CHAPTER 2

Preparing to Install the Router

This chapter describes important information to consider before you begin to install the router, and includes the following sections:

- Safety Recommendations
- General Site Requirements
- Preparing to Connect to a Network
- Where to Go Next

Safety Recommendations

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.
- Put the removed chassis cover in a safe place.
- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses if you are working under any conditions that might be hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.

Warning Ultimate disposal of this product should be handled according to all national laws and regulations. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Maintaining Safety with Electricity

Follow these guidelines when working on equipment powered by electricity.

Warning Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or can weld the metal object to the terminals. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Locate the emergency power OFF switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn OFF the power.
- Power OFF the router and unplug the power cord before doing the following:
  - Installing or removing a chassis
  - Working near power supplies

Warning Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Warning Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is OFF and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.

Warning Read the installation instructions before you connect the system to its power source. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn OFF power to the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Always follow ESD-prevention procedures when removing and replacing components. Ensure that the chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

Caution For safety, periodically check the resistance value of the antistatic strap, which should be between 1 to 10 megohms (Mohms).

General Site Requirements

This section describes the requirements your site must meet for safe installation and operation of your system. Ensure that your site is properly prepared before beginning installation.

Site Environment

The router can be placed on a desktop or mounted in a rack or on a wall. The location of the chassis and the layout of your equipment rack or wiring room are extremely important for proper system operation. Equipment placed too close together, inadequate ventilation, and inaccessible panels can cause system malfunctions and shutdowns, and can make system maintenance difficult.

When planning your site layout and equipment locations, remember the precautions described in the next section, “Preventive Site Configuration” to help avoid equipment failures and reduce the possibility of environmentally caused shutdowns. If you are experiencing shutdowns or unusually high errors with your existing equipment, these precautions may help you isolate the cause of failures and prevent future problems.

Preventive Site Configuration

The following precautions will help you plan an acceptable operating environment for your router and will help you avoid environmentally caused equipment failures.

- Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate your system has adequate air circulation.
- Always follow the ESD-prevention procedures described in the section “Preventing Electrostatic Discharge Damage” earlier in this chapter to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.

- Ensure that the chassis cover is secure. The chassis is designed to allow cooling air to flow effectively within it. An open chassis allows air leaks, which may interrupt and redirect the flow of cooling air from internal components.

Configuring Equipment Racks

The following information will help you plan an acceptable equipment rack configuration.

- Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested because each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the intake or the exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated all the way into the rack.
- In an enclosed rack with a ventilation fan in the top, excessive heat generated by equipment near the bottom of the rack can be drawn upward and into the intake ports of the equipment above it in the rack. Ensure that you provide adequate ventilation for equipment at the bottom of the rack.
- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the chassis. The best placement of the baffles depends on the airflow patterns in the rack, which are found by experimenting with different arrangements.

Power Supply Considerations

Check the power at your site to ensure that you are receiving “clean” power (free of spikes and noise). Install a power conditioner if necessary.

Warning The device is designed to work with TN power systems. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

The router power supply includes the following features:

- Autoselects either 110V or 220V operation.
- All units include a 6-foot (1.8-meter) electrical power cord. (A label near the power cord indicates the correct voltage, frequency, current draw, and power dissipation for the unit.)

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors). (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Preparing to Connect to a Network

When setting up your router, consider distance limitations and potential electromagnetic interference (EMI) as defined by the EIA.

Warning The Ethernet, Token Ring, serial, console, and auxiliary ports contain safety extra-low voltage (SELV) circuits. BRI circuits are treated like telephone-network voltage (TNV) circuits. Avoid connecting SELV circuits to TNV circuits. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

ISDN Connections

Use a BRI cable (not included) to connect the router directly to an ISDN. (See Table 2-1.)

