the cover.

Step 8: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Network Interface Controller Subsystems

This section describes the network interface controller cards. Cisco Systems offers a variety of interfaces contained on different types of controller cards. Some controller cards contain more than one interface type. There are also restrictions on the types and number of interfaces you may configure in each of the chassis; these are noted throughout the descriptions.

The Cisco network interface controller cards include the following:

- Fiber Distributed Data Interface card (CSC-FCI)
- Multiport Ethernet Controller card (CSC-MEC)
- Serial-Port Communications Interface card (CSC-SCI)
- High-Speed Serial Communications Interface card (CSC-HSCI)
- Multiport Communications Interface card providing both serial and Ethernet network connections (MCI)
- 4Mbps Token Ring interface card (CSC-R)
- 4 or 16Mbps Token Ring interface card (CSC-R16)

Each card is described in the following subsections.

Installing the CSC-FCI Controller Card

The Cisco Fiber Distributed Data Interface controller card (CSC-FCI) is the system interface for both single-mode and multimode FDDI networks. It is connected to the cBus backplane in the AGS+. Each FDDI applique requires one CSC-FCI controller card. The CSC-FCI contains a 16-million-instructions-per-second (MIPS) processor for fast packet switching. It uses Advanced Micro Devices AM79C83 FORMAC chips for media access control functions.

Figure 5-20 is a line drawing of the CSC-FCI FDDI controller card viewed from the component side.

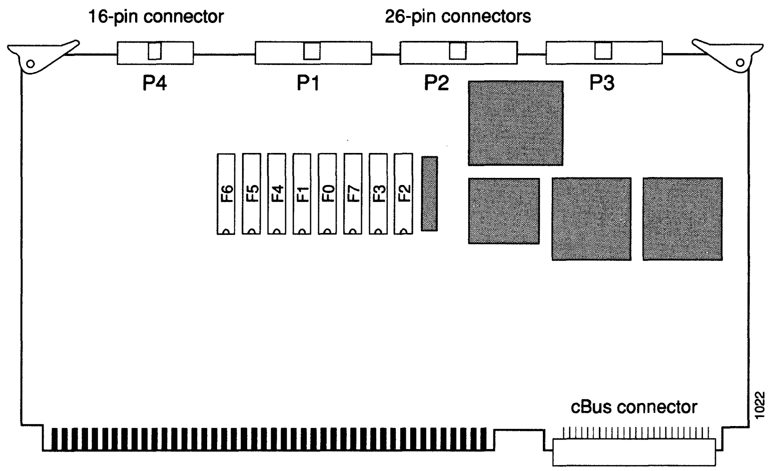


Figure 5-20 CSC-FCI Card — Component Side View

Procedure:

Install the CSC-FCI card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the AGS+ card access panel to gain access to the card cage.

Step 3: Switch settings: the CSC-FCI card has no user-selectable settings. It comes preconfigured from the factory and needs no other configuration.

Step 4: Insert the CSC-FCI in the card cage. See Figure 5-20 for an illustration of slot placement.

There are four cables coming from the applique card. The cables are labeled P1, P2, P3, and P4. Refer to Figure 5-20 for an illustration of the connectors on the CSC-FCI controller card. In general, route cables under the card cage through the space provided, and then up to the card where they attach. Be careful not to restrict the airflow or destroy the integrity of the electrical grounding or power supply.

Step 5: Connect the 16-pin cable labeled P4 to the 16-pin connector labeled P4.

Step 6: Connect the 26-pin cable labeled P1 to the 26-pin connector labeled P1.

Step 7: Connect the 26-pin cable labeled P2 to the middle 26-pin connector labeled P2.

Step 8: Connect the 26-pin cable labeled P3 to the 26-pin connector at the far edge of the card labeled P3.

Step 9: Turn on the system for installation check.

Upon power-up, all LEDs light, indicating the card is active. Once the system is booted and the cBus Controller card firmware has completed its discovery phase, it then lights only those LEDs that indicate the presence of a card in any cBus slot. There are four sets of LEDs, one for each interface slot in the cBus. One light from each set will light upon detection of an interface card. Figure 5-21 illustrates which LED will light to indicate the presence of a card in the cBus. The orientation of Figure 5-21 is looking at the card as installed—edge on, component side up. The numbers above each LED indicate the cBus slot number.

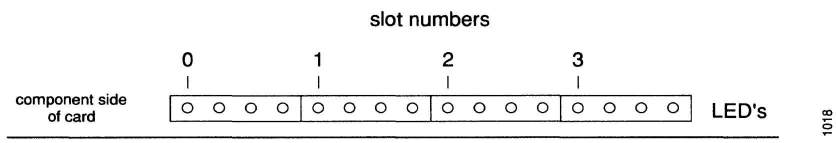


Figure 5-21 CSC-CCTL LED Indications — Edge-on View

An error condition is indicated if no LEDs light at power-up, or after the booting sequence. If this happens, check that all cards are firmly seated. If there is still no indication upon a second power-up attempt, contact a Cisco Systems at the number provided in the "Service and Support" section in the front of this publication.

Step 10: When the card tests successfully, turn off power to the system and replace the panel. Then, reboot the system.

Installing the CSC-MEC Card

The Cisco Multiport Ethernet Controller (CSC-MEC) card provides two, four, or six high-speed Ethernet ports. It operates on Cisco's proprietary cBus backplane in the AGS+ router, and provides switching rates of over 20,000 packets per second for both bridging and routing functions.

The card contains a 16-million-instructions-per-second (MIPS) bit-slice processor to provide a high-speed data path between the CSC-MEC and other high-speed interfaces on the cBus.

Figure 5-22 is a line drawing of the CSC-MEC card viewed from the component side.

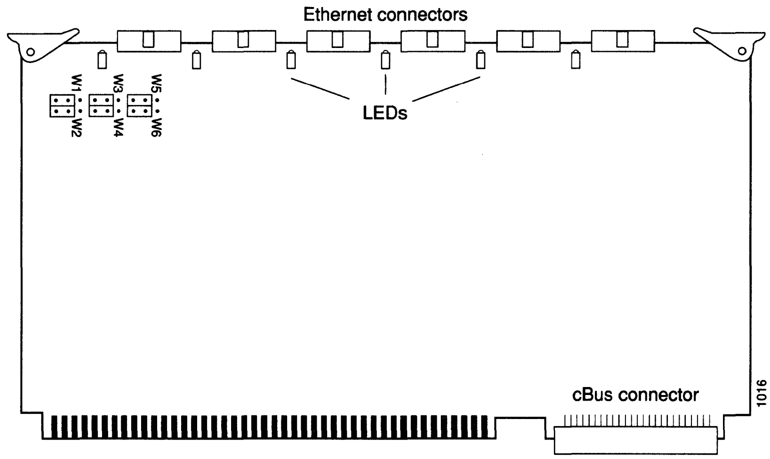


Figure 5-22 CSC-MEC Card — Component Side View

The CSC-MEC Ethernet ports support the IEEE 802.3/Ethernet Version 2 specifications by default, and Ethernet Version 1 specifications with modifications.

Procedure:

Install the CSC-MEC card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the AGS+ card access panel to gain access to the card cage.

Step 3: Check that the jumper settings are correct. Figure 5-23 shows the default jumper settings, which are correct for operation with IEEE 802.3 and Ethernet Version 2 specification transceivers. To connect Ethernet Version 1 specification transceivers, you must change the jumper setting as specified in Figure 5-24.

Step 4: Insert the CSC-MEC in the card cage. See Figure 5-1 for an illustration of slot placement in the cBus.

Step 5: Internally, connect a cable and 15-pin Ethernet connector to a port on the card and to an Ethernet connector on the back panel.

Step 6: Externally, attach an Ethernet transceiver cable from the 15-pin slide latch connector to a transceiver or MAU.

Make sure that the connecting cable is an IEEE 802.3 cable if connecting to an IEEE 802.3 transceiver, or an Ethernet-compatible cable if connecting to an Ethernet Version 1 or 2 transceiver. See step 3 for instructions to make the jumper settings necessary to attach to an Ethernet Version 1, Version 2, or IEEE 802.3 transceiver.

Note: Follow the same internal cabling pattern established at the factory.

Step 7: Turn on the system for an installation check and watch for the Ethernet LEDs to light. Depending upon the configuration of the card, there will be two, four, or six LEDs lit upon turn on. The ports are activated from left to right when viewing the card edge-on, component side up. The LED is located to the right of the connector. The LEDs light to indicate the interface is functional, even when it is not attached to a transceiver. Use the monitoring commands described in the section "Unit Numbering," earlier in this chapter, to display the interface configuration.

If, after the power-up and boot sequence, no LED is lit for a connector that should be functional, turn off power and check that the card is firmly seated in the card cage, then go through the installation check again. If after a second power-up and boot sequence the LED is not lit, contact customer service with the phone numbers provided in the section titled "Service and Support" in the front of this guide.

Step 8: When the card tests successfully, turn off power and replace the panel, then reboot the system.

CSC-MEC Jumper Settings for Ethernet Version 1

Figure 5-24 shows the appropriate jumper settings to use when you attach Ethernet Version 1 cables to the Ethernet connector. Figure 5-23 shows the appropriate jumper settings to use when you attach Ethernet Version 2 and IEEE 802.3 cables to the Ethernet connector.

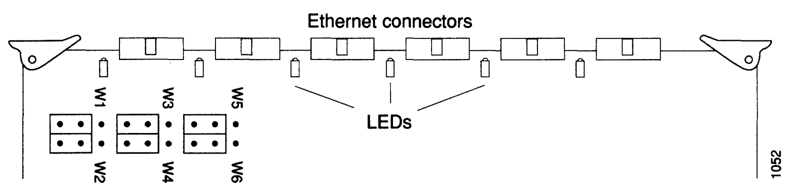


Figure 5-23 Jumper Settings for Ethernet Version 2 and IEEE 802.3

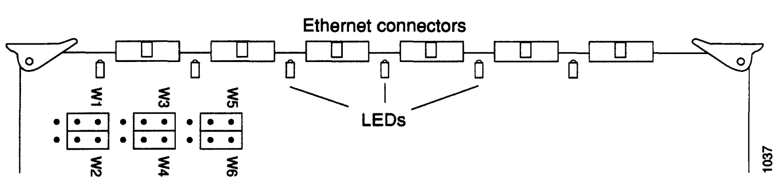


Figure 5-24 Jumper Settings for Ethernet Version 1

Jumpers on pin sets W1 through W6 set the electrical specifications for the Ethernet transceiver connection. Each jumper is moved right one pin, as shown in Figure 5-24 to change the electrical specifications of its corresponding connector. Pin set W1 corresponds to the far left connector when using the orientation seen in Figure 5-24 (facing the component side of the card with the connectors at the top). Each connector corresponds consecutively to a pin set, moving right to left. These designations do not correspond to the unit numbers assigned to each Ethernet port by firmware; that process is described in the section "Unit Numbering," earlier in this chapter.

Installing the HSCI Card

The High-speed Serial Communications Interface (HSCI) is a higher-speed version of the Serial Communications Interface (CSC-SCI) card. The HSCI provides a full duplex synchronous serial interface for transmitting and receiving data at rates of up to 52 Mbps with the HSA applique, or 125 Mbps with the ULA applique; the actual rate is determined by the external DSU and the service.

The HSCI card resides on the cBus in the system card cage. Before installing the card, read the "cBus Configuration" section earlier in this chapter. Figure 5-25 shows the HSCI card viewed from the component side.

In addition to normal network diagnostics, the HSCI card provides a ribbon cable loopback hardware diagnostic, which is described later in this section.

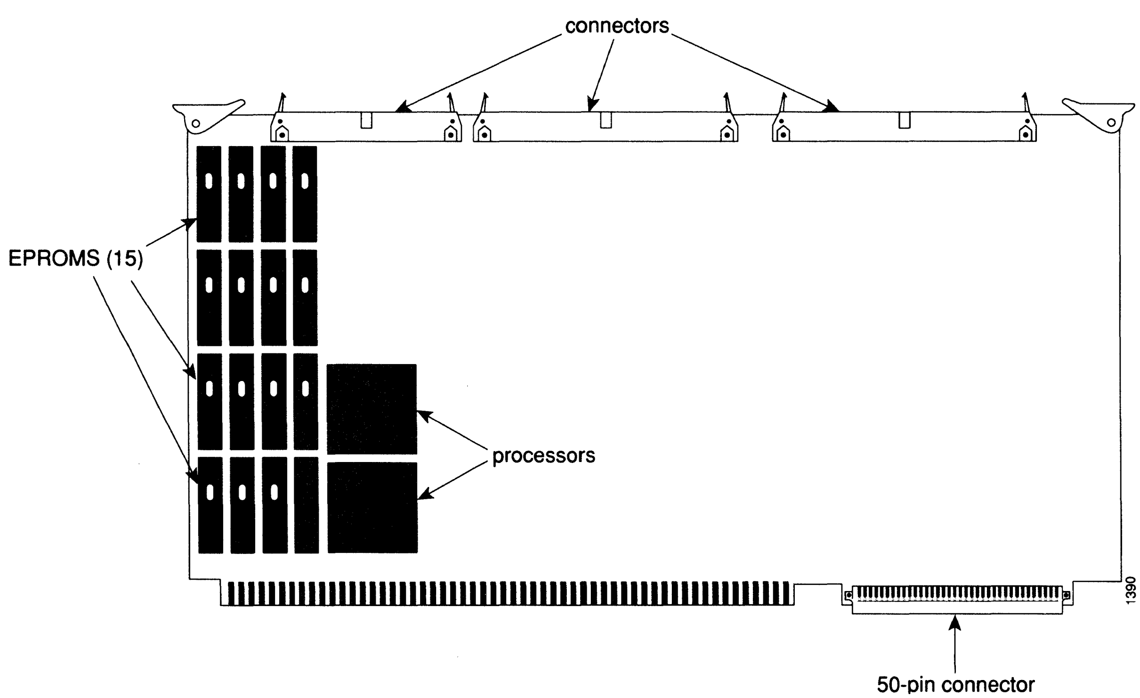


Figure 5-25 HSCI Network Interface Card — Component Side View

You will need a standard (#1) Phillips screwdriver, and an ESD-prevention wriststrap to install the HSCI Network Interface Card in one of the cBus slots in the system card cage. You need only remove the front card cage access panel to install the HSCI card.

Caution: Be sure to follow the ESD prevention procedures described in the previous section. Failure to do so may cause intermittent or immediate equipment failure.

Procedure:

Install the HSCI card as follows:

Step 1: Turn off the AGS+ and unplug it.

Step 2: Remove the front access panel to gain access to the card cage.

Step 3: Insert the HSCI in cBus slot 3 or other predetermined cBus slot.

Step 4: Place any additional HSCI cards into slots 2, then 1, then 0, respectively.

Step 5: Connect the 6-pin cable, from the HSA or ULA applique, to the power connector on the card.

Step 6: Connect 50-pin Receive (R) cable from the applique to the Receive (R) connector on the card.

Step 7: Connect the 50-pin Transmit (T) cable from the applique to the Transmit (T) connector on the card.

Step 8: With HSA applique only—Connect the 34-pin cable from the HSA to the 34-pin connector on the card.

Step 9: Replace the front access panel.

Step 10: Turn on the system for an installation check.

