CHAPTER 2

Preparing for Installation

Before you can install the chassis, you must consider and implement certain prerequisites. This chapter includes the following preinstallation requirements:

- Safety recommendations
  - Safety with electricity
  - Preventing electrostatic discharge (ESD) damage
- General site requirements
  - Site environment
  - Preventive site configuration
- Installation Checklist and Site Log
- Tools and equipment required
- Network connection preparation
  - Distance and interference limitations
- Console and auxiliary port considerations
- Network connection considerations
- Chassis components

Safety Recommendations

To ensure general safety, follow these guidelines:

- Keep the chassis area clear and dust-free during and after installation.
- Keep tools and chassis components away from walk areas.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught in the chassis. Fasten your tie or scarf and sleeves.

Warning Metal objects will heat up when connected to power and ground. This heated metal can cause serious burns or can weld to a terminal.

Safety with Electricity

The successful installation of the chassis should not require access to the chassis interior; however, if this becomes necessary, the following warning will appear at the beginning of any related procedures:

Warning Before accessing the chassis interior, turn off power to the chassis and unplug the power cord. Use extreme caution around the chassis because potentially hazardous voltages are present.

Failure to observe this warning and act accordingly may increase the potential for shock hazard or electrocution. Before beginning a procedure that requires access to the chassis interior, it is strongly advised that you read through the entire procedure. After you read the procedure, if you have any doubts about your ability to perform any part, contact a customer service representative for information on how to proceed.

Electrical Safety Guidelines

Following are basic guidelines for working near electricity:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power before installing or removing a chassis.
- Never assume that power has been disconnected from a circuit; always check.
- Do not work alone when potentially hazardous conditions exist.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Wear safety glasses when working under conditions that might be hazardous to your eyes.
- Carefully examine your work area for such possible hazards as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, use the following guidelines when working with any equipment that may be connected to a power source and is still connected to telephone wiring or other network cabling.

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

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which occurs when electronic components are improperly handled, can result in complete or intermittent failures. ESD can impair electronic circuitry and equipment. Typically, the successful installation of the chassis should not require handling any components; however, always follow ESD prevention procedures.

Caution To prevent ESD damage, attach an ESD wrist strap before handling any components. The chassis power cord must be connected, but to prevent shock hazard, the power must be turned off.

Following are the guidelines for preventing ESD damage:

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

Step 2 To safely channel unwanted ESD voltages to ground, connect the wrist strap to an unpainted chassis frame surface or another proper grounding point or surface.

Step 3 Use the edge ejectors to remove the card. Handle the card by its sides. Place the card on an antistatic surface or in a static shielding bag. To prevent further damage to the card by ESD voltages, defective cards must remain in the static shielding bag if they will be returned for repair or replacement.

Step 4 Handling the new card by its edges only, insert it into the chassis. 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.

Note For safety, periodically check the resistance value of the antistatic strap. The measurement should be within the range of 1 and 10 Mohms.

General Site Requirements

To preclude unintended shutdowns, the chassis should be properly installed and maintained. The chassis has an internal blower that pulls air through the card cage from left to right (with the chassis front facing you). The chassis is designed to operate in a level, dry, clean, well-ventilated, and air-conditioned environment. If either the intake or exhaust vents are blocked in any way, this air-cooling function will be impaired, and the CSC-ENVM card, sensing this, will shut down the chassis. While purposeful chassis shutdown due to a fault or failure is a function of the CSC-ENVM card, unnecessary shutdowns due to air intake blockage and poor external ventilation can and should be avoided.

If the ambient temperature of the room air drawn into the chassis is higher than desirable, the air temperature inside the chassis may also be too high. This condition can occur when the wiring closet or rack in which the chassis is mounted is not ventilated properly, when the exhaust of one chassis (or other electronic device) is directed so that it enters the air intake vent of the chassis, or when the chassis is the top unit in an unventilated rack. Any of these conditions can inhibit air flow and induce a shutdown by the CSC-ENVM card.

Note The router can be installed in wiring closets and rack systems as long as the site prerequisites are observed before installation and are maintained throughout chassis operation.

Site Environment

The chassis can be used as a tabletop or rack-mounted system in a data processing or lab environment. Because the large cooling fan in the chassis is somewhat noisy (approximately 60 decibels, A weighted [dBa]), the chassis is intended for unattended or computer room use. Table 2-1 lists the air temperature and voltage warning thresholds for the chassis, and Table 2-2 lists the environmental specifications.