Warning Network hazardous voltages are present in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages also are present on the system card in the area of the BRI port (RJ-45 connector), regardless of when power is turned OFF. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Warning The ISDN connection is regarded as a source of voltage that should be inaccessible to user contact. Do not attempt to tamper with or open any public telephone operator (PTO)-provided equipment or connection hardware. Any hardwired connection (other than by a nonremovable, connect-one-time-only plug) must be made only by PTO staff or suitably trained engineers. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Table 2-1 lists the specifications for ISDN BRI cables. Refer to the section “ISDN BRI Port and Cable Pinouts” in the appendix “Cable Specifications” for pinouts.

Table 2-1 ISDN BRI Cable Specifications

Specification	High-Capacitance Cable	Low-Capacitance Cable
Resistance (at 96 kHz)	160 ohms/km	160 ohms/km
Capacitance (at 1 kHz)	120 nF[1]/km	30 nF/km
Impedance (96 kHz)	75 ohms	150 ohms
Wire diameter	0.024 in. (0.6 mm)	0.024 in. (0.6 mm)
Distance limitation	32.8 ft (10 m)	32.8 ft (10 m)

1. nF = nanoFarad.

Synchronous Serial Connections

Before you connect a device to the synchronous serial port (labeled “SERIAL”), you will need to know the following:

- The type of device, DTE or DCE, you are connecting to the synchronous serial interface.
- The type of connector, male or female, required to connect to the device.
- The signaling standard required by the device.

DTE or DCE

A device that communicates over a synchronous serial interface is either a DTE or DCE device. A DCE device provides a clock signal that paces the communications between the device and the router. A DTE device does not provide a clock signal. DTE devices usually connect to DCE devices. The documentation that came with the device should indicate whether it is a DTE or DCE device. (Some devices have a jumper to select either mode.) If you cannot find the information in the documentation, refer to Table 2-2 to help you select the proper device type.

Table 2-2 Typical DTE and DCE Devices

Device Type	Gender	Typical Devices
DTE	Male[1]	Terminal
		PC
		Router
DCE	Female[2]	Modem
		CSU/DSU[3]
		Multiplexer

1. If pins protrude from the base of the connector, the connector is male.
2. If the connector has holes to accept pins, the connector is female.
3. CSU/DSU = Channel service unit/data service unit.

Speed and Distance Limitations

Serial signals can travel a limited distance at any given bit rate; generally, the slower the data rate, the greater the distance. All serial signals are subject to distance limits, beyond which a signal degrades significantly or is completely lost.

Table 2-3 lists the maximum speeds and distances for EIA/TIA-232 signals. This signaling standard supports unbalanced circuits at signal speeds up to 64 kbps.

Table 2-3 EIA/TIA-232 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	200	60
4800	100	30
9600	50	15
19200	50	15
38400	50	15
64000	25	7.6

Balanced drivers allow EIA/TIA-449 signals to travel greater distances than the EIA/TIA-232 signals. Table 2-4 lists the maximum speeds and distances for EIA/TIA-449, V.35, X.21, and EIA-530 signals.

Table 2-4 EIA/TIA-449, V.35, X.21, and EIA-530 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	4,100	1,250
4800	2,050	625
9600	1,025	312
19200	513	156

Table 2-4 EIA/TIA-449, V.35, X.21, and EIA-530 Speed and Distance Limitations (Continued)

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
38400	256	78
56000	102	31

Caution The EIA/TIA-449 and V.35 interfaces support data rates up to 2.048 Mbps. Exceeding this maximum could result in loss of data and is not recommended.