Step 11: Check the LEDs on the applique. If any of the cables are crossed, the red ER indicator, shown in Figure 5-26, will light.

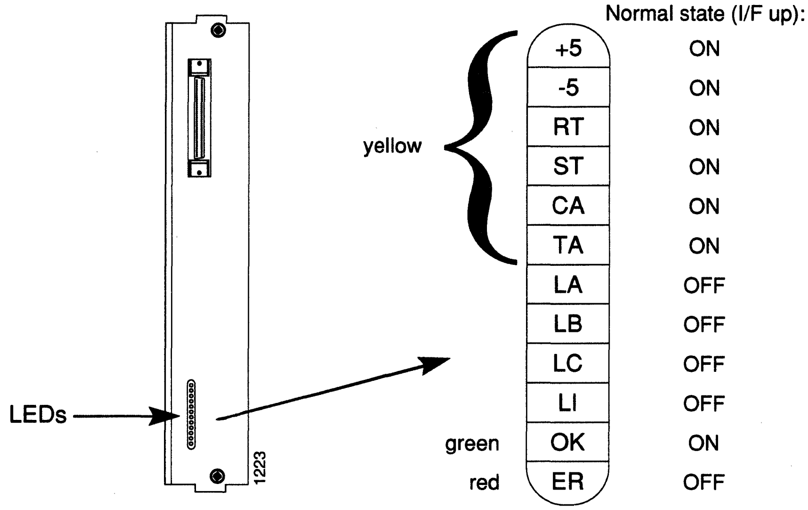


Figure 5-26 HSA Error Indicator

Ribbon Cable Loopback Test

The ribbon cable loopback is a hardware troubleshooting and verification feature. After installing or swapping an HSCI card, or ULA or HSA applique, or if the HSSI complex or the UltraNet complex is not functional, use this test to verify operation of the HSCI card.

Note: When performing the hardware ribbon cable loopback function, it is not necessary to use the software **loopback** command, since a physical loopback is already created.

Procedure:

To perform the ribbon cable loopback test:

Step 1: Turn off the AGS+ power, and remove the front card cage access panel.

Step 2: On the HSCI card, disconnect both 50-pin cables and, if present, the 34-pin cable.

Connect a cable with two 50-pin connectors between the Transmit and Receive ports of the HSCI card (see Figure 5-27).

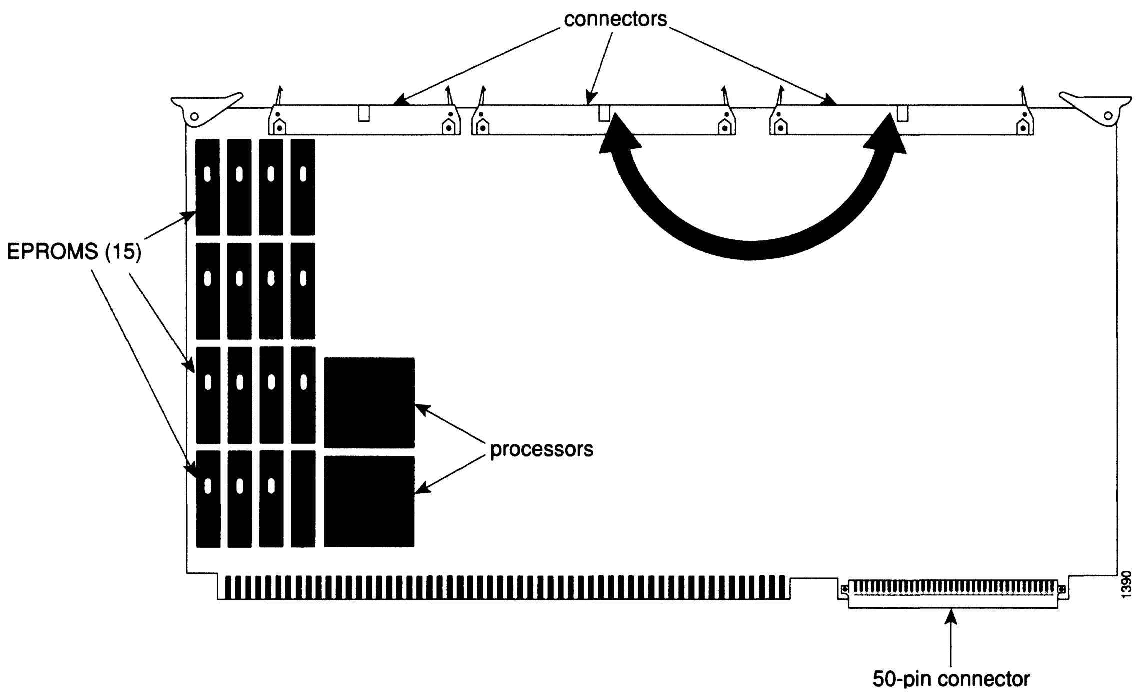


Figure 5-27 Cable Connections for Loopback Test

Step 3: Turn the AGS+ power back on. The software will recognize the HSCI as an UltraNet interface, which is the default when no applique is installed.

Step 4: At the # prompt, enter the following commands. For the ultra address, use any non-0/0 value. For the ip address, use any valid ip address, such as the one already assigned to the serial interface you're testing.

```
#config
interface ultranet 0
ultra address 88/20
ip address [addr] [mask]
no shutdown
^Z
```

Step 5: Then *ping* the interface.

```
ping [addr]
```

Step 6: If the ping returns a series of exclamation points (!!!!!), the ping was successful. Any fault with the installation of the interface is now isolated to the applique or farther out on the interface. If the ping returns a series of ellipses (.....), the ping was not successful; the fault is isolated to the HSCI card.

Step 7: Turn off the AGS+ power, and remove the 50-pin cable from the HSCI Transmit and Receive ports.

Step 8: Reconnect the two internal 50-pin cables (and, if present, the 34-pin cable) to the HSCI card.

Step 9: Replace the front card cage access panel, and turn the AGS+ power back on.

Installing the SCI Card

The Cisco Serial-port Communications Interface (SCI) card, shown in Figure 5-28, provides up to four 4-megabit per second, channel-independent, serial interface ports on two 50-pin connectors. Each connector supports two synchronous serial ports. The 50-pin cable is split so that appliques of varying types can share the same cable.

Most Cisco systems routers will contain either the Serial Port Communications Interface (SCI) cards, which offers up to four fast serial ports, and/or the Multiport Communications Interface (MCI) cards (described in a later section), which offer both fast serial and Ethernet ports.

Power Requirements: 4.2A at +5V.

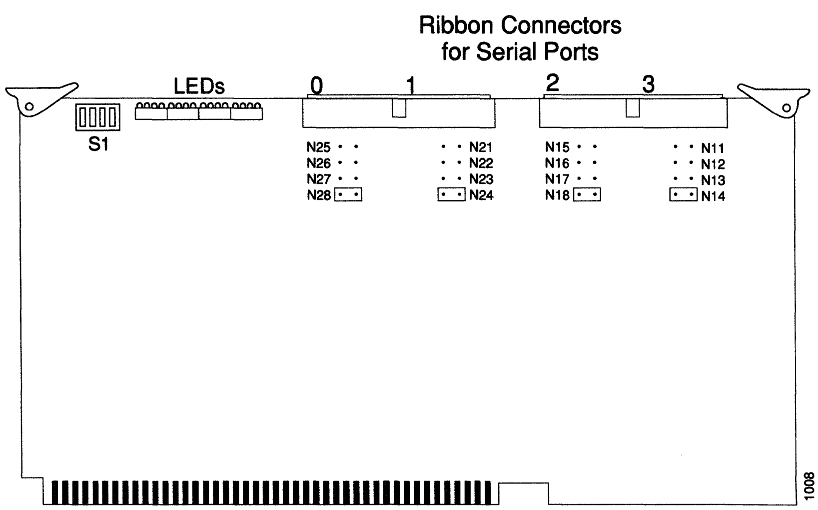


Figure 5-28 SCI Card — Component Side View

Warning: Each end of the 50-pin ribbon cable is keyed for correct attachment. Reversal of the cable at either end causes permanent damage to the SCI card.

Chassis Restrictions

The chassis limitations of the SCI and MCI controllers are shown in Table 5-4. The CSC-R card consumes as much power as an MCI-type interface. If using both MCI and CSC-R interfaces in any chassis, the total number of controllers must not exceed the numbers indicated.

Table 5-4 Number of SCI/MCI Interfaces per Chassis

Chassis	No./Controllers
AGS+	7
AGS	4
MGS	3; one must be an MCI to which the CSC-MC attaches
CGS	1; MCI only

Procedure:

Install the SCI card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type and M-chassis) or the cover (C-chassis) to gain access to the card cage.

Step 3: Select jumper settings. Configurable options for the SCI include serial interface clocking and the system bus unit number.

Step 4: Unit number selection—Select the appropriate dip switch setting, located in the upper left-hand corner of the card, next to the bank of LEDs. (Table 5-5 shows the SCI switch settings for unit numbering.)

Note: The unit numbers of the CCTL, SCI, MCI, and CSC-R16 cards must be unique.

Step 5: Choose the clock options. The SCI card has four clock options; they are controlled by the jumpers located just under the 50-pin ribbon cable connectors. (Table 5-7 shows the appropriate settings.) The jumper settings must agree with the requirements of the appliques for proper operation. DTE appliques usually require normal External Transmit Clock.

Step 6: Insert the SCI card in the card cage.

Step 7: Connect a 50-pin ribbon cable to the SCI card serial port.

Step 8: Connect one half of the opposite end of the cable to a 25-pin connector on the appropriate applique. Connect the other half to the auxiliary port, if your system is configured with one.

Step 9: Attach these connectors to an applique on the back panel (RS-232, V.35, or RS-449) as ordered.

Note: On the newer Cisco-designed RS-232 applique, the cable between the SCI card and the applique is keyed on both ends. This means that the cable connector is installed on the serial port so the connector pins are aligned.

When making this connection with older, non-Cisco designed appliques, it is important to determine the location of pin-1 for each port and match it correctly to pin-1 on the applique. If the connectors are not installed correctly, it will cause damage to the interface controller card.

Step 10: Turn on the system for installation check.

Step 11: Check LEDs. The SCI card contains a bank of 16 LEDs; however, only four are currently used. The LEDs listed in Table 5-6 light when the interface acknowledges the Carrier Detect signal from the CSU/DSU.

Step 12: Replace the card access panel or the cover.

Step 13: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Table 5-5 shows the SCI Switch S1 settings for unit numbering.

Table 5-5 SCI Switch S1 Settings for Unit Numbering

Unit	S1-1	S1-2	S1-3	S1-4
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on
6	off	on	on	off
7	off	on	on	on

Table 5-6 shows the SCI card LED descriptions. When the indicated LED is lit, Carrier Detect is present on that serial interface. To identify the LEDs, LED 0 is at the left side as you face the bank of LEDs.

Table 5-6 SCI LED Descriptions

LED	Port
0	Serial 0
4	Serial 1
8	Serial 2
12	Serial 3

Table 5-7 shows the appropriate SCI jumper settings for the clock options. The last two columns of the table (DTE and DCE) indicate the setting that should be used with either the DTE or DCE applique. Cisco products are shipped with the factory default set to work with the DTE appliques. These appliques require external clocking; the CSU/DSU provides the clocking for the circuit.

Table 5-7 SCI Jumper Settings for Clock Options

Jumper Pair	Signal Description	Interface	DTE	DCE
N24	Normal External Transmit Clock	Serial 0	X	—
N23	Inverted External Transmit Clock	Serial 0	—	—
N22	Normal Internal Transmit Clock	Serial 0	—	X
N21	Inverted Internal Transmit Clock	Serial 0	—	—
N28	Normal External Transmit Clock	Serial 1	X	—
N27	Inverted External Transmit Clock	Serial 1	—	—
N26	Normal Internal Transmit Clock	Serial 1	—	X
N25	Inverted Internal Transmit Clock	Serial 1	—	—
N14	Normal External Transmit Clock	Serial 2	X	—
N13	Inverted External Transmit Clock	Serial 2	—	—
N12	Normal Internal Transmit Clock	Serial 2	—	X
N11	Inverted Internal Transmit Clock	Serial 2	—	—
N18	Normal External Transmit Clock	Serial 3	X	—
N17	Inverted External Transmit Clock	Serial 3	—	—
N16	Normal Internal Transmit Clock	Serial 3	—	X
N15	Inverted Internal Transmit Clock	Serial 3	—	—

Most DTE interfaces require Normal External Transmit Clock. All DCE interfaces require Internal Transmit Clock (non-inverted). See the section "Clock Rates" earlier in this chapter for information about setting the clock rates.

Installing the MCI Card

The Cisco Systems Multiport Communications Interface (MCI) card provides up to two Ethernet ports and one 50-pin serial interface that supports up to two synchronous serial ports by means of a split 50-pin cable and ribbon connector. The MCI card also supports the CSC-MC nonvolatile memory card. This memory is attached to the MCI card by a special 50-pin connector located just behind the Ethernet connectors; see Figure 5-29.

No special configuration changes are necessary on the MCI card when using nonvolatile memory, and such use does not affect the card's performance.

Power Requirements: 5.2A @ +5V

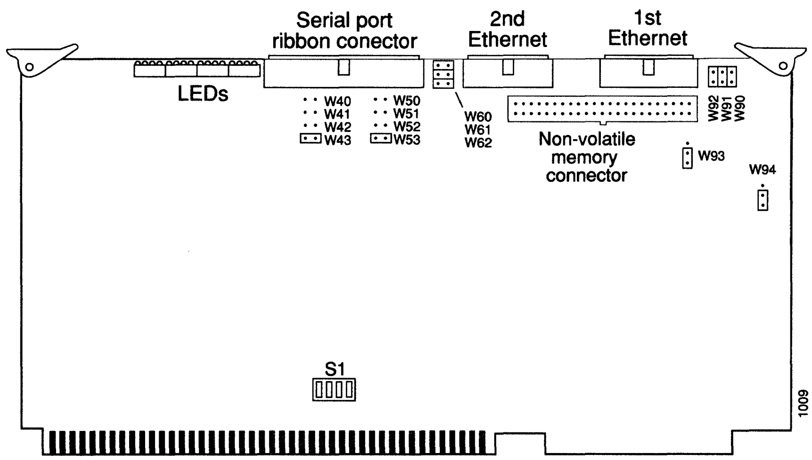


Figure 5-29 MCI Card — Component Side View

Warning: Each end of the 50-pin ribbon cable is keyed for correct attachment, and reversal of the cable at either end causes permanent damage to the MCI card.

The Ethernet ports support Ethernet Versions 1 and 2, and IEEE 802.3. The serial ports can be ordered with software support for low-speed (maximum of 64 kilobits) or high-speed (up to 4 Megabits) data rates.

Chassis Restrictions

Refer to Table 5-4 for the number of MCI cards that can be used per chassis.

Procedure:

Install the MCI card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type and M-chassis) or the cover (C-chassis) to gain access to the card cage.

Step 3: Select jumper settings. Refer to Figure 5-29 for a view of the 16 jumper areas and the one dip switch, S1.

Step 4: Set jumper areas W40 through W53 to select the appropriate serial clocking options. Refer to Table 5-8 for settings, and to the section "Clock Rates," earlier in this chapter, for information about setting the clock rates.