Depending upon the temperature and cooling capability of your site, the chassis will require at least a minimum amount of clearance (approximately 2 to 4 inches in an enclosed rack or closet) on all sides to prevent the chassis from taking in the heated exhaust air of other equipment.

Table 2-1 Chassis Air Temperature and Voltage Warning and Fatal Thresholds

Designation	Warning Threshold	Fatal Threshold
Internal intake air at the sensor (tolerance is 3 C)	104 F (40 C)	109.4 F (43 C)
Air flow (exhaust)	Warning Message	136.4 F (58 C)
+5V supply	5%	10%
+12V supply	10%	15%
–12V supply	10%	15%
–5V supply	5%	10%

Table 2-2 Chassis Environmental Specifications

Description	Minimum	Maximum
Ambient temperature, operating	32 F (0 C)	104 F (40 C)
Ambient temperature, nonoperating	–40 F (–40 C)	185 F (85 C)
Ambient humidity, operating	5% RH[1]	95% RH
Ambient humidity, nonoperating	5% RH	95% RH
Altitude, operating	–500' (–152 m)	10,000' (3,050 m)
Altitude, nonoperating	–1,000' (–304 m)	30,000' (9,144 m)
Vibration, operating	–	5–500 Hz, 0.5G (0.1 oct./min.)
Vibration, nonoperating	– – –	5–100 Hz, 1G (0.1 oct./min.) 100–500 Hz, 1.5G (0.2 oct./min.) 500–1,000 Hz, 1.5G (0.2 oct./min.)

1. All values of relative humidity (RH) are noncondensing.

Preventive Site Configuration: Avoiding Shutdowns

The proper placement of the chassis and the layout of your equipment rack or wiring closet are essential for successful system operation. Equipment placed too close together and inadequately ventilated can cause system malfunctions and shutdowns. In addition, chassis front panels made inaccessible by poor equipment placement can make system maintenance difficult.

Read and follow these precautions when planning your site layout and equipment locations; this will help avoid future equipment failures and reduce the likelihood of environmentally caused shutdowns.

General Precautions

- The CSC-ENVM card monitors the interior chassis environment and provides warnings for high temperature, maximum and minimum voltages, and reports on occurrences.
- Remember that electrical equipment generates heat, and ambient room temperature alone may not be adequate to cool equipment to acceptable operating temperatures.
- Never place chassis side by side because the heated exhaust air from one chassis will be drawn into the intake vent of the next.
- Follow ESD prevention procedures to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that the chassis cover and card access panels are in place and secure. The chassis is designed to direct cooling air through the card cage; an open access panel will redirect the air flow.

Equipment Racks

- Install the chassis only in an enclosed rack that has adequate ventilation or an exhaust fan; use an open rack where possible.
- A ventilation system that is too powerful in a closed rack may also prevent cooling by creating negative air pressure around the chassis and redirecting the air away from the chassis intake vent. If necessary, operate the chassis with the rack door open or in an open rack.
- The correct use of baffles inside the enclosed rack can assist in cooling the chassis.
- Ensure that the rack is not overly congested. In an enclosed rack, ideally separate the units with 12 to 15 inches of vertical clearance. The horizontal clearance is standard for most enclosed racks; avoid obstructing this space. Open racks are recommended, but not required.
- Equipment near the bottom of the rack may generate excessive heat that is drawn upward and into the intake ports of equipment above, leading to failures in the chassis at or near the top of the rack. If the enclosed rack you are using does not have a ventilation fan, one should be installed.

Installation Checklist

Use the Installation Checklist following to assist you with your installation, by allowing you to keep track of what was done, by whom, and when. Make a copy of this checklist and make entries as each procedure is completed. Include a copy of the checklist for each system in your Site Log along with your records for the router. (See the section “Site Log” on page 2-7.)

Installation Checklist

for site

_____

Task	Verified by	Date
Chassis received		
Chassis system unpacked		
Chassis components verified		
Read “Safety Recommendations” section on page 2-1		
Installation Checklist copied		
Site Log established and background information entered		
Site power voltages verified		
Site environmental specifications verified		
Required tools available		
Network connection equipment available		
Chassis mounted in rack (optional)		
Chassis connected to AC source		
Network interface cables and devices connected		
ASCII terminal attached to console port		
Console port set for 9600 baud, 8 data bits, 2 stop bits, no parity		
System boot complete (all Normal LEDs lit)		