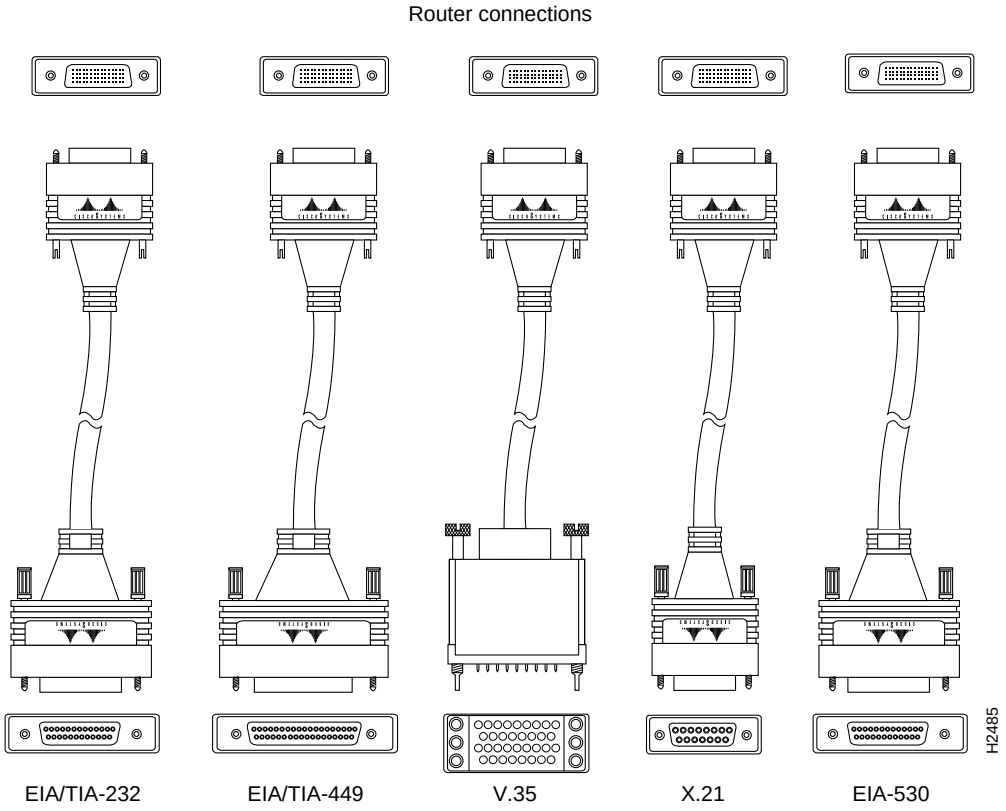
Signaling Standards

The synchronous serial port supports the following signaling standards: EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530. You can order a DB-60 shielded serial transition cable that has the appropriate connector for the standard you specify. The router end of the shielded serial transition cable has a DB-60 connector, which connects to the serial port on the rear panel of the router. The other end of the serial transition cable is available with the connector appropriate for the standard you specify. The documentation for the device you want to connect should indicate the standard used for that device. The synchronous serial port can be configured as DTE or DCE (except EIA-530, which is DTE only), depending on the attached cable.

Note All serial ports configured as DTE require external clocking from a CSU/DSU or other DCE device.

Figure 2-1 shows the serial transition cables you can connect to the serial port on the rear panel of the router.

Figure 2-1 Serial Transition Cables



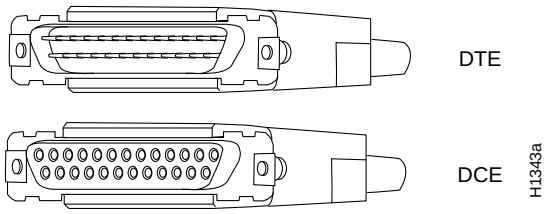
Although attempting to manufacture your own serial cables is not recommended (because of the small size of the pins on the DB-60 serial connector), cable pinouts are provided in the appendix “Cable Specifications.” To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

EIA/TIA-232 Connections

The EIA/TIA-232 standard supports unbalanced circuits at signal speeds up to 64 kbps. The serial port (labeled “SERIAL”) supports *synchronous* connections. The console and auxiliary ports also use an EIA/TIA-232 connection; however, the console and auxiliary ports support *asynchronous* connections.