Step 5: Select grounding options with jumper areas W90 through W62. Table 5-9 lists the grounding options. Inserting a jumper grounds a signal, and removing a jumper allows the signal to float. The MCI card provides these options to accommodate the differences between the Ethernet Version 1 and IEEE 802.3 electrical specifications. Ethernet permits certain signals to float, whereas IEEE 802.3 requires the signals to be grounded.

The factory default is to ground all signal pairs, which is compatible with both Ethernet and IEEE 802.3 requirements.

Jumpers W94 and W93 are 3-pin jumpers that select between Ethernet and IEEE 802.3 electrical levels. Using the orientation shown in Figure 5-29, place a jumper on the lower pair of pins to select IEEE 802.3 or Ethernet Version 2, or on the upper pair of pins to select Ethernet Version 1.

Jumper W94 controls the first Ethernet and jumper W93 controls the second Ethernet. The factory default is to select IEEE 802.3/Ethernet Version 2. This setting must be changed to operate with an Ethernet Version 1 transceiver.

Step 6: Select unit numbers. Switch S1 determines the unit number of the MCI card. Unit numbers are shown in Table 5-10 for this four-position switch.

Note: The unit numbers of the CCTL, SCI, MCI, and CSC-R16 cards must be unique.

Step 7: Insert the MCI card in the card cage.

Step 8: Once you have the MCI card installed, you may use the EXEC command **show controller mci** to display the hardware type for this card.

Step 9: Internally, connect a 50-pin ribbon cable to the MCI card serial connector.

Step 10: Connect each half of the opposite end of the cable to a 25-pin connector.

Step 11: Attach these connectors to an applique on the back panel (RS-232, V.35, or RS-449) as ordered. When making this connection with older, non-Cisco designed appliques, it is important to determine the location of pin-1 for each port and match it correctly to pin-1 on the applique.

Note: On the newer Cisco-designed appliques, the cable between the control card and the applique is keyed on both ends. This means that the cable connector is installed on the port so the connector pins are aligned.

Caution: If the connectors are not installed correctly, it will cause damage to the interface controller card.

Step 12: Internally, connect a cable and a connector to the port on the card and to the Ethernet connector on the back panel.

Step 13: Externally, attach an Ethernet transceiver cable from the 15-pin slide latch connector to a transceiver or MAU.

Step 14: Turn on the system for installation check.

Step 15: Check LEDs. The MCI card contains a bank of 16 LEDs; however, only four are currently used. The LEDs listed in Table 5-11 light to indicate when an interface is running.

In Ethernet systems, this means that the interface is attached to the multibus correctly, but it may not be functional. For serial lines, this means that Carrier Detect is true and the interface is enabled.

Step 16: Replace the card access panel or the cover.

Step 17: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Table 5-8 shows the appropriate MCI jumper settings for the clock options. The last two columns of the table (DTE and DCE) indicate the setting that should be used with either the DTE or DCE applique. Note that all Cisco products are shipped with the factory default set to work with the DTE appliques.

Occasionally, delays occur between the SCTE clock and the transmit data that may push the data transition out to the point where using an inverted clock is appropriate (jumpers W52 and W42). Both ends of the wire may have variances that differ slightly. Typical delays measured at Cisco indicate that the inverted clock may be appropriate above 1.3 MHz, depending upon the DTE-clock-to-data skews and setup required, and allowing some margin for temperature, cable, and other variables. Some DCE will not accept SCTE, so SCT must be used. Inverting the clock may be the only way to compensate for the cable length and circuit delays in the DTE and DCE.

Table 5-8 MCI Jumper Settings for Clock Options

Jumper Pair	Signal Description	Interface	DTE	DCE
W53	Normal External Transmit Clock	First Serial	X	—
W52	Inverted External Transmit Clock	First Serial	—	—
W51	Normal Internal Transmit Clock	First Serial	—	X
W50	Inverted Internal Transmit Clock	First Serial	—	—
W43	Normal External Transmit Clock	Second Serial	X	—
W42	Inverted External Transmit Clock	Second Serial	—	—
W41	Normal Internal Transmit Clock	Second Serial	—	X
W40	Inverted Internal Transmit Clock	Second Serial	—	—

Table 5-9 shows the jumper settings for grounding options on the MCI card.

Table 5-9 MCI Jumper Settings for Grounding Options

Jumper Pair	Signal Description	Interface
W90	Receive Pair Shield	First Ethernet
W91	Transmit Pair Shield	First Ethernet
W92	Power Pair Shield	First Ethernet
W60	Power Pair Shield	Second Ethernet
W61	Transmit Pair Shield	Second Ethernet
W62	Receive Pair Shield	Second Ethernet

Table 5-10 shows the MCI Switch S1 settings for unit numbering. Ensure that the unit switches on the MCI cars, SCI cards, and cBus CCTL card each have different settings.

Table 5-10 MCI Switch S1 Settings for Unit Numbering

Unit	S1-1	S1-2	S1-3	S1-4
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on
6	off	on	on	off
7	off	on	on	on

Table 5-11 shows indications for the four LEDs currently used by the MCI card. These LEDs are numbered from left to right, as you face them.

Table 5-11 MCI LED Descriptions

LED	Port
0	Ethernet 0
4	Serial 0
8	Ethernet 1
12	Serial 1

Installing the CSC-R Token Ring Interface

The Cisco Systems Token Ring interface (CSC-R) provides interconnection of Cisco routers and terminal servers to IEEE-802.5 and IBM Token Ring media. The implementation is based on the TI-TMS380 chipset and an Intel 80186 controller. The data rate for this media is a maximum of four megabits per second and is fully compatible with the IEEE 802.5 standard.

Power Requirements: 4.7A at +5V

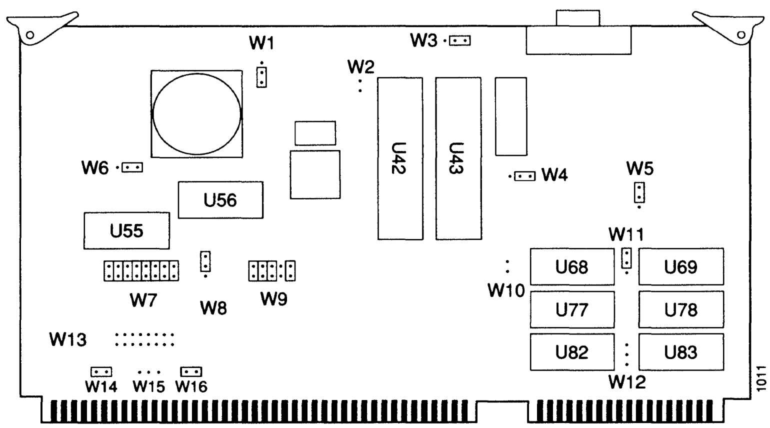


Figure 5-30 CSC-R Card — Component Side View

Chassis Limitations

The CSC-R and other controller cards must not exceed the number indicated in Table 5-12.

Table 5-12 Number of CSC-R Interfaces per Chassis

Chassis	No./Controllers
AGS+ with a CSC/3 processor card	3
AGS with a CSC/3 processor card	3
AGS with CSC/2 processor card	4
MGS	1
CGS	0

There must be a CSC-MT or CSC-ENVM card in the system to provide shared system bus memory for the CSC-R cards. You also need to take into account the power requirements of the CSC-MT or CSC-ENVM cards.

Procedure:

Install the CSC-R card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type and M-chassis) or the cover (C-chassis) to gain access to the card cage.

Step 3: Select jumper settings. The CSC-R card contains a number of jumpers that determine how the card behaves, including two jumper blocks that set the I/O address and the card number of this interface. Modify only these jumper blocks, where appropriate; leave all other jumper blocks at the factory-default settings.

Step 4: Figure 5-30 shows the location of the 16 jumpers and the firmware ROMs.

Step 5: Select unit number. When shipped, the CSC-R card is configured as unit 0. Table 5-13 shows how to change jumper area W9 to relocate the Token Ring interface to another unit number.

Step 6: Ensure that the processor card is installed in the second slot.

Step 7: Insert CSC-R card in the third slot from the top of the card cage, just below the processor card (see Figure 5-34 for correct placement).

The CSC-R card acts as a system bus master in the server. There must be an uninterrupted series of bus master cards in the card cage slots, immediately below the processor. Install all CSC-R cards (and any other bus masters such as the CSC-P interface card) next to each other in the chassis. Allow no gaps between these cards; the CSC-MT or the EVNM card must be in the top slot in the chassis. See Table 5-14 for the recommended card placement order.

Step 8: Internally, connect the permanently-attached ribbon from the of the Token Ring connector to the port on the CSC-R card.

Step 9: Externally, connect a Token Ring lobe cable to the 9-pin Token Ring connector.

Step 10: Turn on the system for installation check.

Step 11: Replace the card access panel or the cover.

When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Table 5-13 shows how to change jumper W9 to reset the Token Ring interface to another unit number.

Table 5-13 CSC-R Jumper W9 Settings for Unit Selection

Unit	A2	A3	A4	A5	A6	A7
0	in	in	in	out	in	out
1	out	in	in	out	in	out
2	in	out	in	out	in	out
3	out	out	in	out	in	out

Table 5-14 shows the recommended card placement order for the CSC-R card and associated bus masters.

Table 5-14 CSC-R Card Placement in Card Cage

Position	Card
1	CSC-MT
2	CSC/2 or CSC/3
3	CSC-R
4	CSC-P

Installing the CSC-R16 Token Ring Interface

The Cisco Systems CSC-R16 Token Ring interface card provides interconnection of Cisco routers and terminal servers to IEEE-802.5 and IBM Token Ring media from either a 16 megabits per second (Mbps) or a 4 Mbps Token Ring LAN. A single jumper setting selects either speed (4 or 16 Mbps). The CSC-R16 supports a single Token Ring interface.

Figure 5-31 shows the CSC-R16 Token Ring interface card viewed from the component side with its jumpers configured according to the factory settings. The enlargement in Figure 5-31 gives a close-up view of the factory-set jumper settings on the card.

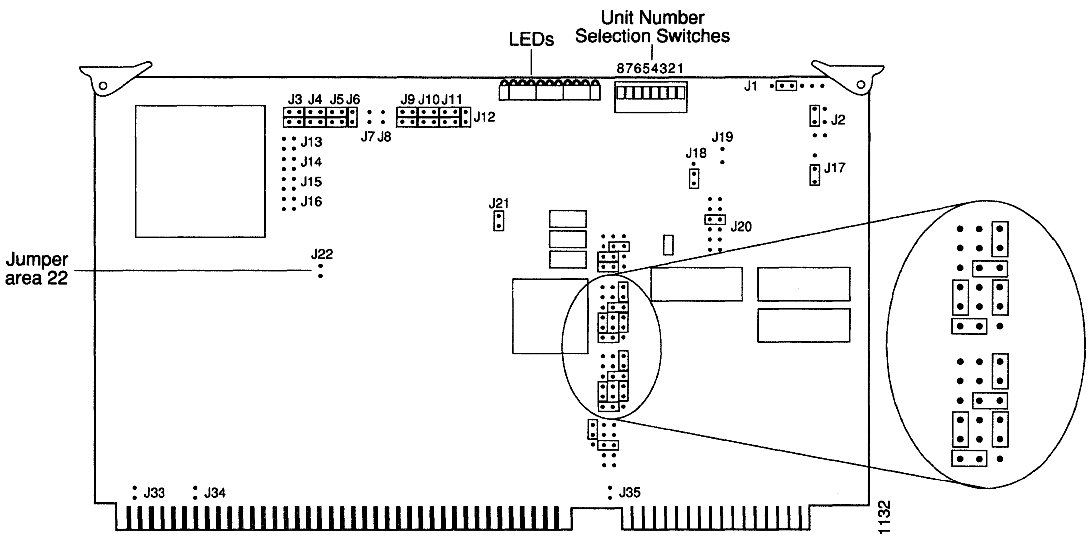


Figure 5-31 The CSC-R16 Token Ring Interface Card

Selecting Token Ring Speed

The speed of the CSC-R16 interface card is user-configurable. CSC-R16 interface cards are shipped configured to run at 16 Mbps. Jumper area J22 configures the CSC-R16 for either 4 Mbps or 16 Mbps operation. No jumper at jumper area 22 (the factory default setting) selects 16 Mbps Token Ring operation; installing a jumper at location J22 selects 4 Mbps Token Ring operation.

Note: A spare jumper is supplied, placed on the posts at jumper area J21. For 4 Mbps operation, remove the jumper from J21 and place it on the posts at jumper area J22.

Table 5-15 shows jumper area J22 configurations for both 16 Mbps and 4 Mbps.

Table 5-15 Jumper Area J22 Function

16 Mbps TR operation (default setting)	
4 Mpbs TR operation	

Note: Setting the speed jumper (J22) to an incompatible speed for the Token Ring causes no damage to the card. However, the entire Token Ring will be nonfunctional for the time that the misconfigured card is attempting to use the ring. This is true of all speed-selectable Token Ring cards.

Unit Numbering

Software-readable switches 1-8 control the unit number of the interface card within the router. Configure the switches as in Table 5-16 to select the desired unit number.

Table 5-16 Dip Switch Settings to Select Unit Number of Interface Card

Switches Control Software Unit Number CSC-R16

Unit #	Switch 1	2	3	4	5	6	7	8
0	D	D	D	D	D	D	D	D
1	U	D	D	D	D	D	D	D
2	D	U	D	D	D	D	D	D
3	U	U	D	D	D	D	D	D
4	D	D	U	D	D	D	D	D
5	U	D	U	D	D	D	D	D
6	D	U	U	D	D	D	D	D
7	U	U	U	D	D	D	D	D

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Key: D - Down position - Edge on view
U - Up position - Edge on view

Key: D — Down Position — Edge-On View
U — Up Position — Edge-On View

Note: Unit numbers of the CCTL, SCI, MCI, and CSC-R16 cards must be unique. Also, unit numbers must be unique within the set of all CSC-R16 interface cards in the same chassis. This is what allows the system to distinguish one CSC-R16 interface card from another. (The same is true for most types of cards in the system.)

CSC-R16 interface card unit numbers begin after CSC-R interface card unit numbers. For example, if there are already two CSC-R interface cards in a system and two CSC-R16 interface cards are added, configured as unit 0 and unit 1, they will be seen by the system as interface Token Ring 2 and 3.

Figure 5-32 shows the numbered positions of the software-readable switches viewed from the edge of the card.

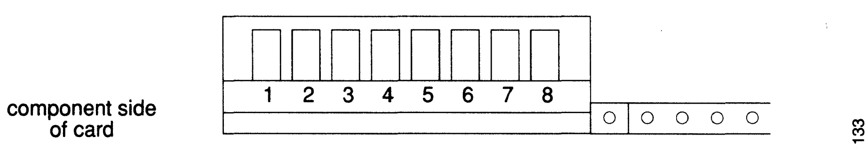

Figure 5-32 Software-Readable Switches — Card-Edge View

Other Configuration Considerations

The CSC-R16 interoperates with the 4 Mbps CSC-R Token Ring interface card, with any of the MCI family of cards, and with any cards in the cBus complex. (The CSC-R interface card's limitations still apply when used in conjunction with the CSC-R16.) The CSC-R16 interface card will also work with the CSC-16 card for use with a Token Ring terminal server.