Router name: _____

Router serial number: _____

Figure 2-1 Installation Checklist

Site Log

The Site Log provides a historical record of all actions relevant to the router system. Keep the Site Log in a common place near the chassis where anyone who performs tasks has access to it. Site Log entries might include the following:

- Installation progress—Make a copy of the Installation Checklist and insert it into the Site Log. Make entries on the Installation Checklist as each procedure is completed.
- Upgrades and removal/replacement procedures—Use the Site Log as a record of system maintenance and expansion history. Each time a procedure is performed on the system, update the Site Log to reflect the following:
  - Installation of additional cards
  - Removal or replacement of cards
  - Configuration changes
  - Maintenance schedules and requirements
  - Corrective maintenance procedures performed
  - Intermittent problems
  - Related comments
  - Configuration notes from related procedures

Tools and Equipment Required

Following are the tools and equipment required to attach the rack-mount kit and install the chassis:

- Chassis rack-mounting hardware (rack-mount flanges and screws)
- Phillips screwdrivers: No. 1 and No. 2
- Flat-blade screwdrivers: small, medium, and large
- Medium-sized adjustable wrench
- Antistatic mat or antistatic foam if available
- ESD wrist strap or disposable ESD kit included with the chassis shipment

Network Connection Preparation

When setting up your system, you must consider a number of factors related to the cabling required for your console terminal connections. Each of these cabling considerations is described in the following sections.

RS-232 Connection Prerequisites

A variety of similar signaling schemes use the name *RS-232*. The following scheme, which is used in all modular and fixed-configuration products, is sufficient to control most modems and hardware flow-control schemes. This 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 (V) power; an open output signal will be near +12 or –12V. The Receive Data input has a 10,000 ohm resistor to the –12V supply that helps prevent open lines from ringing and causing spurious input to the communication server. An open Receive Data line will be near –7V, but can vary from –6 to –10V depending on temperature and component variation.

Distance Limitations

The length of your networks and the distance between connections depends on the type of signal, the signal speed, and the transmission media (the type of cable used to transmit the signals). For example, standard coaxial cable has a greater channel capacity than twisted-pair cabling. The distance and rate limits in these descriptions are the IEEE recommended maximum speeds and distances for signaling. You can usually get good results at speeds and distances far greater than these; however, the maximum distances are not recommended.

For instance, the recommended maximum rate for V.35 is 2 megabits per second (Mbps), but is commonly used at 4 Mbps without any problems. If you understand the electrical problems that might arise and can compensate for them, you should get good results with rates and distances greater than those shown here; however, do so at your own risk.

The following distance limits are provided as guidelines for planning your network connections before installation.

FDDI Connections

The distance limitations for single-mode and multimode Fiber Distributed Data Interface (FDDI) stations are listed in Table 2-3. Both FDDI modes provide 11 decibels (dB) of optical power.

Table 2-3 FDDI Maximum Transmission Distances

Transceiver Type	Max. Distance Between Stations
Single-mode	Up to 6.2 mi (10 km)
Multimode	Up to 1.2 mi (1.9 km)

Ethernet Connections

The maximum distances for Ethernet network segments and connections depend on the type of transmission cable used. The unshielded twisted-pair (UTP) cabling used with 10BaseT is suitable for voice transmission, but may incur problems at 10-Mbps data rates. UTP cabling does not require the fixed spacing between connections that is necessary with the coax-type connections. Table 2-4 lists the IEEE recommendations for the maximum distances between 10BaseT station (connection) and hub.

Table 2-4 Ethernet UTP Maximum Transmission Distances

Transmission Speed	Max. Station-to-Hub Distance
10 Mbps (10BaseT)	328' (100 m)

Serial Connections

As with all signaling systems, serial signals can travel a limited distance at any given rate. Generally, the lower the baud rate, the greater the distance. Table 2-5 lists the standard relationship between baud rate and distance for RS-232 signals.

Table 2-5 IEEE Standard RS-232 Transmission Speed Versus Distance

Baud Rate	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

Balanced drivers allow RS-449 signals to travel greater distances than RS-232. Table 2-6 lists the standard relationship between baud rate and distance for RS-449 signals.

Table 2-6 IEEE Standard RS-449 Transmission Speed Versus Distance

Baud Rate	Distance (Feet)	Distance (Meters)
2400	4100	1250
4800	2050	625
9600	1025	312
19200	513	156
38400	256	78
56000	102	31
T1	50	15

The distance limits for RS-449 (listed in Table 2-6), which are also valid for V.35 and X.21, are recommended maximum distances. You can get good results at distances and rates far greater than these. In common practice, RS-449 supports 2-Mbps rates, and V.35 supports 4 Mbps without any problems; however, exceeding these maximum distances is not recommended.