The network end of the EIA/TIA-232 serial transition cable (not included) provides a DB-25 connector, as shown in Figure 2-2. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. EIA/TIA-232 serial transition cables are available with a DB-25 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-2 EIA/TIA-232 Serial Transition Cable Connectors, Network End



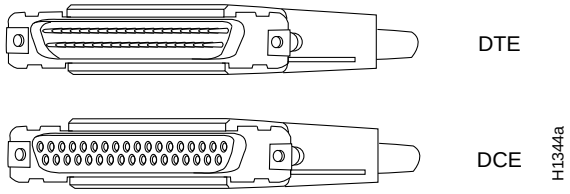
EIA/TIA-449 Connections

The EIA/TIA-449 standard, which supports balanced and unbalanced transmissions, is a faster (up to 2 Mbps) version of the EIA/TIA-232 standard that provides more functions and supports transmissions over greater distances.

The EIA/TIA-449 standard was intended to replace the EIA/TIA-232 standard, but it was not widely adopted primarily because of the large installed base of DB-25 hardware and because of the larger size of the 37-pin EIA/TIA-449 connectors, which limited the number of connections possible (fewer than possible with the smaller, 25-pin EIA/TIA-232 connector).

The network end of the EIA/TIA-449 serial transition cable (not included) provides a DB-37 connector, as shown in Figure 2-3. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. EIA/TIA-449 serial transition cables are available with a DB-37 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-3 EIA/TIA-449 Serial Transition Cable Connectors, Network End

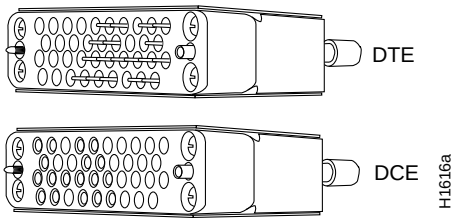


V.35 Connections

The V.35 standard is recommended for speeds up to 48 kbps, although in practice it is used successfully at 4 Mbps.

The network end of the V.35 serial transition cable (not included) provides a standard 34-pin Winchester-type connector, as shown in Figure 2-4. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. V.35 cables are available with a standard V.35 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-4 V.35 Serial Transition Cable Connectors, Network End

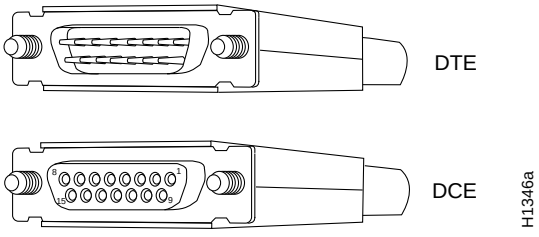


X.21 Connections

The X.21 connector uses a 15-pin connector for balanced circuits and is commonly used in the United Kingdom to connect to the public data network. X.21 relocates some of the logic functions to the DTE and DCE interfaces and, as a result, requires fewer circuits and a smaller connector than EIA/TIA-232.

The network end of the X.21 serial transition cable (not included) is a standard DB-15 connector, as shown in Figure 2-5. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. X.21 cables are available with a plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-5 X.21 Serial Transition Cable Connectors, Network End

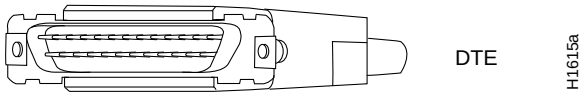


EIA-530 Connections

The EIA-530 standard, which supports balanced transmission, provides the increased functionality, speed, and distance of EIA/TIA-449 on the smaller, DB-25 connector used for EIA/TIA-232, instead of the 37-pin connector used for EIA/TIA-449. Like EIA-TIA-449, EIA-530 refers to the electrical specifications of EIA/TIA-422 and EIA/TIA-423. Although the specification recommends a maximum speed of 2 Mbps, EIA-530 is used successfully at 4 Mbps or faster speeds over short distances.

The EIA/530 serial transition cable (not included) is available in DTE mode only. The network end of the EIA-530 adapter cable is a standard DB-25 plug commonly used for EIA/TIA-232 connections, as shown in Figure 2-6. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. To order a cable, refer to the section "Obtaining Service and Support" in the "Overview of the Router" chapter.