The CSC-R16 Token Ring interface card will operate from any slot in the chassis.

Note: The CSC-R16 will *not* interoperate with the older Type 1 and Type 2 Ethernet cards, nor with the CSC-S and CSC-T cards.

Chassis Configurations

The CSC-R16 can be installed in the AGS+, AGS, and MGS chassis:

Table 5-17 shows the maximum number of CSC-R16 cards which can be supported in the AGS+, AGS, and MGS chassis models with the CSC/3 processor card configured with different card combinations.

Table 5-17 CSC-R16 Chassis Configurations with a CSC/3

Chassis	No. of CSC-R16	No. of CSC-R16 & 1 MCI/SCI	No. of CSC-R16 & 2 MCI/SCI
AGS+	7	6	5
AGS	4	4	3
MGS	2	2	1

Figure 5-18 shows the maximum number of CSC-R16 cards which can be supported in the AGS and MGS chassis models with the CSC/2 processor card configured with different card combinations.

Note: Fewer cards can be supported in conjunction with the CSC/2 processor card due to the higher current draw when compared to the CSC/3 processor card.

Table 5-18 Maximum Chassis Configurations with the CSC/2 Processor Card

Chassis	No. of CSC-R16	No. of CSC-R16 & 1 MCI/SCI	No. of CSC-R16 & 2 MCI/SCI
AGS	4	3	2
MGS	2	1	0

LED Descriptions

Along the top edge of the CSC-R16 interface card are 13 red status LEDs and one green LED, as shown in Figure 5-33. The descriptions of their functions and layout are shown in Table 5-19.

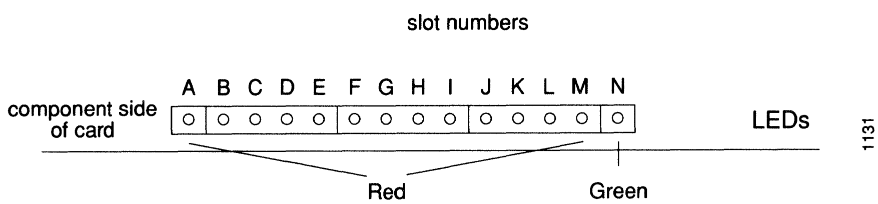

Figure 5-33 CSC-R16 LED Indicators — Edge-on View

Table 5-19 CSC-R16 Indicators

LEDs	Function
A	Processor Halted
B	-12V Fused
C	+12V Fused
D	+5V Fused
E	+5V
F-M	Activity Lights
N	Run (Green)

In normal operation, the activity lights on LEDs, F-M, will cycle back and forth.

Installation

Before installing any new cards, be sure to read through this entire document for complete installation instructions and information on configuring the card for proper operation.

Before beginning any procedures, *turn off system power and unplug the power cord.*

Installing the CSC-R16 Card

Install the CSC-R16 interface card in a chassis as follows:

Procedure:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type and M-chassis) to gain access to the card cage.

Step 3: Select jumper settings. For 16 Mbps operation leave open the jumper setting at jumper area J22. For 4 Mbps operation apply a jumper at location J22. Modify only jumper block J22, if appropriate, using the spare jumper from jumper area J21. Leave all other jumper blocks at the factory-default settings.

Figure 5-32 shows the eight switches controlling the unit number. Configure the switches as shown in Table 5-16 to select a unique R16 unit number within the router

Step 4: Insert the CSC-R16 card in the card cage.

Step 5: Attach the 10-pin DIP header cable to the keyed connector as shown in Figure 5-34.

Note: The red stripe on the cable is on the right in the orientation shown in Figure 5-34. In addition, the arrows on the connectors indicate the cable's correct position.

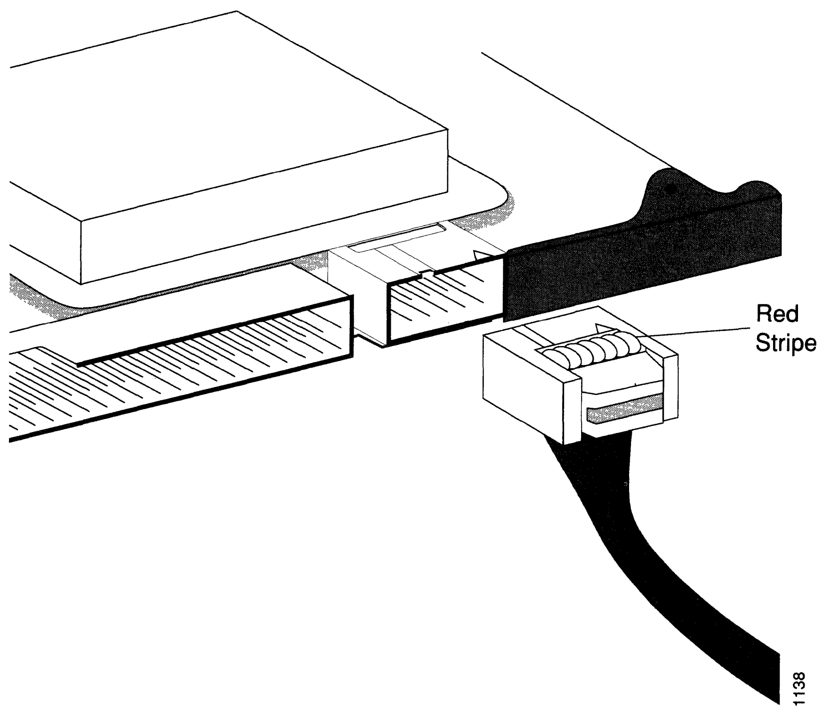

Figure 5-34 10-Pin DIP Header Cable Attachment

Step 6: Internally, connect the permanently attached ribbon from the Token Ring connector to the port on the CSC-R16 card.

Step 7: Externally, connect a Token Ring lobe cable to the 9-pin Token Ring connector.

Step 8: Turn on the system for installation check.

Step 9: When the installation is successful, replace the card access panel.

Peripheral Device Controllers

Installing the CSC-16 Terminal Server Serial Line Card

The CSC-16 is Cisco Systems' 16-port asynchronous serial attachment; it is also called the Terminal Server Serial Line card.

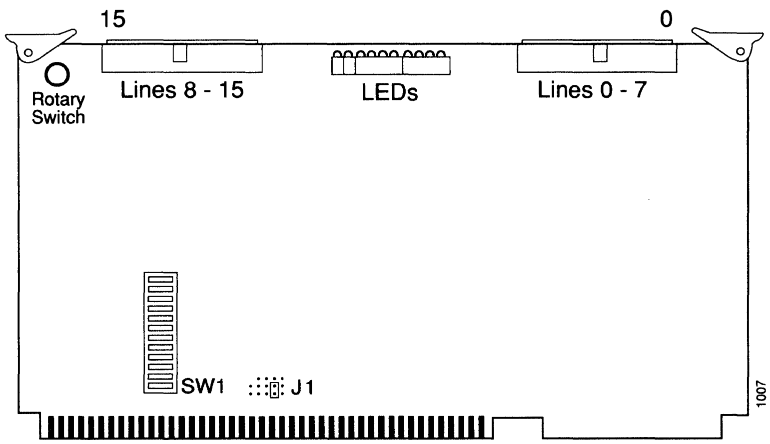

Figure 5-35 CSC-16 Card — Component Side View

Chassis Limitations

This card can be used in the A-type and M-chassis only. Table 5-20 shows the number of CSC-16 serial line cards allowed in the various chassis.

Note: If you are installing a new CSC/3 processor card in your system the CSC-16 card must be returned to the factory to have a jumper unsoldered and moved to a new location.

Table 5-20 Number of CSC-16 Interfaces per Chassis

Chassis	No. of Controllers
ASM	6
MSM	2
TRouter	1

Procedure:

Install the CSC-16 terminal server serial line card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A- and M-chassis) to gain access to the card cage.

Step 3: Check the unit number switch SW1, which is described in the following section, "Unit Number Selection."

Step 4: Insert the CSC-16 card in the card cage.

Step 5: The CSC-16 card has two connectors; each carries signals for eight asynchronous serial lines. (Refer to Figure 5-35 .) Attach a 50-pin cable to each connector on the interface card. Attach the opposite end of the cable to the 50-pin master connector, which is attached to one of the following external connector and/or appliques assembly types:

- Two 25-pair Telco (Amphenol) connectors
- Eight RJ-11 Telco applique assemblies
- Eight enclosed RS-232 (DTE or DCE) assemblies

Note: Follow the same cabling pattern established at the factory. In general, route cables under the card cage through the space provided, and then up to the card where they attach. Be careful not to restrict the airflow, especially when using the flat 25-pair cables. Always preserve the integrity of the electrical grounding and power supply.

Step 6: Turn on the system for installation check.

Step 7: Check the LEDs. Near the center of the card edge, which is visible when the card is installed, are ten LEDs that display the line state of two RS-232 ports (one port on each half). Near the right edge of the card (on the left side as oriented in Figure 5-35) is a 10-position rotary switch that can be operated with a small screwdriver. At one end of the screwdriver slot is a pointer. This pointer identifies which pair of ports are being monitored in the LED display. (Figure 5-36 describes the LED display.)

The position of the rotary switch determines which pair of ports are monitored, for example, 0 and 8, or 1 and 9, etc. The default position of the switch as shipped is set to position to 0, and therefore will display the signals for ports 0 and 8. The ports shown in each half of the display are selected according to Table 5-21.

Table 5-21 CSC-16 Rotary Switch Descriptions

*Switch Position	Left 5 LEDs	Right 5 LEDs
0	0	8
1	1	9
2	2	10
3	3	11
4	4	12
5	5	13
6	6	14
7	7	15
8	0	8
9	1	9

Step 8: Replace the card access panel.

Step 9: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any comments on the procedure in the site log, if desired.

The LEDs display the line state in the order shown in Figure 5-36, as viewed from the card edge.

R	T	C	R	D	R	T	C	R	D
X	X	T	N	T	X	X	T	N	T
D	D	S	G	R	D	D	S	G	R

Ports 0–7	Ports 8–15
RXD =	Received Data
TXD =	Transmitted Data
CTS =	Clear to Send
RNG =	Ring Indication
DTR =	Data Terminal Ready

Figure 5-36 CSC-16 LED Descriptions

Unit Number Selection

The switch SW1 controls selection of the system bus memory unit number. SW1-2 should be on, and SW1-1 and SW1-3 through SW1-8 should be off. Figure 5-37 shows the CSC-16 default SW1 switch settings.

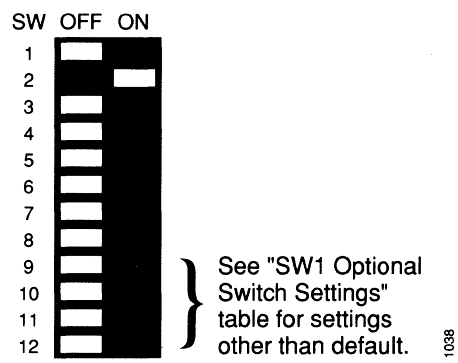

Figure 5-37 CSC-16 Default SW1 Switch Settings

Table 5-22 lists the settings for SW1-9 through SW1-12, which are optional, and depend on the card unit number. The default setting is shown as card unit "0."

Table 5-22 CSC-16 SW1 Optional Switch Settings

Unit	9	10	11	12
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on

The ports shown in each half of the LED display are selected according to Table 5-21.

Note: The system software addresses the terminal lines in octal, so that port 0 is addressed as tty1, and port 15 is addressed as tty20.

Installing the CSC-P Parallel Printer Card

The CSC-P is Cisco Systems' parallel printer interface card. Figure 5-43 shows the component side view of the CSC-P card.

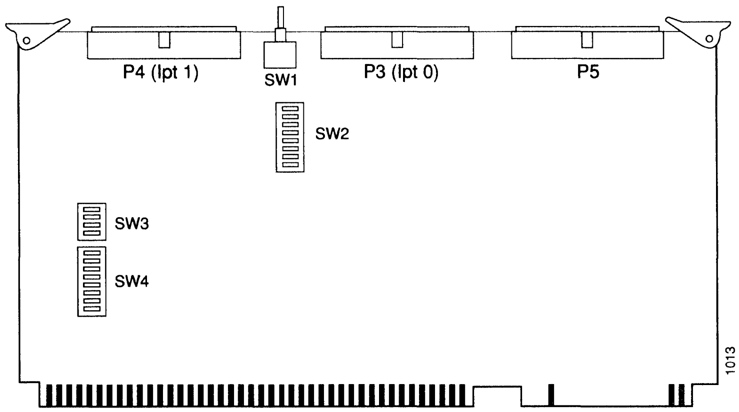

Figure 5-38 CSC-P Card — Component Side View

Chassis Limitations

The ASM Terminal Server can support up to two parallel interface units, each of which can control two printers.

Memory Requirements

There *must* be a CSC-MT enhanced memory or CSC-ENVM card in the system to provide shared system bus memory for the CSC-P cards, which require a minimum of 32 kilobytes. You also need to take into account the power requirements of the CSC-MT or CSC-ENVM card. Note that certain combinations of CSC-R and CSC-P cards may demand more memory than the amount supplied by the CSC-MT or CSC-ENVM card. The software automatically detects this requirement. If this occurs, contact Cisco Systems for assistance.

Procedure:

Install the CSC-P card in a chassis as follows:

Step 1: Turn off the unit and unplug it.

Step 2: Remove the card access panel (A-type chassis).

Step 3: Select the CSC-P switch settings according to Table 5-23:

Table 5-23 CSC-P Switch Settings

Switch	Setting	Description
SW1	center	Self-test
SW2	all on	system bus address bits
SW3–1	on	Select style of system bus address decoding
SW3–2	—	On for unit 0, off for unit 1
SW3–3	off	system bus address bits
SW3–4	off	system bus address bits
SW4–4	on	Interrupt level of card; all other SW4 switches off

Step 4: Insert CSC-P card in the card cage.The placement of the interface in the chassis backplane is critical for correct operation. See Table 5-24 for the recommended card placement order. If your system has a mixture of bus master cards, refer to Table 5-14 for the recommended card placement order.

Step 5: Ensure that the processor card is installed in the second slot; the CSC-MT card must be in the top-most slot of the chassis.

Step 6: Install the CSC-P cards and any other bus masters (such as the CSC-R interface card) next to each other in the chassis; there must be an uninterrupted series of bus master cards in the card cage slots, immediately below the processor.Allow no gaps between these cards.

Step 7: Attach the internal cables.

Step 8: Turn on the system for installation check.

Step 9: Replace the card access panel (A-type chassis).

Step 10: When the procedure is complete, enter the time, date, and your initials next to the appropriate entry in the Installation Checklist. Enter any additional comments on the procedure in the site log, if desired.

Table 5-24 shows the recommended card placement order for the CSC-P in the chassis backplane.

Table 5-24 CSC-P Card Placement in Card Cage

Position	Card
1	Memory card
2	Processor card
3	Printer Card

Appendix A
CPU Bootstrap Program

Appendix A describes how to test for problems with system memory and the central processing unit (CPU) cards using the bootstrap program. This program can help you isolate or rule out hardware problems encountered when installing your Cisco server. The diagnostic LEDs on the CPU cards assist you in monitoring and diagnosing problematic system activity.