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 routers.

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

If you use unshielded twisted-pair (UTP) 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 2-4, use a high-quality twisted-pair cable with one ground conductor for each data signal.

If wires exceed recommended distances or pass between buildings, give special consideration to the effect of lightning strikes in your vicinity. The electromagnetic pulse (EMP) 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, so take precautions to avoid these problems by providing a properly grounded and shielded environment, with special attention to issues of electrical surge suppression.

The AGS+ meets FCC part 15B Class A requirements and Verband Deutscher Electrotechniker (VDE) 0871 Limit B levels. All external cables used with the AGS+ need to be constructed with the following requirements:

- The cable must be double shielded with 90% minimum braid coverage over 100% foil coverage.
- The shield must be terminated 360 degrees to a metal backshell that fully contacts the connector.

As an example, the cable should be of equivalent construction to Hitachi Part Number HCM

Console and Auxiliary Port Connection Prerequisites

You must adjust the baud rate of your terminal to match the console and auxiliary port default baud rate of 9600, 8 data bits, no parity, and 2 stop bits. Consult your terminal's documentation for this wiring specification. The console port is a data communications equipment (DCE) device, and the auxiliary port is a data terminal equipment (DTE) device. If necessary, refer to Appendix A, "Cabling Specifications," for the console and auxiliary port wiring scheme required to connect the router to a console terminal or to build your own cables.

Network Connection Considerations

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

- To install and configure the router, you need a terminal with an RS-232 DTE connector. You can 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 can be purchased as additional equipment. (Contact a customer service representative.) This additional equipment is not required for a 10BaseT connection with the 10BaseT applique.
- To use a low-speed synchronous serial interface at your installation, you need a synchronous modem or a channel service unit/digital service unit (CSU/DSU) to connect to the network. RS-232, RS-449, or V.35 connections (or attachments) are typically provided as the electrical interfaces on the CSU/DSU.
- To attach a chassis to a T1 network, you need a T1 CSU/DSU, that converts the High-Level Data Link Control (HDLC) synchronous serial data stream into a T1 data stream with the correct framing and ones density. (The term *ones density* refers to the telephone system requirement of a minimum number of 1 bits per time unit in a data stream.) Several T1 CSU/DSU devices are on the market. A T1 CSU/DSU is available as additional equipment. Note also that most T1 CSU/DSUs provide either a V.35 or RS-449 electrical interface to the system.
- To connect the chassis to AC power, you need the proper AC receptacle at your site. The chassis power supply is either autoranging, or is factory-configured for either 110 VAC or 240 VAC operation (230 VAC in the United Kingdom). All chassis include a 6-foot electrical power cord.

Warning If the voltage indicated on the chassis label is different from the power outlet voltage, *do not connect the chassis to that receptacle*. A voltage mismatch can cause equipment damage and may pose a fire hazard.

Chassis Components

Table 2-7 lists all of the components that are included with the shipment of chassis or that are available as options.

Table 2-7 Descriptions of Chassis Components

Component	Description
Chassis buses	9-slot Multibus backplane and 5-slot high-speed ciscoBus backplane
Processor cards	CSC/3 or CSC/4
ciscoBus controller	CSC-CCTL or CSC-CCTL2
Interface cards	Up to 7 interface and controller cards. Specific restrictions exist on the number and type of cards that can be used.
System memory	64 KB of RAM and 64 KB of NVRAM (standard) on the CSC-ENVM card. Alternate 32 KB of NVRAM and 4 MB of Flash memory on the optional CSC-MC+ Flash memory card.
External connectors	Mounting plates with connectors and appliques for attachment to various types of networks. Chassis will include the external connectors for the interfaces you ordered.
Accessories	Rack-mount kit that includes screws and 2 flanges for mounting the chassis in a 19" rack.

Component	Description
Power supplies	MAS-400 110 VAC or MAS-400B 240 VAC power supply. MAS-25 230 VAC power supply is used in the U.K.
Blower	MAS-10 110 VAC blower or MAS-10B 240 VAC blower
Documentation (optional)	*AGS+ Hardware Installation and Maintenance, Router Products Configuration Guide, Getting Started Guide, Internetworking Technology Terms and Acronyms, Troubleshooting Internetworking Systems, System Error Messages*, and *Command Summary* publications.