Figure 2-6 EIA-530 Serial Transition Cable Connector, Network End



Ethernet Connections

The IEEE has established Ethernet as standard 802.3. The most common Ethernet implementations are as follows:

- 10Base5 (AUI)—Ethernet on thick coaxial cable, also known as thick Ethernet. The maximum segment distance is 1,640 feet (500 meters).
- 10Base2 (Thinnet)—Ethernet on thin coaxial cable, also known as thin Ethernet. The maximum segment distance is 607 feet (185 meters).
- 10BaseT—Ethernet on unshielded twisted-pair (UTP) cable. The maximum segment distance is 328 feet (100 meters). UTP cables look like the cables used for ordinary telephones; however, UTP cables meet certain electrical standards that telephone cables do not.

Ethernet model routers include an Ethernet AUI interface, which operates at speeds up to 10 Mbps.

The cables and transceivers required to connect the router to an Ethernet network are not included. For ordering information, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Token Ring Connections

The IEEE has established Token Ring as standard 802.5. The distance limitations for the IEEE 802.5 specification indicate a maximum segment distance of 328 feet (100 meters) for UTP cabling. The distance limitation is 1,640 feet (500 meters) for shielded twisted-pair (STP) cabling.

Token Ring can operate at two different ring speeds: 4 and 16 Mbps. All devices on the ring must agree on the operating speed.

Use a Token Ring lobe cable to connect the router to a media attachment unit (MAU). The lobe cable and MAU are not included with the router. Refer to the section “Token Ring Port Pinouts” in the appendix “Cable Specifications” for the Token Ring port pinouts.

Console and Auxiliary Port Connections

Your router includes an asynchronous serial console and an auxiliary port. The console and auxiliary ports provide access to the router either locally (with a console terminal) or remotely (with a modem). This section discusses important cabling information to consider before connecting a console terminal (an ASCII terminal or PC running terminal emulation software) to the console port or modem to the auxiliary port.

The main difference between the console and auxiliary ports is that the auxiliary port supports hardware flow control and the console port does not. Flow control paces the transmission of data between a sending device and a receiving device. Flow control ensures that the receiving device can absorb the data sent to it before the sending device sends more. When the buffers on the receiving device are full, a message is sent to the sending device to suspend transmission until the data in the buffers has been processed. Because the auxiliary port supports flow control, it is ideal for use with the high-speed transmissions of a modem. Console terminals transmit at slower speeds than modems; therefore, the console port is ideal for use with console terminals.

Console Port Connections

Your router includes an EIA/TIA-232 asynchronous serial console port (RJ-45). Cables and adapters to connect a console terminal (an ASCII terminal or PC running terminal emulation software) to the console port are included. To connect an ASCII terminal to the console port, use the RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) with the female RJ-45-to-DB-25 adapter (labeled “TERMINAL”). To connect a PC running terminal emulation software to the console port, use the RJ-45-to-RJ-45 roll-over cable with the female RJ-45-to-DB-9 adapter (labeled “TERMINAL”). The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 2 stop bits. The console port does not support hardware flow control. For detailed information about installing a console terminal, see the section “Connecting to the Console Port” in the chapter “Installing the Router.” See the appendix “Cable Specifications” for cable and port pinouts.

Auxiliary Port Connections

Your router includes an EIA/TIA-232 asynchronous serial auxiliary port (RJ-45) that supports hardware flow control. A cable and an adapter to connect a modem to the auxiliary port are included. To connect a modem to the auxiliary port, use the RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) with the male RJ-45-to-DB-25 adapter (labeled “MODEM”). For detailed information about connecting devices to the auxiliary port, see the section “Connecting a Modem to the Auxiliary Port” in the chapter “Installing the Router.” See the appendix “Cable Specifications” for cable and port pinouts.

Where to Go Next

Proceed to the next chapter, “Installing the Router,” for installation instructions.