Use the processor configuration register information contained in this appendix to set the console baud rate. This appendix also provides a summary of the bootstrap diagnostic tests and command options.

Appendix B lists the signals for the CPU console port and the CPU auxiliary port.

Complete hardware troubleshooting procedures are found in the *Field Service Manual.* For further assistance, contact Cisco or your nearest field service representative.

Processor Cards

Cisco Systems offers two processors for use in its servers. The CSC/3 card is an MC68020 processor running at 30 MHz with four megabytes of RAM and up to two megabytes of ROM. The CSC/2 card is an MC68020 processor running at 12.5 MHz with one megabyte of RAM and up to two megabytes of ROM.

The CSC/3 and CSC/2 Processor

Figure A-1 shows a partial view of the component side of the CSC/3 and CSC/2 processor cards as viewed with the bus connectors at the bottom.

Note: This card orientation is opposite from the card orientation in most of the other illustrations in this guide.

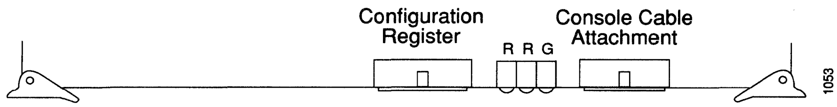

Figure A-1 Partial View of CSC/3 and CSC/2 Processor Cards

For both cards, the 50-pin connector in the center of the card is used as a configuration register for the processor diagnostics. The section "Configuration Register Settings" describes the settings for this register.

To the right of the configuration register, both processor cards have two red LEDs and a green LED. The leftmost LED is a software-programmable status light; it lights during initialization, flashes to indicate an error, and remains off under normal operation. The middle LED is the processor halt light; it lights when the processor halts for any reason. The green LED is another software-programmable status light; it lights when the system has passed its self-test and has begun normal operation.

The 50-pin header to the right of the LEDs is the console cable attachment. A cable connects this header to an RS-232 connector on the back panel of the A-type, C-, and M-chassis.

Configuration Register Settings

The CSC/3 and CSC/2 cards have a 16-bit hardware configuration register which are the far right 16 pairs of jumper pins on the 50-pin connector in the center of the card (refer to Figure A-1). Bit 0 is the far right pair of pins. To set a bit to 1, insert a vertical jumper. To clear a bit to 0, remove the vertical jumper.

To change configuration register settings, turn off the server, set or clear the bits, and restart the server, or, alternately, change the jumper settings while the power is still on, and then give the privileged command **# reload.** It is not necessary to remove the processor card from the backplane to change the jumper setting. Configuration register setting changes take effect when the server restarts. Figure A-2 shows the configuration register with the factory settings for the CSC/3 and Figure A-3 shows the configuration register with the factory settings for the CSC/2.

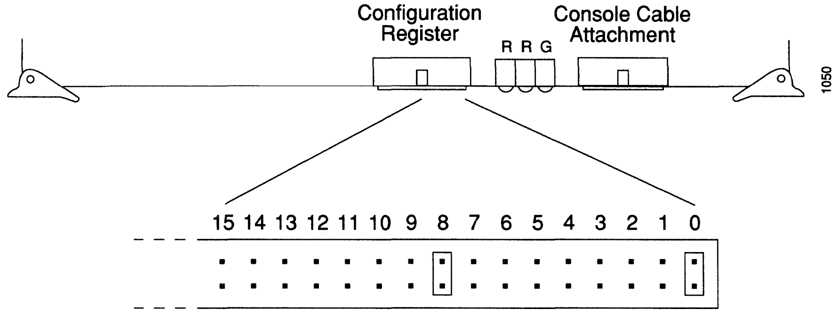

Figure A-2 CSC/3 Configuration Register with Factory Settings

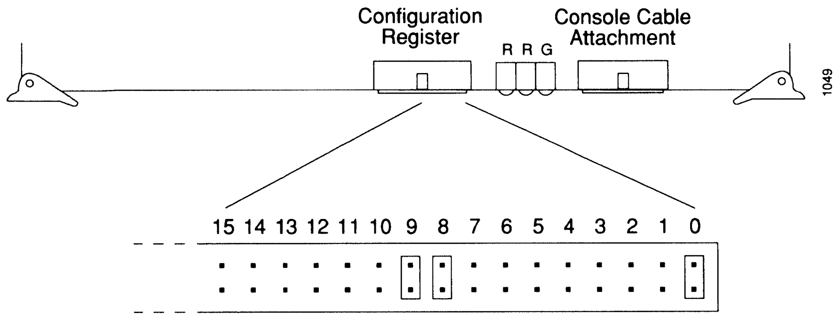

Figure A-3 CSC/2 Configuration Register with Factory Settings

The lowest four bits of the processor configuration register (bits 3, 2, 1, and 0) form the *boot field.* The boot field specifies a number in binary. If you set the boot field value to 0, you must boot the operating system manually by giving a **b** command to the system bootstrap program. If you set the boot field value to 1 (the factory default), the server boots using the default ROM software. If you set the boot field to any other bit pattern, the server uses the resulting number to form a boot file name for netbooting.

The server creates a boot file name as part of the automatic configuration processes. To form the boot file name, the server starts with "Cisco" and links the octal equivalent of the boot field number, a dash, and the processor type name. Table A-1 lists the default boot file names or actions for the CSC/3 processor. The list is the same for the CSC/2 processor card, with "csc2" substituted for "csc3."

Table A-1 Default Boot File Names

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
bootstrap mode	0	0	0	0
ROM software	0	0	0	1
cisco2-csc3	0	0	1	0
cisco3-csc3	0	0	1	1
cisco4-csc3	0	1	0	0
cisco5-csc3	0	1	0	1
cisco6-csc3	0	1	1	0
cisco7-csc3	0	1	1	1
cisco10-csc3	1	0	0	0
cisco11-csc3	1	0	0	1
cisco12-csc3	1	0	1	0
cisco13-csc3	1	0	1	1
cisco14-csc3	1	1	0	0
cisco15-csc3	1	1	0	1
cisco16-csc3	1	1	1	0
cisco17-csc31111				

The four bits after the boot field (bits 4, 5, 6, and 7) in the configuration register are unused and must be left cleared (0).

Bit 8 in the configuration register controls the console Break key. Setting bit 8 (the factory default) causes the processor to ignore the console Break key. Clearing bit 8 causes the processor to interpret Break as a command to force the system into the bootstrap monitor, suspending normal operation.

Bit 9 in the configuration register controls the use of a secondary bootstrap procedure when netbooting. If inserted, a secondary bootstrap with the filename `boot-csc2` is first loaded into the system over the network. This bootstrap image then loads in the desired boot file, completing the netbooting process.

Note: Bit 9 is inserted on the CSC/2 processor card by factory default, but by default is not present on the CSC/3 processor card.

Bit 10 in the configuration register controls the host portion of the Internet broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the broadcast address. Table A-2 shows the combined effect of bits 10 and 14.

Table A-2 Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Address (<net><host>)
out	out	<ones><ones>
out	in	<zeros><zeros>
in	in	<net><zeros>
in	out	<net><ones>

Bits 11 and 12 in the configuration register determine the baud rate of the console terminal. Table A-3 shows the bit settings for the four available baud rates. The factory default is 9600 baud.

Table A-3 System Console Terminal Baud Rate Settings

Baud	Bit 12	Bit 11
9600	0	0
4800	0	1
1200	1	0
2400	1	1

Bit 13 in the configuration register determines the server response to a boot-load failure. Setting bit 13 causes the server to load operating software from ROM after five unsuccessful attempts to load a boot file from the network. Clearing bit 13 causes the server to continue attempting to load a boot file from the network indefinitely. By factory default, bit 13 is cleared to 0.

Bit 14 in the configuration register controls the network and subnet portions of the Internet broadcast address. Setting bit 14 causes the server to include the network and subnet portions of its address in the broadcast address. Clearing bit 14 causes the server to set the entire broadcast address to all ones or all zeros, depending on the setting of bit 10. By factory default, bit 14 is cleared to 0. See Table A-2 for the combined effect of bits 10 and 14.

Bit 15 in the configuration register controls factory diagnostic mode in the server. Setting bit 15 causes the server to produce detailed CPU self-check messages, to automatically prompt for interface addresses (not look for addresses on the network), not to read configuration files or non-volatile memory, and automatically set to diagnostic tracing modes using the **debug** commands. Clearing bit 15 (the factory default) causes the server to operate normally.

Bits 20 through 23 (the four pairs of pins on the far left of the 50-pin header) are not used in normal operation, however, they can be used to invoke the Slave mode, External Reset function, Halt Processor, and Cache Disable mode functions.

Figure A-4 shows the optional jumper configurations. This is an edge-on view of the configuration register on a processor card installed in the backplane.

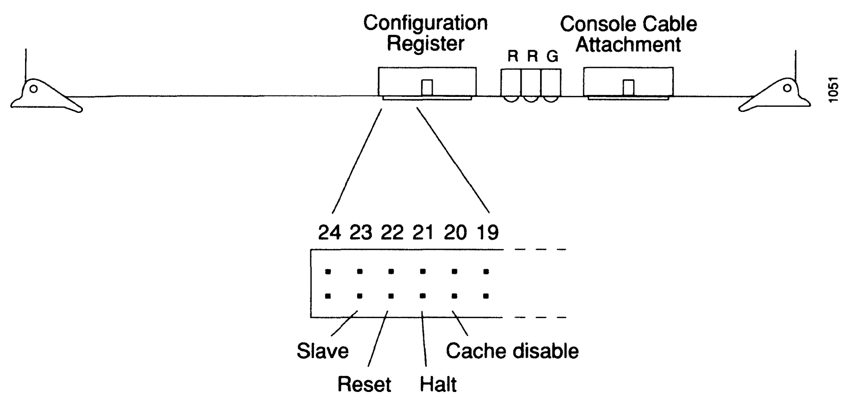

Figure A-4 Optional CSC/3 and CSC/2 Configuration Register Settings

Bootstrap Diagnostic Tests

The system bootstrap diagnostics for both the gateway system and terminal servers help initialize the processor hardware and boot the main operating system software. If you remove the jumpers from the boot file number field (bits 3, 2, 1, and 0) of the configuration register, you can start the server in stand-alone bootstrap mode. The bootstrap mode prompt is > (angle bracket).

Once in bootstrap mode, type ? to see a list of commands and options available to you.

```
> ?
$            Toggle cache state
B [filename] Bootload filename and start it
C [address]  Continue [optional address]
D /S M L V   Deposit value V of size S into location L with modifier M
E /S M L     Examine location L with size S with modifier M
G [address]  Start up execution
H            Offer help with commands
I            Initialize
K            Stack trace
L filename   Bootload filename, but do not start it
O            Show configuration register option settings
P            Set break point
S            Single step next instruction
T function   Test device (? for help)
Deposit and Examine sizes may be B (byte), L (long) or S (short).
Modifiers may be R (register) or S (byte swap).
```

The following bootstrap commands are among the most useful:

- The **H** command prints a summary of the bootstrap commands.
- The **I** command causes the bootstrap program to re-initialize the hardware and clear the contents of memory.
- The **K** command runs a stack trace on system hardware.
- The **B** command with no argument boots the default software from ROM, assuming there are no jumpers in the boot field portion of the configuration register. You may include an argument, *filename,* to specify a file to be booted over the network using TFTP. You may also include a second argument, *host,* which is the Internet address or name of a particular server host.
- The **T** command runs various diagnostic tests.

Type `T ?` to display a list of the diagnostic tests:

```
M   Memory test
P   Probe IO/memory space
```

Use the **Memory test** to test memory. By default, the test examines on-board memory. You can test nonvolatile memory by supplying starting and ending addresses as described in Table A-4. (The CSC-MC memory cannot be tested in this way.)

Table A-4 Nonvolatile Memory Addresses

Test	CSC/2 and CSC/3
CSC-ENVM 64K System memory	Start: 2000000 End: 200FFFF
CSC-ENVM 64K Nonvolatile memory	Start: 20B0000 End: 20BFFFF
CSC-MT 48K System memory	Start: 2000000 End: 200BFFF
CSC-MT 32K Nonvolatile memory	Start: 20B0000 End: 20B7FFF

Use the **Probe IO/memory space** test to look at the mapped I/O space in main memory and test for interface card responses. The test starts at address 2000000 for both the CSC/2 and CSC/3. You can specify probe increments in order to look for specific regions. The test uses the probe increments to search for registers that can be read from and written to (see samples, below).

Running the Diagnostics

Follow these steps to run the server diagnostics:

Step 1: Turn off the server.

Step 2: Remove the jumpers from the boot file number field (bits 3, 2, 1, and 0) of the processor configuration register. (Note jumper positions before removal.)

Step 3: Restart the system. Wait for the server to print the two-line banner message and prompt you with an angle bracket (>).

Note: If you start the server with the Break disable (bit 8) jumper removed from the configuration register, you can press the Break key on the console terminal to force the gateway server into bootstrap mode. Type **c** to continue normal execution of the system software.

Memory/Bus Diagnostic

To test memory, type the following, and then press the Return key.

>**t m**

Press the Return key after each prompt displayed to use the default addresses and select the default tests. The following is a sample of the Memory/Bus Diagnostic on the CSC/3 processor card:

```
Memory/Bus diagnostic
Starting Address [1000]?
Ending Address [400000]?
Hex argument for variable tests [FFFF]?
Select Tests [all]?
Number of passes to run [2]?
Message Level (0=silence, 1=summary, 2=normal)[2]?
Testing addresses between 0x1000 and 0x400000
Begin pass 0, test 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   End pass
Begin pass 1, test 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   End pass
No errors during 2 passes
```

Note: All values are in hexadecimal; do not use the prefix "0x" when entering a number.

Running a single pass of the diagnostic takes only a few minutes. If the program encounters memory problems, it displays appropriate error messages on the console terminal.

IO/Memory Space Probe

To test I/O space, type the following, and press the Return key.

>**t p**

The probe begins at address *2000000* for the CSC/3 card. You can specify probe increments. The following example shows a test done in probe increments of 10 on the CSC/3:

```
IO/memory space probe
Starting address [2000000]?
Ending address [210FFFF]?
Probe increment (in shorts) [1]? 10
Probing from 0x2000000 to 0x210FFFF with interval 0x10
Region 0x210C000 to 0x210C060 exists (OK)
Done
>
```

This example shows a test done in probe increments of 1:

```
IO/memory space probe
Starting address [2000000]?
Ending address [210FFFF]?
Probe increment (in shorts) [1]?
Probing from 0x2000000 to 0x210FFFF with interval 0x1
Region 0x210C000 to 0x210C07E exists (OK)
Done
>
```

Appendix B
Signal Summaries

Appendix B lists the pinout signal summaries for Cisco's asynchronous serial interface and for connecting terminal and nonterminal devices. It also describes the pinouts for each applique type and each connector type.

Note: All pins not specifically listed are not connected.

Following is a list of the pinout signal summaries contained in this chapter:

- RS-232 asynchronous serial line card (CSC-16) connectors—Telco 50-pin connectors
- Connecting terminals—RS-232 DTE devices
  - — RS-232 DTE with modem control
  - — RS-232 DTE with CTS required
  - — RS-232 DTE with hardware flow control
- Connecting NonTerminal Devices—DCE, and DCE with CTS
  - — CPU console port wiring scheme
  - — CPU auxiliary port wiring scheme
  - — Connectors and appliques

    (For a description of the obsolete applique pinouts, refer to the Cisco *Field Service Manual.*)
  - — RJ-11 pin signals (Converting RJ-11 to DB25 output)
  - — RJ-11 pinout
  - — Champ to female DB-25 connector pinout
  - — Champ to male DB-25 connector pinout
  - — Cisco synchronous DTE RS-232 pinout
  - — Cisco synchronous DCE RS-232 pinout
  - — Cisco DTE RS-449 pinout
  - — Cisco DCE RS-449 pinout
  - — Cisco X.21 to RS-449 transition cable
  - — Cisco V.35 applique pinouts

— Ethernet (AUI) pinout

— Token Ring connector pinout

— Fiber optical bypass switch pinout

RS-232 Asynchronous Serial Line Card Connectors

The serial RS-232 lines on the terminal server appear at the rear of the chassis as female Telco 50-pin connectors. Each connector supports eight RS-232 lines. Each serial line card (CSC-16) has two such connectors.

Table B-5 describes the first two lines on a Telco 50-pin connector. For each RS-232 signal, the color code from in Appendix C is shown, as is the pin number on the Telco 50-pin connector, and the signal source. The remaining lines of the connector follow the same pattern. The signal names used in this chapter assume that the terminal server is viewed as a DTE (data terminal equipment) device.

Table B-5 Telco 50-pin Connector Pin-Out

Line	Brief Name	Full Signal Name	Color Code	Pin Number	Signal Source
1	GND	Signal Ground	White-Blue	26	—
1	TxD	Transmit Data	Blue-White	01	Server
1	RxD	Receive Data	White-Orange	27	Device
1	RING	Ring Indicate	Orange-White	02	Device
1	DTR	Data Terminal Ready	White-Green	28	Server
1	CTS	Clear to Send	Green-White	03	Device
2	GND	Signal Ground	White-Brown	29	—
2	TxD	Transmit Data	Brown-White	04	Server
2	RxD	Receive Data	White-Slate	30	Device
2	RING	Ring Indicate	Slate-White	05	Device
2	DTR	Data Terminal Ready	Red-Blue	31	Server
2	CTS	Clear to Send	Blue-Red	06	Device

Connecting Terminal (DTE) Devices

In the simplest case of connecting a terminal (a DTE device) to the terminal server, you need connect only Signal Ground, Transmit Data, and Receive Data signals. Table B-6 shows the pinouts.

Table B-6 Connecting an RS-232 DTE Without Controls

Signal	Name	Signal Source	Female DB-25 (DCE)
GND	Signal Ground	—	Pin 7
TxD	Transmit Data	Server	Pin 3
RxD	Receive Data	Device	Pin 2
RING	Ring Indicate	Device	—
DTR	Data Terminal Ready	Server	—
CTS	Clear to Send	Device	—

For more line control, connect the DTR output (pin 20) of the terminal to the CTS (Clear to Send) input line of the terminal server (see Table B-7). Then configure the line with the **modem cts-required** subcommand of the line configuration command. In this mode, the terminal server always asserts DTR (Data Terminal Ready) except when it briefly lowers the signal before entering the idle state. The terminal server requires that the attached device assert the CTS input at all times. If CTS goes down, any connections are closed and the terminal server enters the idle state. The terminal server will not respond to the activation character or form a reverse connection while the CTS signal is low on such a line.

Table B-7 Connecting an RS-232 DTE with CTS Required

Signal	Name	Signal Source	Female DB-25 (DCE)
GND	Signal Ground	—	Pin 7
TxD	Transmit Data	Server	Pin 3
RxD	Receive Data	Device	Pin 2
RING	Ring Indicate	Device	—
DTR	Data Terminal Ready	Server	—
CTS	Clear to Send	Device	Pin 20

If you want RTS/CTS or hardware flow control on a directly connected line, connect the RTS (Request to Send) output (pin 4) of the terminal to the CTS input of the terminal server (see Table B-8). Then configure the line with the **flowcontrol** subcommand of the line configuration command. RTS/CTS flow control is not possible on a line using modem control.

Table B-8 Connecting an RS-232 DTE with Hardware Flow Control

Signal	Name	Signal Source	Female DB-25 (DCE)
GND	Signal Ground	—	Pin 7
TxD	Transmit Data	Server	Pin 3
RxD	Receive Data	Device	Pin 2
RING	Ring Indicate	Device	—
DTR	Data Terminal Ready	Server	—
CTS	Clear to Send	Device	Pin 4

Connecting Nonterminal (DCE) Devices

When you attach a DCE device with modem control to the terminal server, you may want to use the pin-out described in Table B-9.

Table B-9 Connecting a DCE with Modem Control

Signal	Name	Signal Source	Male DB-25 (DTE)
GND	Signal Ground	—	Pin 7
TxD	Transmit Data	Server	Pin 2
RxD	Receive Data	Device	Pin 3
RING	Ring Indicate	Device	Pin 22
DTR	Data Terminal Ready	Server	Pin 20
CTS	Clear to Send	Device	Pin 8

You may vary this construction. For example, if you set up the device so that CTS follows DCE, you then wire the terminal server CTS input to pin 5 (standard CTS) instead of to pin 8 (standard DCE).

When you attach a dial-in modem (or a terminal switch with modem controls) to the terminal server, configure the terminal server line with the **modem callin** subcommand of the line configuration command. The terminal server handles the signals as follows:

1. The terminal server waits for a transition on its RING input signal.
2. The terminal server asserts its DTR output signal and waits up to 20 seconds for the attached device to assert the CTS input signal.
3. When CTS goes high, the RS-232 connection is complete.

If CTS does not go high within 20 seconds, the terminal server drops its DTR output and returns to the idle state. If the CTS input is dropped at any time after the connection is completed, the terminal server drops its DTR output and returns to the idle state.

If a device with modem control is to be attached to the terminal server and accessed by telnet to that particular serial line on the terminal server, then configure the line with the **modem callout** subcommand. The terminal server handles the signals as follows:

1. The terminal server creates a driver process associated with the line.
2. The terminal server raises the DTR output signal for that line, and waits up to 20 seconds for the device to assert the CTS input signal.
3. When CTS is asserted, the RS-232 connection is complete.

If the CTS input is not asserted within 20 seconds, the terminal server drops its DTR output. The terminal server advances to the next line in the rotary group if the first line is part of a rotary group. The terminal server then raises DTR on that line and waits again for CTS.

If the terminal server cannot complete a handshake with a line or runs to the end of a rotary group without successfully connecting, it closes the connection. If the CTS input drops at any time after the connection is completed, the terminal server drops its DTR output, closes the connection, and returns to the idle state.

CPU Console Port Wiring Scheme

By default, the console ports on the CPU cards are wired for DCE. The following table lists the DCE wiring scheme for the console port.

Table B-10 CPU Console Port RS-232 DCE Wiring Scheme

Pin	Signal
1	GND
2	RxD (in)
3	TxD (out)
4	(RTS)
5	(CTS)
6	DSR (out)
7	GND
8	DCD (out)

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Both DSR and DCD are active when your system is running. The RTS (connector 4) signal tracks the state of the CTS (connector 5) input as shown in Table B-10. The console port does not support flow control.

CPU Auxiliary Port Wiring Scheme

An auxiliary port is supported for all processors. This is a DTE port on the CPU card (CSC/3 and CSC/2) to which an RS-232 port from a CSU/DSU or protocol analyzer may be attached for access from the network. The CSC/2 auxiliary port asserts DTR only when a Telnet connection is established.

A special internal cable must be ordered for use with this auxiliary port. The auxiliary port shares the ribbon cable between the processor card (CSC/2 or CSC/3) and the console port. The console-port end of the cable is split, so it has two RS-232 connectors at the connector-panel end, one for the console port, one for the auxiliary port. The processor-card end of the cable has one 50-pin ribbon connector, which connects to the console cable port on the processor card.

Table B-11 shows the RS-232 signals used on this port.

Table B-11 CPU Auxiliary Port RS-232 DTE Wiring Scheme

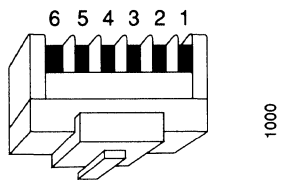
Pin	Signal
2	TxD (out)
3	RxD (in)
7	Signal Ground
20	DTR (out)
24	TxClk (out)

Both DTR and RTS are active when your system is running. Modem control signals are ignored. The auxiliary port does not support flow control.

Connectors and Appliques

RJ-11 Pin Signals (Converting RJ-11 to DB-25 Output)

Figure B-5 shows an RJ-11 plug, and the pin assignments for an RJ-11 plug and socket. Both male (DCE) and female (DTE) adapters, which convert RJ-11 to DB-25, are shown in Figure B-6. The pin signals for these adapters are provided in Table B-12.



Pin	Signal
1	Data Terminal Ready (DTR)
2	Received Data (RxD)
3	Transmitted Data (TxD)
4	Ground (GND)
5	Ring Indicate (RING)
6	Clear to Send (CTS)

Figure B-5 RJ-11 Plug and Pin Signals

Table B-12 RJ-11 to DB-25 Adapter Pinout

Signal	Direction	Female DCE	Male DCE	Female DTE	Male DTE	Modular Jack
GND		7	7	7	7	4
TxD	From Cisco	3	3	2	2	3
RxD	To Cisco	2	2	3	3	2
RING	To Cisco	22	22	5	5	5
DTR	From Cisco	5	5	20	20	1
CTS	To Cisco	20	20	5	5	6

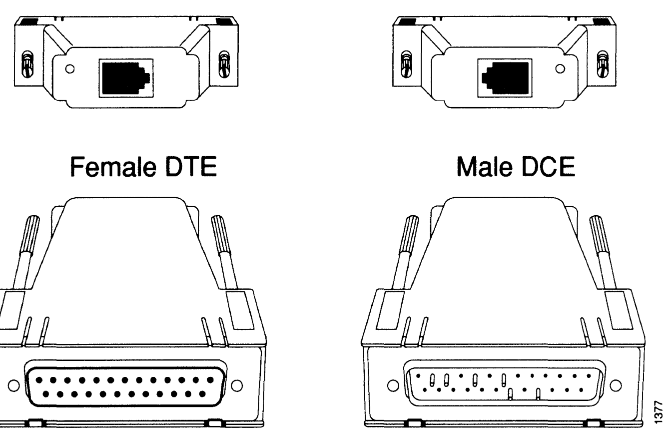


Figure B-6 DB-25 Adapters—Front and Rear Views

"Champ-to-D Octopus" Connectors

The "champ-to-D octopus" connector provides one 50-pin connector that consolidates wires from eight DB-25 male or female connectors.

Table B-13 lists the pinout for the female DB-25 connectors attached to the first of eight positions on the champ 50-pin Telco connector.

Table B-13 Champ-to-Female DB-25 Connector Pinout

Telco	DB-25	Signal
1	3	TxD
2	22	RING
3	20	CTS
26	7	GND
27	2	RxD
28	5	DTR

Table B-14 lists the pinout for the male DB-25 connectors attached to the first of eight positions on the champ 50-pin Telco connector.

Table B-14 Champ-to-Male DB-25 Connector Pinout

Telco	DB-25	Signal
1	2	TxD
2	22	RING
3	5	CTS
26	7	GND
27	3	RxD
28	20	DTR

Cisco Synchronous RS-232 DTE Applique Pinout

Table B-15 lists the pinout for the Cisco synchronous RS-232 DTE applique.

Table B-15 Cisco Synchronous RS-232 DTE Applique Pinout

Mnemonic	Pin	Signal Direction
RXD	3	To Cisco
RXC	17	To Cisco
TXD	2	To modem (DCE)
TXC	15	To Cisco
DTR	20	To modem (DCE)
RTS	4	To modem (DCE)
CTS	5	To Cisco
CD	8	To Cisco
DSR	6	To Cisco

Cisco Synchronous RS-232 DCE Applique Pinout

Table B-16 lists the pinout for the Cisco synchronous RS-232 DCE applique. This applique is used to make connections to synchronous serial lines.

Table B-16 Cisco Synchronous RS-232 DCE Pinout

Mnemonic	Pin	Signal Direction
RXD	3	From DTE device
RXC	17	From Cisco
TXD	2	From Cisco
TXC	15	From Cisco
DTR	20	From DTE device
RTS	4	From DTE device
CTS	5	From Cisco
CD	6	From Cisco

Cisco RS-449 DTE Applique Pinout

Table B-17 shows the standard Cisco RS-449 DTE pinout. Using the interface configuration subcommand **loopback** drives the LL signal to the modem or CSU/DSU, to switch into local loopback mode. All Cisco RS-449 DTE appliques return transmit clock on TT. This is designed to compensate for clock phase shift on long cables. It is important that the RS-449 modem be configured to accept TT.

Table B-17 Cisco RS-449 DTE Applique Pinout

Mnemonic	Pin	Signal Direction
Chassis ground	1	—
Not connected	2	—
SDA (TXD+)	4	To modem
SDB (TXD-)	22	To modem
STA (SCT+)	5	To Cisco
STB (SCT-)	23	To Cisco
RDA (RXD+)	6	To Cisco
RDB (RXD-)	24	To Cisco
RSA (RTS+)	7	To modem
RSB (RTS-)	25	To modem
RTA (SCR+)	8	To Cisco
RTB (SCR-)	26	To Cisco
CSA (CTS+)	9	To Cisco
CSB (CTS-)	27	To Cisco
DMA (DSR+)	11	To Cisco
DMB (DSR-)	29	To Cisco
TRA (DTR+)	12	To modem
TRB (DTR-)	30	To modem
RRA (RLSD+,CD+)	13	To Cisco
RRB (RLSD-,CD-)	31	To Cisco
TTA (SCTE+)	17	To modem
TTB (SCTE-)	35	To modem
LL	10	To modem
Not connected	36	—
Signal Ground	37	—

Cisco RS-449 DCE Applique Pinout

Table B-18 shows the standard Cisco RS-449 DCE applique pinout.

This interface responds to the LL signal by looping signals SDA and SDB to signals RDA and RDB, forming an outbound loopback. It forms a local loopback by looping local data back to the MCI card or the SCI card.

This applique requires that the clock be supplied from the MCI card or the SCI card. It then generates signals RT and ST. It is important that the DCE attached to this interface returns TT along with its data (SD) to avoid cable-induced clock problems.

Table B-18 Cisco RS-449 DCE Applique Pinout

Mnemonic	Pin	Signal Direction
Chassis ground	1	—
Not connected	2	—
SDA (TXD+)	4	From DTE
SDB (TXD-)	22	From DTE
STA (SCT+)	5	From Cisco
STB (SCT-)	23	From Cisco
RDA (RXD+)	6	From Cisco
RDB (RXD-)	24	From Cisco
RSA (RTS+)	7	From DTE
RSB (RTS-)	25	From DTE
RTA (SCR+)	8	From Cisco
RTB (SCR-)	26	From Cisco
CSA (CTS+)	9	From Cisco
CSB (CTS-)	27	From Cisco
DMA (DSR+)	11	From Cisco
DMB (DSR-)	29	From Cisco
TRA (DTR+)	12	From DTE
TRB (DTR-)	30	From DTE
RRA (RLSD+,CD+)	13	From Cisco
RRB (RLSD-,CD-)	31	From Cisco
TTA (SCTE+)	17	From DTE
TTB (SCTE-)	35	From DTE
LL	10	From DTE
Not connected	36	—
Signal Ground	37	—

X.21 to RS-449 Transition Cable

The following table provides the pinouts for constructing an X.21 to RS-449 transition cable. This is of particular importance for X.21 connections in the UK and Germany.

Table B-19 15-Pin X.21 Adapter Cable Pinouts

15-Pin X.21 Adapter Cable

DTE (cisco) RS-449 37-Pin Female "D"			DCE X.21 15-Pin Male "D"	
Dir	**Name**	**Pin**	**Pin**	**Name**
→	TXD +	4	2	TX Data A
→	TXD −	22	9	TX Data B
←	RXD +	6	4	RX Data A
←	RXD −	24	11	RX Data B
←	SCT +	5	6	Clock A
←	SCR +	8		
←	SCT −	23	13	Clock B
←	SCR −	26		
→	RTS +	7	3	Control A
→	RTS −	25	10	Control B
←	DCD +	13	5	Indicate A
←	DSR +	11		
←	CTS +	9		
←	DCD −	31	12	Indicate B
←	DSR −	29		
←	CTS −	27		
	SIG Ground	19	8	Zero Volts
	RCV Common	20		
	SND Common	37		

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Cisco V.35 Applique Pinout

Table B-20 shows the Cisco V.35 dual-mode applique pinout. The HD-22 referenced in this table is a 26-pin high-density 3-row "D" connector mounted on the dual-mode applique. The V.35 cable connector is the square V.35 connector. Table B-21 shows the Cisco V.35 DTE applique pinout. Using the interface configuration command loopback drives the LT signal to the modem to change into local loopback mode. When operating at speeds above 300 KHz per second, the SCTE becomes especially important. All Cisco V.35 appliques return Transmit Clock on SCTE. This is designed to compensate for clock phase shift on long cables. The V.35 modem *must* be configured to accept SCTE.

With the V.35 dual-mode applique in DCE mode, the applique can be configured to use SCTE or SCT. The default is to use SCTE, which is selected when the jumper is in; to set SCT, remove the jumper.

The default mode of the dual-mode applique is DCE. To select DTE mode, connect pin 9 to pin 18 on the HD-22 connector.

Table B-20 V.35 Dual-mode Applique Pinout

HD-22 DTE Pin	DCE Pin	V.35 Cable Connector Pin	Signal	Function	Direction
26	26	A	FG	Frame Ground	—
17	17	B	SG	Signal Ground	—
23	24	C	RTS	Request to Send	To modem
24	23	D	CTS	Clear to Send	To Cisco
22	25	E	DSR	Data Set Ready	To Cisco
20	19	F	RLSD	Receive Line Signal Detect (Carrier Detect)	To Cisco
19	20	H	DTR	Data Terminal Ready	To modem
21	22	K	LT	Local Test (Loopback)	To modem
2	4	R	RD+	Receive Data+	To Cisco
12	14	T	RD-	Receive Data-	To Cisco
6	5	V	SCR+	Serial Clock Receive+	To Cisco
16	15	X	SCR-	Serial Clock Receive-	To Cisco
4	2	P	SD+	Send Data+	To modem
14	12	S	SD-	Send Data-	To modem
5	6	U	SCTE+	Serial Clock Transmit External+	To modem
15	16	W	SCTE-	Serial Clock Transmit External-	To modem
1	3	Y	SCT+	Serial Clock Transmit+	To Cisco
11	13	a	SCT-	Serial Clock Transmit-	To Cisco
Tie together	9	—	DCE/DTE	Selects DCE mode	—
for DCE	18	—	DCE/DTE	Selects DCE mode	—

Table B-21 V.35 DTE Applique Pinout

Pin	Signal	Function	Direction
A	FG	Frame Ground	—
B	SG	Signal Ground	—
C	RTS	Request to Send	To modem
D	CTS	Clear to Send	To Cisco
E	DSR	Data Set Ready	To Cisco
F	RLSD	Receive Line Signal Detect (Carrier Detect)	To Cisco
H	DTR	Data Terminal Ready	To modem
J	RI	Ring Indicate (na)	To Cisco
K	LT	Local Test (Loopback)	To modem
R	RD+	Receive Data+	To Cisco
T	RD-	Receive Data-	To Cisco
V	SCR+	Serial Clock Receive+	To Cisco
X	SCR-	Serial Clock Receive-	To Cisco
P	SD+	Send Data+	To modem
S	SD-	Send Data-	To modem
U	SCTE+	Serial Clock Transmit External+	To modem
W	SCTE-	Serial Clock Transmit External-	To modem
Y	SCT+	Serial Clock Transmit+	To Cisco
a	SCT-	Serial Clock Transmit-	To Cisco

Ethernet (AUI) Pinout

A transceiver must be used with all Cisco Systems Ethernet products (MCI and CSC-E cards). Transceivers are available from a variety of sources for thick LAN, thin LAN, twisted-pair Ethernet, and other media. Table B-22 gives the pinout designations.

Table B-22 Ethernet (AUI) Pinout

Pin	Circuit	Description
3	DO-A	Data Out Circuit A
10	DO-B	Data Out Circuit B
11	DO-S	Data Out Circuit Shield (na)
5	DI-A	Data In Circuit A
12	DI-B	Data In Circuit B
4	DI-S	Data In Circuit Shield
7	CO-A	Control Out Circuit A (na)
15	CO-B	Control Out Circuit B (na)
8	CO-S	Control Out Circuit Shield (na)
2	CI-A	Control In Circuit A
9	CI-B	Control In Circuit B
1	CI-S	Control In Circuit Shield
6	VC	Voltage Common
13	VP	Voltage Plus
14	VS	Voltage Shield (na)
Shell	PG	Protective Ground

Token Ring Connector Pinout

Cisco Systems Token Ring network attachment card (CSC-R) uses a standard DE-9 (PC-type) Token Ring connector. This requires a Token Ring adapter cable which is not supplied. The pinout for this female DE-9 connector is shown in Table B-23.

Table B-23 Token Ring Connector Pinout

Pin	Signal
1	Ring Receive-
6	Ring Receive+
5	Ring Transmit-
9	Ring Transmit+

Optical Bypass Switch Pinout

Table B-24 lists the signal descriptions for the optical bypass switch available for systems configured with FDDI.

Table B-24 Optical Bypass Switch Pinout

Pin	Description
1	+5 volts to secondary switch
2	+5 volts to primary switch
3	Ground to enable primary switch
4	Ground to enable secondary switch
5	Sense circuit — 1 kilohm to +5 volts
6	Ground — sense circuit return

HSSI Interface

Table B-25 lists the pinouts for the 50-pin, male connectors on the interface cable required for connecting to an HSSI network.

Table B-25 HSSI Interface Cable Pinout

DTE Pin #	Direction DTE ↔DCE	DTE Pin #	Signal Name
1	—	26	SG - Signal Ground
2	←	27	RT - Receive Timing
3	←	28	CA - DCE Available
4	←	29	RD - Receive Data reserved
5	←	30	LC - Loopback Circuit C
6	←	31	ST - Send Timing
7	—	32	SG - Signal Ground
8	→	33	TA - DTE Available
9	→	34	TT - Terminal Timing
10	→	35	LA - Loopback circuit A
11	→	36	SD - Send Data
12	→	37	LB - Loopback circuit B
13	—	38	SG - Signal Ground
14-18	→	39-43	5 ancillary to DCE
19	—	44	SG - Signal Ground
20-24	←	45-49	5 ancillary from DCE
25	—	50	SG - Signal Ground

Appendix C
Industry-Standard Wiring Plans

When you install more than a few terminals, you face the problem of organizing the wiring. AT&T has devised, for the telephone industry, a uniform scheme for dealing with large numbers of wires. The scheme uses two color codes—one for large numbers of wires organized in pairs, and the other for smaller numbers of wires often organized in pairs. Cisco Systems recommends the use of this wiring scheme whenever possible.

For large numbers of wires, each pair is assigned a two-color code. The colors are selected from two groups of five, resulting in what is called a binder-group of 25 pairs. The colors used for a group are white, red, black, yellow, and violet. The colors used for "pair within group" are blue, orange, green, brown, and slate.

Each pair must have a unique color combination. One wire within each pair has a solid background of its group color and stripes of the "pair within group" color, and the second wire has the colors reversed. Table C-1 lists the sequences. Note that red-brown and red-orange wires can be easily confused.

Table C-1 Telephone Industry 25-Pair Color Code and Pin Numbers — Part 1 of 2

Pair Number	Wire Number	Solid Color	Stripe Color	Pin Number
1	1	White	Blue	26
1	2	Blue	White	1
2	1	White	Orange	27
2	2	Orange	White	2
3	1	White	Green	28
3	2	Green	White	3
4	1	White	Brown	29
4	2	Brown	White	4
5	1	White	Slate	30
5	2	Slate	White	5
6	1	Red	Blue	31
6	2	Blue	Red	6
7	1	Red	Orange	32
7	2	Orange	Red	7
8	1	Red	Green	33
8	2	Green	Red	8
9	1	Red	Brown	34
9	2	Brown	Red	9
10	1	Red	Slate	35
10	2	Slate	Red	10
11	1	Black	Blue	36
11	2	Blue	Black	11
12	1	Black	Orange	37
12	2	Orange	Black	12
13	1	Black	Green	38
13	2	Green	Black	13
14	1	Black	Brown	39
14	2	Brown	Black	14
15	1	Black	Slate	40
15	2	Slate	Black	15
16	1	Yellow	Blue	41
16	2	Blue	Yellow	16

Table C-2 Telephone Industry 25-Pair Color Code and Pin Numbers — Part 2 of 2

Pair Number	Wire Number	Solid Color	Stripe Color	Pin Number
17	1	Yellow	Orange	42
17	2	Orange	Yellow	17
18	1	Yellow	Green	43
18	2	Green	Yellow	18
19	1	Yellow	Brown	44
19	2	Brown	Yellow	19
20	1	Yellow	Slate	45
20	2	Slate	Yellow	20
21	1	Violet	Blue	46
21	2	Blue	Violet	21
22	1	Violet	Orange	47
22	2	Orange	Violet	22
23	1	Violet	Green	48
23	2	Green	Violet	23
24	1	Violet	Brown	49
24	2	Brown	Violet	24
25	1	Violet	Slate	50
25	2	Slate	Violet	25

Cables with more than 25 pairs of wires are constructed from 25 pair groups.Very large cables have other variations generally not encountered inside terminal wire plants.

For smaller numbers of wires, such as wires for an individual telephone station or terminal, you may use a second color code scheme. Table C-3 shows this color code and the usual correspondence with the paired-wire color code.The alternate color code is included because sometimes the station wire uses the first three pairs of the standard color code (white-blue, blue-white, and so on) while other times it uses the six alternate colored wires.

Table C-3 Second Color Code Scheme for Smaller Numbers of Wires

Pair Number	Wire Number	Solid Color	Stripe Color	Alternate Color	Pin Number
1	1	White	Blue	Green	4
1	2	Blue	White	Red	3
2	1	White	Orange	Black	2
2	2	Orange	White	Yellow	5
3	1	White	Green	White	1
3	2	Green	White	Blue	6

Appendix D
Optional Rack-Mount Installation

This appendix describes the procedure for the optional rack-mount installation. A rack-mount arrangement may be convenient for computer room applications and anywhere space is an issue.

Each A-type chassis and M-chassis is shipped with a rack-mount kit, which includes two flanges and 13 screws for the A-type chassis and eight screws for the M-chassis. These screws are used to attach the flanges to the front of the chassis. The A-type chassis and M-chassis are the only two models that can be rack mounted.

Figure D-1 shows several chassis in a rack-mount installation.

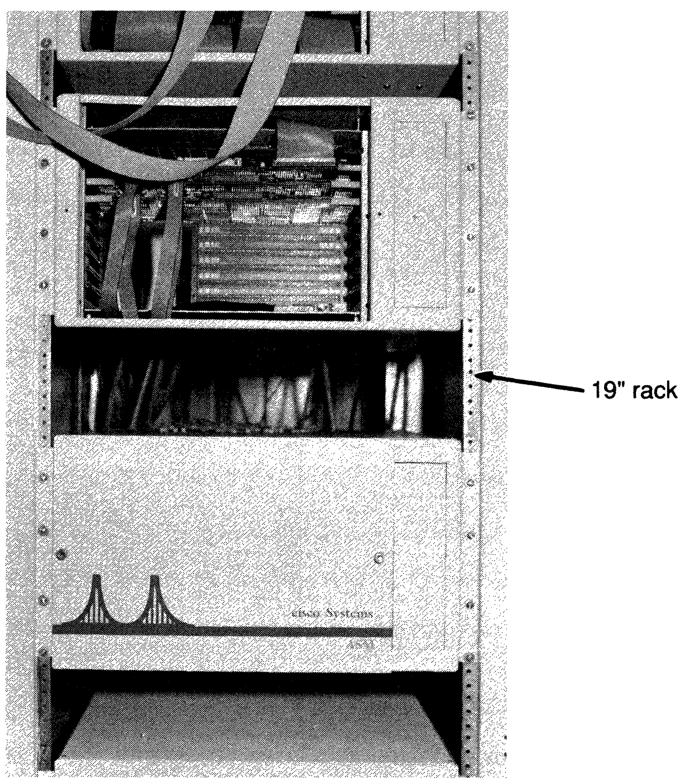

Figure D-1 Cisco Chassis Rack-Mount Installation

Tools Required:

The following items are required for rack-mount installation:

- Standard 19-inch rack.
- Phillips screwdriver for #2 Phillips flat-head screws.
- Customer-supplied screws for mounting chassis in rack. Mounting screws are not included because required sizes may vary from rack to rack.

Procedure:

Follow these steps to install your chassis in a standard 19-inch rack:

Step 1: Attach flanges to side of chassis with screws provided.

Step 2: Mount chassis in rack using the customer-supplied screws.

Step 3: Attach external cables to chassis back panel.

Step 4: Follow the standard start-up sequence to verify operation.

Note the following when installing chassis in a rack:

- A-type chassis and M-chassis may be mixed in the same rack.
- Chassis may be installed with tops and bottoms flush to each other; however, they should not be mounted side by side. When mounted next to each other, one chassis will blow exhaust into the fan intake of another, causing cooling problems.

A-Type Chassis Switch Guard

A switch guard is included with the rack-mount kit for the A-type chassis. The switch guard is designed to prevent inadvertent power cut-off to the A-type chassis. It protects the power switch from accidental shut-off.

Procedure:

Follow these steps to install the switch guard:

Step 1: Power down the unit and unplug it.

Step 2: Remove the two screws which affix the on/off switch to the chassis. The stiff wiring attached to the switch will prevent it from falling off inside.

Step 3: Carefully place the switch guard over the switch. Align the large hole with the switch and the two small holes with the screw holes. Note that the switch guard extends further to the bottom of the switch than the top.

Step 4: Replace the screws in the switch, passing them through the holes in the switch guard. Tighten the screws.

Optional Slide-Mount Kit

The M-chassis also has an optional slide-mount kit for rack-mount installations. It is only available for the M-chassis.

Note: Rack-mount installation of the M-chassis with the slide mount, requires two people; one person must support the chassis while the second person inserts the screws.

Tools Required:

The following items are required for slide mount installation:

- Standard 19-inch rack.
- Phillips screwdriver for #2 Phillips flat-head screws.
- Customer-supplied screws for mounting chassis slide mount in rack. Mounting screws are not included because required sizes may vary from rack to rack.

Procedure:

Follow these steps to install the M-chassis using the slide mount in a standard 19-inch rack:

Step 1: Install the slide mount in the rack with the four screws provided.

Step 2: Fully extend the slide mount.

Step 3: Have one person lift and support the M-chassis; align the pinouts on the chassis with the screw holes on the inner-most section of the slide mount; insert the customer-provided screws.

Note: The M-chassis has five pinouts while the slide mount requires four screws. With the M-chassis facing toward you, insert the screws starting with the *second* pinout.

Step 4: With the slide mount fully extended, insert the first two screws through the inner-most section; insert the third screw through the access hole; then retract the slide mount until you can insert the fourth screw through the access hole.

Step 5: Attach external cables to the chassis back panel.

Step 6: Follow the standard start-up sequence to verify operation.

Glossary

The following is a glossary of terms commonly used in Cisco Systems' literature.

access list A list kept by the gateway to control access to or from the gateway for a number of services (for example, to restrict packets with a certain IP address from leaving a particular interface on the gateway).

APP Abbreviation for "applique."

applique A printed circuit board that is mounted on the rear of the chassis; it contains the connector hardware for attachment to a network. Appliques translate and transpose the serial communications signals into the signals expected by the communication standard of choice, such as RS-232, V.35, and so on.

ARP Address Resolution Protocol. A protocol which is used to bind an IP address to an Ethernet/802.3 address.

ASCII American Standard Code for Information Interchange. The standard code used for information interchange among data processing systems, data communication systems, and associated equipment; the ASCII set consists of control and graphic characters.

asynchronous transmission A mode of data transmission, often referred to as start-stop transmission. Each character is transmitted with its own start and stop bits to inform the receiving device of the beginning and end of a character.

AUI Attachment Unit Interface. An Ethernet transceiver cable, or the back panel connector to which such a cable might attach.

bandwidth A capacity of an interface, usually defined in bits per second (bps).

binary A numbering system characterized by ones and zeros (on and off); also referred to as base 2.

bit Binary digit. The units used in the binary numbering system, 0 and 1.

bit rate The speed at which bits are transmitted, usually expressed in bits per second (bps).

BootP A protocol which is used by a server to determine the IP address of its Ethernet interfaces.

bridge A device that connects two network segments using the same medium. Bridges operate at Level 2 of the ISO model (the data-link layer) and are protocol-insensitive.

broadband IEEE specification 802.4 standard for connecting a set of network hosts using a single multichannel cable. The broadband standard permits simultaneous multiple high-bandwidth channels, with each channel occupying a particular frequency range; channel access uses modems. Broadband systems are commonly used to transmit video data.

broadcast A packet or frame whose destination address contents an address to which all entities on the network must listen. Typically, this address contains all ones.

cBus Cisco's proprietary high-speed bus used with the FDDI and other high-speed cards.

CCITT French acronym for International Telegraph and Telephone Consultative Committee, an international organization that develops communication standards such as Recommendation X.25.

checksum A method for checking the integrityof transmitted data. A checksum is an integer value computed from a sequence of octets by treating then as integers and computing the sum. The value is recomputed at the receiving end and compared for verification.

cross talk Interfering energy transferred from one circuit to another.

CSMA/CD Carrier-Sense Multiple Access with Collision detection. The style of network access used by Ethernet and IEEE 802.3.

CSU/DSU Customer Service Unit/Data Service Unit. A device that converts V.35 or RS-449 signals to a properly coded T1 transmission signal.

DCC Data Communications Channel. The transmission media and intervening equipment involved in the transfer of information between DCEs. DCCs may be half- or full-duplex.

DCE Data Communications Equipment. The devices and connections of a communications network which connect the communication circuit with the end device (data terminal equipment). A modem can be considered DCE.

DDN Defense Data Network. This is the MILNET and associated parts of the Internet that connect military installations. Used loosely, it refers to the MILNET, ARPANET, and the TCP/IP protocols they use.

DECnet A protocol suite developed and supported by Digital Equipment Corporation.

DoD Department of Defense.

domain names A directory service for matching host names with IP addresses. See RFC 882.

DS3 Digital Signal level 3. Also known as T3. The bit rate for DS3 transmission is 44.736 Mbps.

DSU Data Service Unit. Provides a DTE with access to digital telecommunications facilities.

DTE Data Terminal Equipment. The part of a data station that serves as a data source, destination, or both, and that provides for the data communications control function according to protocols. DTE includes computers, protocol converters, and multiplexers.

EGP Exterior Gateway Protocol. A protocol for exchanging routing information with the DDN core gateway system and similar large groups of networks. See RFC 904.

EPROM Erasable Programmable Read-Only Memory integrated circuit.

ESD Electrostatic discharge. Undesirable discharge of static electricity that can damage equipment and impair electrical circuitry.

encapsulation The wrapping of data in a certain protocol header. For example, on Ethernet, all data is encapsulated in either an Ethernet header or IEEE 802.2 header.

Ethernet A local area network (LAN) developed by Xerox Corporation. Ethernet networks operate at 10 megabits per second using CSMA/CD. Ethernet is a baseband-type connection. The IEEE 802.3 standard is similar to Ethernet, but not identical.

EXEC The interactive command processor of the Cisco software.

gapped clock A clock stream at a nominal bit rate, which may be missing clock pulses at arbitrary intervals for arbitrary lengths of time.

gateway A multiprotocol, multimedia network level routing device. Also called a router, it forwards packets of data from one network to another, based on network-level (ISO model Level 3) information, and is protocol sensitive.

HDH HDLC Distant Host protocol (HDH or 1822-J) which is a means of running the 1822 protocol over synchronous serial links instead of over special purpose 1822 hardware. HDH is essentially 1822 leaders and data encapsulated in LAPB (X.25 Level 2) packets.

HDLC High-Level Data Link Control, which specifies an encapsulation method of data on synchronous serial data links. The Cisco HDLC support performs only framing and checksumming functions. No retransmission or windowing is done.

host Any entity which only accepts or generates data on a network, and does not forward data.

HSA High-speed applique, the connector/circuit card assembly which provides the interface between the CSS-HSCI system card and the external interface cable to the DSU.

HSCI High-Speed Serial Communications Interface, the system card for the HSSI and UltraNetwork options in the AGS+.

HSSI High-Speed Serial Interface, and defacto standard for transmission at rates of up to 52 Mpbs.

ICMP Internet Control Message Protocol. Provides message packets to report changes in packet processing. See RFC 792.

IEEE Institute of Electrical and Electronic Engineers.

IGRP Interior Gateway Routing Protocol. A proprietary protocol developed by cisco Systems to address the problem of routing within a large network of general topology comprised of segments having different bandwidth and delay characteristics.

interface (1) The connections between two separate systems or pieces of equipment. (2) The specifications of a connection between two systems or pieces of equipment, including type and function of interconnecting circuits and type and form of signals to be interchanged via those circuits.

internetwork A network of networks; also called an internet. An internetwork is a group of LANs and WANs that are geographically or organizationally separate, but appear to users as one integrated network.

interoperability The ability of computing equipment manufactured by different vendors to communicate over one integrated network. This communication includes mail, file transfer, and remote access.

IP Internet Protocol is a Level 3 protocol which contains addressing information and some control information which allows packets to be *routed*. See MIL-STD-1777.

ISO International Standards Organization. An international group that drafts, discusses, proposes, and specifies standards for network protocols. ISO is best known for its seven-layer reference model that describes the conceptual organization of protocols.

ISO layer Any of seven levels in a model proposed by the International Standards Organization (ISO) to describe the functions and relationships in computer networks. The lowest layers (1 and 2) specify media standards; upper layers specify functions more visible to users and programs using the network.

LAN Local Area Network. A LAN consists of local segments of Ethernet cable, broadband cable, or token rings.

lapb link access procedure balanced. X.25 represents two levels of the OSI reference model, Levels 2 and 3. Level 2 or lapb is the protocol that implements Level 2. This protocol provides a mechanism to exchange data (frames), detect out of sequence or missing frames, and provide for retransmission and acknowledgment.

load-balancing The ability of a gateway to distribute traffic overall its network ports that are the same distance from the destination address. Good load-balancing algorithms use both line speed and reliability information. Load-balancing increases the utilization of network segments, thus increasing effective network bandwidth.

MAU Medium Attachment Unit. Also known as an Ethernet transceiver, a MAU is a device that converts digital data from the Ethernet interface for connection to the appropriate medium.

MEC Multiport Ethernet Controller.

MCI Multiport Communications Interface.

media The physical cabling plant, satellite, or microwave circuits over which network data passes. Common network media are coaxial and fiber optic cable, twisted-pair wiring, and telephone circuits.

MTU Maximum Transmission Unit. Refers to the maximum packetsize, in bytes, that a particular interface will handle.

name server A server provided on the network which responds to domain name requests. See RFC 882.

network Refers to a collection of computers and other devices that are able to communicate with each other over distances.

NV Nonvolatile memory. Memory whose contents is not lost when power is removed.

Octet Eight bits.

OSI Open System Interconnect. A reference to protocols for the interconnection of cooperative computer systems (specifically ISO standards).

packet A collection of bits that constitutes one network transmission. Packets must include relevant network address and accounting information, as well as user data.

packet-switched Type of network on which each packet contends with others for data transmission. The channel is occupied only for the duration of the packet. Routers are called packet switches as they move along the route to its destination. In contrast, a circuit-switched network system dedicates one circuit at a time to data transmission.

PAD Packet Assembler/Disassembler. A term used with X.25 networks that refers to a terminal multiplexer device that forms a connection between terminals and hosts across the network.

PAL Programmable Array Logic integrated circuit.

parallel A method of transmission in which all bits of a data character are transmitted simultaneously over separate paths. Contrast with serial transmission.

parity Provides a low overhead method of detecting single bit errors. A bit is attached to a binary word to make the total number of digits always odd (odd parity) or even (even parity).

ping The ICMP echo message and its reply. See RFC 792.

protocol The language a network uses to pass information among the various computers and other hosts such as gateways and terminal servers.

protocol translator A network device that converts one protocol into another similar protocol. For example, the CPT performs conversion between X.25 PAD and TCP/IP Telnet.

Proxy ARP The function of a router sending an ARP response to a host which does not know how to use a router.

PSN Packet Switch Node; the central switching node in the X.25 architecture. Usually the PSN is a DCE and allows for connection of multiple DTEs. See Recommendation X.25.

public data network A network operated either by a government (as in Europe) or by a private concern to provide computer communications to the public, usually for a fee. Public data networks enable small organizations to create a WAN without all the equipment costs of long-distance circuits.

public standard protocol A network specification available to the public. Anyone may write a program that implements a public standard protocol and thus enables network hosts to communicate in this language.

PUP PARC Universal Protocol; developed at Xerox Palo Alto Research Center, and is similar to IP.

RARP Reverse Address Resolution Protocol; the logical reverse of ARP and provides a method for finding IP addresses based on Ethernet/802.3 addresses. See RFC 903.

redirect A part of the ICMP protocol suite which allows a router to tell a host to use another router.

reset A function of the software which clears the existing data on a single interface when a significant number of input or output errors are detected. A reset differs from a restart in that a reset acts upon a single interface, and a restart acts upon more than one. A reset clears the single problematic interface and the system continues operation; a restart completely shuts down the firmware/ software on a card then restarts it.

restart A function of the software which completely shuts down and restarts the firmware/software on an interface card when it detects significant errors in more than one interface. See *reset*. For multiple interface cards, the number of restarts is shown with the show controller command.

router A multiprotocol, multimedia network level routing device. Also called a gateway, it forwards packets of data from one network to another, based on network-level (ISO model Level 3) information.

routing The act of forwarding an incoming packet toward the destination host. Routing is very complex in large networks, because of the many potential intermediate destinations a packet might traverse before reaching its destination host.

RS-232 An interface between terminals and computers, or between two computers, that uses a serial binary data interchange. Although the standard most commonly used in the United States is RS-232-C, most people refer to it as simply RS-232.

serial A method of data transmission in which the bits of a data character are transmitted sequentially over a single channel. Contrast with parallel transmission.

SCI Serial-Port Communications Interface.

SLIP Serial Line Internet Protocol. This standard for connecting personal computers to a LAN supports the use of low-cost telephone wiring and serial interfaces, while providing all the connectivity of a TCP/IP network.

SNMP Simple Network Management Protocol. Provides a means to access and set configuration and run time parameters of the router and terminal servers. See RFC 1155, RFC 1156, and RFC 1157.

SONET Synchronous Optical NETwork. An ANSII/CCITT standard for standardizing the use of optical communications equipment.

subnet An extension of the Internet addressing scheme that allows a site to use a single Internet address for multiple physical networks.

synchronous transmission A high efficiency signaling method used for medium-distance and long-distance serial communication. Synchronous lines usually have modems at each end. Unlike asynchronous transmission, the synchronous signaling scheme continually transmits data; if no useful data is available, the scheme sends special symbols called idle characters. This is also known as block transmission mode.

T1 Refers to a telephone signaling standard used for transmission of data through the telephone hierarchy. The rate of transmission is 1.544 megabits per second.

T1 Converter Device that converts the HDLC synchronous serial datastream of the server into a T1 data stream with the correct framing and ones density.

TCP Transmission Control Protocol. The so-called level 4 or "Transport" layer in the OSI model. When used with IP, it provides for the reliable transmission of data through retransmission. TCP/IP was developed by the U.S. Department of

Defense to support the construction of worldwide internetworks. This protocol is the most commonly used public standard protocol available today. Most computer systems can support TCP/IP.

Telnet A virtual terminal protocol. See RFC 854 and MIL STD 1782.

terminal server A device that connects terminals, modems, and microcomputers to LANs or WANs and handles the network protocol on behalf of connected devices. Port multiplexers, TACs, and PADs are all terminal servers.

TFTP Trivial File Transfer Protocol. A simplified method of transfer of logical files on an IP network. See RFC 783

Token Ring IEEE specification 802.5 for connecting a set of stations to some transmission medium. A station puts a message onto the ring. Each station on the ring, including the recipient, in turn copies the message. When the original sender receives its own message back, the sender deletes the message from the ring.

UDP User Datagram Protocol. Another transport layer protocol; however, unlike TCP, it is stateless. See RFC 768.

WAN Wide Area Network. A WAN includes long-distance communication circuits such as long-distance telephone circuits, fiber optic cable, or satellite media. Often composed of LANs, a WAN can integrate WANs and LANs into an internetwork.

X.25 CCITT has published Recommendation X.25 for connections between DTE and DCE equipment. Many establishments have X.25 networks in place that provide remote terminal access. These networks can be used for other types of data, including the Internet Protocol, DECnet, XNS, and others.

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